

**Chapter 9**

**The Education Specific part of the Curriculum for**

**MASTER OF SCIENCE (MSc) IN ENGINEERING  
PRODUCT DEVELOPMENT AND INNOVATION**

**Curriculum 2016, Version 1.1**

**Applicable to students admitted September 2016 onwards**

The curriculum is divided into general provisions (Chapters 1-8), a programme specific section (Chapter 9) and descriptions of the programme's individual course modules. Students should familiarise themselves with all three parts in order to get a complete overview of the provisions regulating the study programme.

## §1 Job Profiles

Master of Science in Engineering (Product Development and Innovation) is a graduate engineering programme, which combines engineering with social science. A strong engineering background with real integration of marketing, management and business development aspects linking up to an assessment of new technologies creates a perfect background for educating project managers, who can take care of a part of or the entire product development process.

The programme applies to candidates from either product-oriented bachelor programmes or manufacturing-oriented programmes wanting to follow a graduate programme that combines a scientific based specialisation within engineering with market-oriented study.

The study programme has a strong global focus and is carried out in an international study environment.

Product Development and Innovation (PDI) graduates are qualified to obtain jobs within:

- Development of business opportunities as entrepreneurs or intrapreneurs based on competencies within a particular specialisation.
- Management of cross functional projects in global distributed networks requiring skills in an analytical as well as a leadership approach to complex structures.
- Academia as PhD student and further career opportunities at the university as a researcher.

The graduate students can specialise within the profiles **Product Value Creation, Technology Entrepreneurship and Business Development** or **Sustainable Product Development**.

The profile **Product Value Creation** more specifically qualifies graduates to:

- Obtain jobs in the area of integrated product development and design.
- Manage product development processes in a global context, where design as well as production may be done in distributed global networks.
- Leading innovation processes which result in new business opportunities in the global market place.
- Create value in products and services, where unique features are integrated into the products based on experience design.
- Take on Product Management, where technical knowledge, organisational understanding and competencies in marketing are needed at a high international level.

The profile **Technology Entrepreneurship and Business Development** more specifically qualifies graduates to:

- Having the mind-set and competences to establish new technology ventures.
- Having the competences to identify and explore new global business opportunities
- Creating new jobs by founding new technology ventures.
- Employment in both new technology ventures and established technology firms focusing on the commercialisation of new technological products.
- Having the skills and competences to manage technological product development, innovation and commercialisation projects in both new and existing firms.

- Having the skills and competence to manage the interaction with co-innovators, complementors and adoption chain partners focusing on the developing new high-tech products.

The profile **Sustainable Product Development** more specifically qualifies graduates to:

- Understand many of the most evident current problems with regards to sustainability.
- Formulate problems with regards to sustainability in a scientific manner.
- Deploy current methods in sustainability assessment.
- Have a thorough knowledge about environmental life cycle assessment (LCA) and the ability to deploy the methodology within product development.
- Understand the most prominent development methods with regards to sustainable product development and show the ability to use them.
- Construct a corporate social responsibility (CSR) policy and instruments to measure the performance of the organisation using the policy.

## §2 Competence Profile of the Study Programme

The competence profile for Master of Science in Engineering (Product Development and Innovation) (PDI) is based on the Danish Qualification Framework, and the study programme is structured in accordance with the education concept 'The Engineering Education Model of the University of Southern Denmark (DSMI).

The PDI graduates are qualified to identify, understand and solve complex problems within the field of engineering. Furthermore, the students will gain knowledge of as well as practical skills and general competencies in project management and consequently will be qualified to participate in cross functional scientific research projects, which involve drawing up and communicating new analyses and models for solving the given problems.

The PDI graduates possess research-based knowledge of theories and methods, which enable them to identify, understand, discuss and reflect on scientific problems within the areas of organisational processes, globalization and market oriented processes as well as on the impact of technological innovation on business development.

The PDI graduates have skills based on a scientific grounding, enabling them to evaluate and choose from different scientific theories, methods and tools and will therefore be able to apply existing models to analysing and solving problems or setting up new models within Product Development and Innovation, Globalization and Entrepreneurship, Technology and Project Management, Experience Design, Technology Entrepreneurship or Sustainable Product Development.

The PDI graduates possess competencies enabling them to professionally and in a cross-functional context participate in or lead projects. The graduates will also be able to communicate the results to colleagues as well as to non-specialists. These common competencies are acquired thanks to the problem and project oriented structure of the study programme, which teaches the students to reflect on their own role and at the same time enables them to take responsibility for own learning, personal development and specialisation.

The Master of Science in Engineering (Product Development and Innovation) will have competencies within the following more specific domains:

- Analysing the total value chain of the product development process, from market analysis, product design and manufacturing to market introduction and sales, in order to make an overall assessment of the phases of the process.
- Acquisition of new knowledge in relevant engineering and business fields and ability to perform engineering and business tasks connected to generating new business opportunities with a deep understanding of local and global internationalisation processes.
- Planning, implementing and management of complex innovation projects within new or existing companies.
- Analysing the organisational structures with respect to global product development and production activities.
- Clear communication, as well as ability to negotiate in English in technical as well as in business spheres.
- Application of relevant theories with all their associated tools to analyse and predict the outcome of real-life competitive business cases that are driven by technological change and industrial shakeouts.

- Application of scientific methods and tools for technology analysis such as technology mapping, patent examination, citation analysis and technology scenarios, and discovery driven planning.
- Application of scientific methods and tools for market analysis such as quantitative surveys, customer analysis, and qualitative analysis such as focus groups and in-depth interviews.
- Application of new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting for new markets and businesses.

PDI graduates will also have gained knowledge, skills and competencies at a high international level within one of the three specialisations:

The graduate in **Product Value Creation** will have special knowledge, skills and competences at a high international level within:

- Design anthropology of experience. Understanding the factors that come into play when we experience a product, service, interface, event or environment and being able to implement unique values in the design of the product. Understanding what constitutes an experience and developing ways to empathize with other people's experiences of design. This requires a thorough understanding of user needs, and students learn techniques of generative human centred enquiry, for example contextual research methods, as a way to inspire new design concepts.
- Experience design change management. The business of designing for experiencing includes the particular challenge of experience design within an organizational context and how to tie an organisation's vision, strategies and brand to experience design.

The graduate in **Technology Entrepreneurship and Business Development** will have special knowledge, skills and competences at a high international level within:

- Applying state-of-the-art technology entrepreneurship, innovation and commercialization theories, models and frameworks to the management of new product ideation, design and development projects in technology startups and established firms.
- Establishing and enabling the growth of a new technology ventures.
- Driving technology innovation or intrapreneurial projects in established companies and existing startups.
- Being able to analyse and improve how the company establishes, develops, maintains, and controls inter-organisational relationships for value creation.
- Outlining marketing strategies for new technological products or services in new or emerging markets.
- Assessing, designing and implementing new technology-driven business models in a global context.
- Identifying and taking into account relevant legal problems when establishing international new ventures, businesses or enterprises.

The graduate in **Sustainable Product Development** will have special knowledge, skills and competences at a high international level within:

- Conducting life cycle assessments on products, systems or services.
- Improving the sustainability performance of organisations through application of CSR policies and instruments.

- Improving the designs of previous products or services with regards to social, economic and environmental aspects of sustainability.
- Identifying and addressing sustainability issues by developing solutions based on rigorous sciences and proven methodologies.
- Working in a multidisciplinary environment towards sustainable solutions.

The study programme for MSc in Engineering (PDI) also qualifies the graduate to apply for a relevant research programme (PhD).

THE GRADUATE WITH AN ACADEMIC PROFILE IN PRODUCT VALUE CREATION WILL HAVE ACQUIRED ...	PDCPRO1 (1.Sem.)	PDCMT (1.sem.)	PDGLO2 (1.sem.)	PDCPTO (1.sem.)	PDCXBD1 (1.sem.)	PDCMPP (2.sem.)	PDGLO1 (2.sem.)	PDCPRO2 (2.sem.)	PDGLO3 (3.sem.)	PDCOI (3.sem.)	PDCXBD2 (3.sem.)	PDCPRO3 (3.sem.)	PDCITC (3.sem.)
THE FOLLOWING COMPETENCES													
Analysing the total value chain of the product development process, from market analysis, product design and manufacturing to market Introduction and sales, in order to make an overall assessment of the phases of the process.		X		X									X
Acquisition of new knowledge in relevant engineering and business fields and ability to perform engineering and business tasks connected to generating new business opportunities with a deep understanding of local and global internationalisation processes.			X				X		X				
Planning, implementing and management of complex innovation projects within new or existing companies.			X							X			
Analysing the organisational structures with respect to global product development, production and sourcing activities.						X							
Clear communication, as well as ability to negotiate in English in technical as well as in business spheres.	X	X						X				X	
Application of relevant theories with all their associated tools to analyse and predict the outcome of real-life competitive business cases that are driven by technological change and industrial shakeouts.		X											X
Application of scientific methods and tools for technology analysis such as technology mapping, patent examination, citation analysis and technology scenarios, and discovery driven planning.			X				X		X				
Application of scientific methods and tools for market analysis such as quantitative surveys, customer analysis, and qualitative analysis such as focus groups and in-depth interviews.			X										
Application of new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting for new markets and businesses.										X			

<p>Design anthropology of experience. Understanding the factors that come into play when we experience a product, service, interface, event or environment and being able to implement unique values in the design of the product. Understanding what constitutes an experience and developing ways to empathize with other people's experiences of design. This requires a thorough understanding of user needs, and students learn techniques of generative human centred enquiry, for example contextual research methods, as a way to inspire new design concepts.</p>					X						X		
<p>Experience design change management. The business of designing for experiencing in-cludes the particular challenge of experience design within an organizational context and how to tie an organisation's vision, strategies and brand to experience design.</p>					X						X		



<b>THE GRADUATE WITH AN ACADEMIC PROFILE IN TECHNOLOGY ENTREPRENEURSHIP AND BUSINESS DEVELOPMENT WILL HAVE ACQUIRED ...</b>	PDCPR01 (1.Sem.)	PDCMT (1.sem.)	PDCGLO2 (1.sem.)	PDCOPTO (1.sem.)	PDCDGS (1.sem.)	PDCM/PD (2.sem.)	PDCGLO1 (2.sem.)	PDCPRO2 (2.sem.)	PDCGLO3 (3.sem.)	PDCOI (3.sem.)	PDCSGS (3.sem.)	PDCPRO3 (3.sem.)	PDCMTTC (3.sem.)
<b>THE FOLLOWING COMPETENCES</b>													
Analysing the total value chain of the product development process, from market analysis, product design and manufacturing to market Introduction and sales, in order to make an overall assessment of the phases of the process.		X		X									X
Acquisition of new knowledge in relevant engineering and business fields and ability to perform engineering and business tasks connected to generating new business opportunities with a deep understanding of local and global internationalisation processes.			X				X		X				
Planning, implementing and management of complex innovation projects within new or existing companies.			X							X			
Analysing the organisational structures with respect to global product development, production and sourcing activities.						X							
Clear communication, as well as ability to negotiate in English in technical as well as in business spheres.	X	X						X				X	
Application of relevant theories with all their associated tools to analyse and predict the outcome of real-life competitive business cases that are driven by technological change and industrial shakeouts.		X											X
Application of scientific methods and tools for technology analysis such as technology mapping, patent examination, citation analysis and technology scenarios, and discovery driven planning.			X				X		X				
Application of scientific methods and tools for market analysis such as quantitative surveys, customer analysis, and qualitative analysis such as focus groups and in-depth interviews.			X										
Application of new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting for new markets and businesses.										X			

THE GRADUATE WITH AN ACADEMIC PROFILE IN SUSTAINABLE PRODUCT DEVELOPMENT WILL HAVE ACQUIRED ...	PDCPRO1 (1.sem.)	PDCMT (1.sem.)	PDCGLO2 (1.sem.)	PDCCPTO (1.sem.)	PDCDGS (1.sem.)	PDCM/PD (2.sem.)	PDCGLO1 (2.sem.)	PDCPRO2 (2.sem.)	PDCGLO3 (3.sem.)	PDCOI (3.sem.)	PDCSGS (3.sem.)	PDCPRO3 (3.sem.)	PDCTMC (3.sem.)
THE FOLLOWING COMPETENCES													
Analysing the total value chain of the product development process, from market analysis, product design and manufacturing to market Introduction and sales, in order to make an overall assessment of the phases of the process.		X		X									X
Acquisition of new knowledge in relevant engineering and business fields and ability to perform engineering and business tasks connected to generating new business opportunities with a deep understanding of local and global internationalisation processes.			X				X		X				
Planning, implementing and management of complex innovation projects within new or existing companies.			X							X			
Analysing the organisational structures with respect to global product development, production and sourcing activities.						X							
Clear communication, as well as ability to negotiate in English in technical as well as in business spheres.	X	X						X				X	
Application of relevant theories with all their associated tools to analyse and predict the outcome of real-life competitive business cases that are driven by technological change and industrial shakeouts.		X											X
Application of scientific methods and tools for technology analysis such as technology mapping, patent examination, citation analysis and technology scenarios, and discovery driven planning.			X				X		X				
Application of scientific methods and tools for market analysis such as quantitative surveys, customer analysis, and qualitative analysis such as focus groups and in-depth interviews.			X										
Application of new theories on innovation and change, including emerging paradigms such as user-driven innovation, open innovation and market forecasting for new markets and businesses.									X				

## **§3 Subject Columns of the Study Programme**

The competencies are acquired by studying the topics in the subject columns listed below. Scientific methods as well as personal competencies are an integrated part of the topics covered by the study programme.

### **Product Development and Innovation Processes**

- The product development process
- The role of technology in innovation
- Organising for innovation
- Manufacturing optimisation in product development
- Design for environment
- Product and process platform design
- Open innovation and new markets

### **Globalisation and Entrepreneurship/Intrapreneurship**

- Business development
- Business model concepts and basic business forms
- Theories of globalisation processes
- Globalisation, culture and innovation
- International entrepreneurship and innovation

### **Technology and Project Management**

- Theories of technological change
- Linking technological change to industrial evolution
- Methods of technological change
- Management of Technology
- Project and programme management
- Portfolio management
- Methods and models for assessing project management systems

### **Experience Design**

- Unique values in the product design
- Theories in understanding user needs and experiences
- Methodologies of contextual design research and analysis
- Experience design within an organisational context
- The link between an organisation's vision and brand to experience design

### **Technology Entrepreneurship and Business Development**

- Entrepreneurial/Innovation skills and mind-set in technology-driven business environments
- Establishing and managing innovation and growth in new global technology ventures
- Technology commercialization frameworks, models and theories in startups and established firms
- Hypothesis-driven entrepreneurship approaches focusing on prototyping, experimentation and customer development
- Effectuation/Bricolage theories of entrepreneurship, open innovation and new product development
- Business development under conditions of high uncertainties
- Linking innovation, networking and early globalization of new technology firms

### **Sustainable Product Development**

- Theories for sustainable product development
- Environmental life cycle assessment
- Global sustainability issues
- Material flow analysis
- Mathematical modelling for environmental applications
- Green supply chain management.

## §4 Profiles of the Study Programme

The graduate students can specialise within the profiles **Product Value Creation, Technology Entrepreneurship and Business Development** or **Sustainable Product Development**

Semester themes for the profile **Product Value Creation**

Semester	Themes
4	Thesis
3	Market and value creation (study abroad)
2	Innovation in a global world
1	Technological change and management

Semester themes for the profile **Technology Entrepreneurship and Business Management**

Semester	Themes
4	Thesis
3	Value creation in the global market place
2	Technological innovation management in a global world
1	Technological entrepreneurship and management

Semester themes for the profile **Sustainable Product Development**

Semester	Themes
4	Thesis
3	Environmental impacts and assessments
2	Formulation and modelling
1	Sustainability and product development

## §5 Structure and Modules of the Study Programme (by academic profile and background)

**Product Value Creation** (for PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	Globalization and Entrepreneurship 3 <b>PDCGLO3</b>					Experience design 2 <b>PDCXBD2</b>					Open Innovation and New Markets <b>PDCOI</b>					Project 3 ( <b>PDCPRO3</b> ) and elective courses (10 ECTS) or In-company Period ( <b>PDCINCO</b> )*														
2. semester (spring)	Project 2 <b>PDCPRO2</b>										Modularization and Platform Design <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					Theories and Methods of Technological change <b>PDCTMTC</b>					Elective				
1. semester (autumn)	Project 1 <b>PDCPRO1</b>					Consumer Product Testing and Optimization <b>PDCCPTO</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Experienced Based Designing 1 <b>PDCXBD1</b>					Elective				
ECTS	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

\*) Choose between Project 3 (5 ECTS) and electives (10 ECTS) OR In-company Period (15 ECTS)

**Product Value Creation** (for non PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	Globalization and Entrepreneurship 3 <b>PDCGLO3</b>					Experience design 2 <b>PDCXBD2</b>					Open Innovation and New Markets <b>PDCOI</b>					Project 2 ( <b>PDCPRO2</b> ) and elective courses (5 ECTS) or In-company Period ( <b>PDCINCO</b> )*														
2. semester (spring)	Fundamentals in Operations and Supply Chain Management <b>PDCFOS</b>					Project 1 <b>PDCPRO1</b>					Modularization and Platform Design <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					Theories and Methods of Technological change <b>PDCTMTC</b>					Elective				
1. semester (autumn)	Market Research <b>PDCMR</b>					Statistics for Product Development and Innovation <b>PDCSTA</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Experienced Based Designing 1 <b>PDCXBD1</b>					Elective				
ECTS	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

\*) Choose between Project 2 (10 ECTS) and electives (5 ECTS) OR In-company Period (15 ECTS)

**Product Value Creation** (for non PDI Bachelor undergraduates – enrolment spring)

Semester	Modules																													
4. semester (autumn)	Master Thesis <b>PDCTH</b>																													
3. semester (spring)	Project <b>PDCPRO2</b> and elective course (5 ECTS) or In-company Period ( <b>PDCINCO</b> )*										Open Innovation and New Markets <b>PDCOI</b>					Globalization and Entrepreneurship 3 <b>PDCGLO3</b>					Experience design 2 <b>PDCXBD2</b>									
2. semester (autumn)	Statistics for product develop- ment and innova- tion <b>PDCSTA</b>					Market Research <b>PDCMR</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Experienced Based Designing 1 <b>PDCXBD1</b>					Elective				
1. semester (spring)	Fundamentals in Operations and Supply Chain Management <b>PDCFOS</b>					Project 1 <b>PDCPRO1</b>					Modularization and Platform Design <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					Theories and Methods of Tech- nological change <b>PDCTMTC</b>					Elective				
ECTS	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

\*) Choose between Project 2 (10 ECTS) and elective (5 ECTS) OR In-company Period (15 ECTS)



**Technology Entrepreneurship and Business Development** (for PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	In-company Period ( <b>PDCINCO</b> )															Open Innovation and New Markets <b>PDCOI</b>	Globalization and Entrepreneurship 3 - the Global Business Model <b>PDCGLO3</b>	Elective***												
	Technology Entrepreneurship & Business Development - 2 <b>PDCTEBD2</b>					Elective***																								
2. semester (spring)	Technology Intrapreneurship & Business Development <b>PDCTIBD</b>					Theories and Methods of Technological change <b>PDCTMTC</b>					Modularization and Platform Design <b>PDCMPD</b>					Globalization and Entrepreneurship 1 - Business Establishment <b>PDCGLO1</b>					Elective					Elective				
1. semester (autumn)	Technology Entrepreneurship & Business Development - 1 <b>PDCTEBD1</b>					Consumer Product Testing and Optimization <b>PDCCP TO</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 - Globalisation of Markets <b>PDCGLO2</b>					Prototyping as a Tool in the Entrepreneurial Process <b>PDCXPEP</b>					Elective				
ECTS	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

\*\*\* Electives: Courses that are compulsory for other profiles/programmes such as Product Value Creation, Operations Management, Sustainable Product Development, Environmental Engineering can also be approved by the Study Board as electives

**Technology Entrepreneurship and Business development** (for non PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	In-company Period ( <b>PDCINCO</b> )															Open Innovation and New Markets <b>PDCOI</b>	Globalization and Entrepreneurship 3 - the Global Business Model <b>PDCGLO3</b>	Elective***												
	Technology Entrepreneurship & Business Development - 2 <b>PDCTEBD2</b>					Elective***																								
2. semester (spring)	Technology Intrapreneurship & Business De- velopment <b>PDCTIBD</b>		Theories and Methods of Tech- nological change <b>PDCTMTC</b>			Modularization and Platform De- sign <b>PDCMPD</b>			Globalization and Entrepreneurship 1 - Business Es- tablishment <b>PDCGLO1</b>			Elective			Elective															
1. semester (autumn)	Technology Entrepreneurship & Business De- velopment - 1 <b>PDCTEBD1</b>		Consumer Product Testing and Opti- mization <b>PDCCPTO</b>			Management of Technology <b>PDCMT</b>			Globalization and Entrepreneurship 2 - Globalisation of Markets <b>PDCGLO2</b>			Prototyping as a Tool in the Entre- preneurial Process <b>PDCXPEP</b>			Elective															
ECTS	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

\*\*\* Electives: Courses that are compulsory for other profiles/programmes such as Product Value Creation, Operations Management, Sustainable Product Development, Environmental Engineering can also be approved by the Study Board as electives

**Sustainable Product Development** (for PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	In-company Period ( <b>PDCINCO</b> )															Open Innovation and New Markets <b>PDCOI</b>	Elective	Globalization and entrepreneurship 3 <b>PDCGLO3</b>												
	Project 2 <b>PDCPRO2</b>					Elective***																								
2. semester (spring)	Project 1 <b>PDCPRO1</b>					Theories and Methods of Tech- nological change <b>PDCTMTC</b>					Modularization and Platform De- sign <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					Basics in Life Cycle Assessment <b>PDCLCA1</b>					Elective				
1. semester (autumn)	Global Sustainability <b>EM-GLSU</b>					Consumer Product Testing and Opti- mization <b>PDCCPTO</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Product and Sup- ply Chain Design for Environment <b>PDCDFE</b>					Elective				
ECTS	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

\*\*\* Electives: Courses that are compulsory for other profiles/programmes such as Product Value Creation, Operations Management, Environmental Engineering can also be approved by the Study Board as electives

**Sustainable Product Development** (for non PDI Bachelor undergraduates – enrolment autumn)

Semester	Modules																													
4. semester (spring)	Master Thesis <b>PDCTH</b>																													
3. semester (autumn)	In-company Period ( <b>PDCINCO</b> )															Open Innovation and New Markets <b>PDCOI</b>	Elective	Globalization and entrepreneurship 3 <b>PDCGLO3</b>												
	Project 2 <b>PDCPRO2</b>					Elective***																								
2. semester (spring)	Project 1 <b>PDCPRO1</b>					Theories and Methods of Tech- nological change <b>PDCTMTC</b>					Modularization and Platform De- sign <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					Basics in Life Cycle Assessment <b>PDCLCA</b>					Elective				
1. semester (autumn)	Global Sustainability <b>EM-GLSU</b>					Consumer Product Testing and Opti- mization <b>PDCCPTO</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Product and Sup- ply Chain Design for Environment <b>PDCDFE</b>					Elective				
ECTS	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

\*\*\* Electives: Courses that are compulsory for other profiles/programmes such as Product Value Creation, Operations Management, Environmental Engineering can also be approved by the Study Board as electives

**Sustainable Product Development** (for non PDI Bachelor undergraduates – enrolment spring)

Semester	Modules																													
4. semester (autumn)	Master Thesis <b>PDCTH</b>																													
3. semester (spring)	In-company Period ( <b>PDCINCO</b> )															Open Innovation and New Markets <b>PDCOI</b>	<b>Elective</b>	Globalization and entrepreneurship 3 <b>PDCGLO3</b>												
	Project 2 <b>PDCPRO2</b>										Elective***																			
2. semester (autumn)	Global Sustainability <b>EM-GLSU</b>					Consumer Product Testing and Opti- mization <b>PDCCPTO</b>					Management of Technology <b>PDCMT</b>					Globalization and Entrepreneurship 2 <b>PDCGLO2</b>					Product and Sup- ply Chain Design for Environment <b>PDCDFE</b>					<b>Elective</b>				
1. semester (spring)	Project 1 <b>PDCPRO1</b>					Theories and Methods of Tech- nological change <b>PDCTMTC</b>					Modularization and Platform De- sign <b>PDCMPD</b>					Globalization and Entrepreneurship 1 <b>PDCGLO1</b>					<b>Elective</b>					Basics in Life Cycle Assessment <b>PDCLCA</b>				
ECTS	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

\*\*\* Electives: Courses that are compulsory for other profiles/programmes such as Product Value Creation, Operations Management, Environmental Engineering can also be approved by the Study Board as electives

## §6-13 Profile: Product Value Creation

### §6 Description of the 1st Semester – Profile Product Value Creation for Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn

#### SEMESTER THEME

Technological Change and Management

#### VALUE ARGUMENT

The courses on first semester will build a theoretical framework on the basic product development skills acquired on the bachelor programme.

The first semester introduces the students to profile courses. The profile courses discuss value creation and how unique features can be integrated in physical products. The teaching is strongly related to the research area of experienced design.

The students gain knowledge and techniques of human-centred research in experience design and extend the strategic experience design approach across the entire value network. Designing a stakeholder-focused value co-creation process from a strategic perspective is one of the main issues which are covered in the profile courses.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context.

There will be a discussion of the many complex issues involved in globalisation processes in forming an understanding of Globalization and Entrepreneurship.

During the first semester the students will develop an understanding of how technology and product development are linked together in order to create successful business opportunities. The focus is on management of technology and innovation from a more general engineering management perspective. The aim is development of a solid theoretical foundation as well as critical insight into the practical problems of value creation and value capture in technology-intensive business environments.

In this semester the students have the opportunity to develop skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors.

#### COMPETENCE GOALS

The competence goals for the first semester **Product Value Creation** are as follows:

- Being able to understand and use techniques of human-centred research in experience design.
- Being able to explain theories in design anthropology, especially those that focus on experience.
- Being able to understand, evaluate and use the theories in the field of technology management.
- Being able to understand the many complex issues involved in globalisation processes with special attention to business and consumer culture.

- Being able to understand and describe how globalisation affects business cultures, strategies and alters consumer practices.
- Being able to identify and map all activities within the firm and analyse them using a basic organizational and strategic management framework.
- Being able to Understand the role of value creation and strategy within an organization.

## **MODULES**

The first semester contains the following modules:

Constituent modules:

PDCPRO1 – Project (5 ECTS)

PDCCPTO Consumer Product Testing and Optimization (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 (5 ECTS)

PDCXBD1 – Experienced Based Designing 1 (5 ECTS)

Elective modules, 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§7 Description of the 1st Semester** – Profile Product Value Creation for students with other background than Bachelor of Science in Engineering (Product Development and Innovation) – enrolment autumn

### **SEMESTER THEME**

Technological Change and Management

### **VALUE ARGUMENT**

The first semester introduces the students to profile courses. The profile courses discuss value creation and how unique features can be integrated in physical products. The teaching is strongly related to the research area of experienced design.

The students gain knowledge and techniques of human-centred research in experience design and extend the strategic experience design approach across the entire value network. Designing a stakeholder-focused value co-creation process from a strategic perspective is one of the main issues which are covered in the profile courses.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context.

There will be a discussion of the many complex issues involved in globalisation processes as the second step in forming an understanding of Globalization and Entrepreneurship.

During the first semester the students will develop an the understanding of how technology and product development are linked together in order to create successful business opportunities. The focus is on management of technology and innovation from a more general engineering management perspective. The aim is development of a solid theoretical foundation as well as critical insight into the practical problems of value creation and value capture in technology-intensive business environments. The first semester also deals with how data from market research analysis can be used in the product development process.

In this semester the students have the opportunity to develop skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors.

### **COMPETENCE GOALS**

The competence goals for the first semester Product Value Creation are as follows:

- Being able to understand and use techniques of human-centred research in experience design
- Being able to explain theories in design anthropology, especially those that focus on experience
- Being able to understand, evaluate and use the theories in the field of technology management
- Being able to understand the many complex issues involved in globalisation processes with special attention to business and consumer culture.
- Being able to understand and describe how globalisation affects business cultures and strategies and alters consumer practices
- Getting insight into the most important types of market research techniques and into the ways market research analysis could be used by key decision-makers and managers involved in the product development and innovation process.



- Being able to use combinations of more advanced quantitative and qualitative data collection and analysis techniques by focusing on both primary and secondary data.

## **MODULES**

The first semester contains the following modules:

Constituent modules:

PDCMR – Market Research (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 (5 ECTS)

PDCXBD1 – Experienced Based Designing 1 (5 ECTS)

PDCSTA – Statistics for Product Development and Innovation (5 ECTS)

Elective modules, 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§8 Description of the 1st Semester** – Profile Product Value Creation for students with other background than Bachelor of Science in Engineering (Product Development and Innovation) – enrolment Spring

### **SEMESTER THEME**

Innovation in a Global World

### **VALUE ARGUMENT**

The first semester introduces the students to some of the fundamental disciplines of the study programme. Because the master programme study appeals to candidates from quite different Bachelor programmes, bridging courses will be run for the students. This means that the master study programme for these students will be in alignment with the main objectives of the PDI courses and the students from different bachelor programmes will be able to communicate across the specializations and disciplines. For the profile Product Value Creation, the bridging course covers operation management and supply chain management.

Furthermore, several basic courses in product architecture and technological change processes are offered. These courses provide the students with the foundation for coping with the courses defined as profile courses in third semester.

The elective courses offered give the student a chance to acquire the necessary competencies in specific areas as an important support to the profile courses. If the student already has any of these competencies at a bachelor level, one of the other electives for this semester can be taken instead.

### **COMPETENCE GOALS**

The competence goals for the first semester are as follows:

- Being able to understand and apply relevant theory, models, concepts and methods within value chain design, statistics, structuring of products as well as technological change processes and business development in global environments.
- Being able to define relevant research problems within the central subject areas such as technological change processes. This course is dedicated to introducing the Science Theory at master level as an add-on linking the special topic of the study programme to competencies acquired by the students at bachelor level.
- Being able to integrate relevant theoretical sources when answering research problems
- Being able to apply the gained knowledge to real-life cases
- Being able to present findings and structure presentations, and shaping research based assignments.

### **MODULES**

The first semester contains six of the following modules:

Constituent modules:

PDCFOS – Fundamentals in Operations and Supply Chain Management (5 ECTS)

PDCMPD – Modularization and Platform Design (5 ECTS)

PDCGLO1 – Globalization and Entrepreneurship1 (5 ECTS)

PDCTMTC – Theories and Methods of Technological Change (5 ECTS)

PDCPRO1 – Project 1 (5 ECTS)

Elective modules, 5 ECTS

**CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§9 Description of the 2nd Semester** – Profile Product Value Creation for Bachelors of Science in Engineering (Product Development and Innovation)

### **SEMESTER THEME**

Innovation in a Global World

### **VALUE ARGUMENT**

The second semester introduces the students to fundamental disciplines of the study programme, such as courses in product architecture and technological change processes. These courses provide the students with the foundation for coping with the profile courses in the third semester. The course Globalisation and Entrepreneurship 1 continues the track from the previous semester.

This semester provides the students with foundational skills in and understanding of the legal aspects as well as business aspects of global entrepreneurship. The students are given an opportunity to develop their skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors. Thereby the students are given a strong basis for further development of the business opportunity. The student can choose among continuing the track from first semester, (entrepreneurship or more thorough research activities), or changing track to the other option.

The elective courses offered will give the student a chance to acquire the necessary competencies in specific areas as an important support to the profile courses.

### **COMPETENCE GOALS**

The competence goals for the second semester are as follows:

- Being able to understand and apply relevant theory, models, concepts and methods within, structuring of products as well as technological change processes and business development in global environments.
- Being able to define relevant research problems within the central subject areas such as technological change processes. This course is dedicated to introducing the Science Theory at master level as an add-on linking the special topic of the study programme to competencies acquired by the students at bachelor level.
- Being able to integrate relevant theoretical sources when answering research problems.
- Being able to apply the gained knowledge to real-life cases.
- Being able to present findings and structure presentations, and shaping research based assignments.

### **MODULES**

The second semester contains five of the following modules:

Constituent modules:

PDCMPD – Modularization and Platform Design (5 ECTS)

PDCGLO1 – Globalization and Entrepreneurship1 (5 ECTS)

PDCTMTC – Theories and Methods of Technological Change (5 ECTS)

PDCPRO2- Project 2 (10 ECTS)

Elective modules, 5 ECTS

### **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§10 Description of the 2nd Semester** – Profile Product Value Creation for students with other background than Bachelor of Science in Engineering (Product Development and Innovation) – enrolment Autumn

### **SEMESTER THEME**

Innovation in a Global World

### **VALUE ARGUMENT**

The second semester introduces the students to some of the fundamental disciplines of the study programme. Because the master programme study appeals to candidates from quite different Bachelor programmes, bridging courses will be run for the students. This means that the master study programme for these students will be in alignment with the main objectives of the PDI courses and the students from different bachelor programmes will be able to communicate across the specializations and disciplines. For the profile Product Value Creation, the bridging course covers operation management and supply chain management as well as statistics for Product Development and Innovation.

Furthermore, several basic courses in product architecture and technological change processes are offered. These courses provide the students with the foundation for coping with the courses defined as profile courses in third semester.

The elective courses offered give the student a chance to acquire the necessary competencies in specific areas as an important support to the profile courses. If the student already has any of these competencies at a bachelor level, one of the other electives for this semester can be taken instead.

### **COMPETENCE GOALS**

The competence goals for the second semester are as follows:

- Being able to understand and apply relevant theory, models, concepts and methods within value chain design, statistics, structuring of products as well as technological change processes and business development in global environments.
- Being able to define relevant research problems within the central subject areas such as technological change processes. This course is dedicated to introducing the Science Theory at master level as an add-on linking the special topic of the study programme to competencies acquired by the students at bachelor level.
- Being able to integrate relevant theoretical sources when answering research problems.
- Being able to apply the gained knowledge to real-life cases.
- Being able to present findings and structure presentations, and shaping research based assignments.

### **MODULES**

The second semester contains 6 of the following modules:

Constituent modules:

PDCFOS – Fundamentals in Operations and Supply Chain Management (5 ECTS)

PDCPRO1 – Project 1 (5 ECTS)

PDCMDP – Modularization and Platform Design, (5 ECTS)

PDCGLO1 – Globalization and Entrepreneurship1, (5 ECTS)

PDCTMTC – Theories and Methods of Technological Change (5 ECTS)

Elective modules, 5 ECTS

**CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

**Description of the 2nd Semester** – Profile Product Value Creation for students with other background than Bachelor of Science in Engineering (Product Development and Innovation) – enrolment Spring

**SEMESTER THEME**

Technological Change and Management

**VALUE ARGUMENT**

The second semester introduces the students to profile courses. The profile courses discuss value creation and how unique features can be integrated in physical products. The teaching is strongly related to the research area of experienced design.

The students gain knowledge and techniques of human-centred research in experience design and extend the strategic experience design approach across the entire value network. Designing a stakeholder-focused value co-creation process from a strategic perspective is one of the main issues which are covered in the profile courses.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context.

There will be a discussion of the many complex issues involved in globalisation processes as the second step in forming an understanding of Globalization and Entrepreneurship.

During the second semester the students will develop an understanding of how technology and product development are linked together in order to create successful business opportunities. The focus is on management of technology and innovation from a more general engineering management perspective. The aim is development of a solid theoretical foundation as well as critical insight into the practical problems of value creation and value capture in technology-intensive business environments. The first semester also deals with how data from market research analysis can be used in the product development process.

In this semester the students have the opportunity to develop skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors.

**COMPETENCE GOALS**

The competence goals for the second semester Product Value Creation are as follows:

- Being able to understand and use techniques of human-centred research in experience design
- Being able to explain theories in design anthropology, especially those that focus on experience
- Being able to understand, evaluate and use the theories in the field of technology management
- Being able to understand the many complex issues involved in globalisation processes with special attention to business and consumer culture.
- Being able to understand and describe how globalisation affects business cultures and strategies and alters consumer practices
- Getting insight into the most important types of market research techniques and into the ways market research analysis could be used by key decision-makers and managers involved in the product development and innovation process.



- Being able to use combinations of more advanced quantitative and qualitative data collection and analysis techniques by focusing on both primary and secondary data.

## **MODULES**

The second semester contains the following modules:

Constituent modules:

PDCMR – Market Research (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 (5 ECTS)

PDCXBD1 – Experienced Based Design 1 (5 ECTS)

PDCSTA – Statistics for Product Development and Innovation (5 ECTS)

Elective modules, 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§11 Description of the 3rd Semester – Profile Product Value Creation for Bachelors of Science in Engineering (Product Development and Innovation)**

### **SEMESTER THEME**

Market and Value Creation

### **VALUE ARGUMENT**

In this semester the student will continue to develop the competencies within the chosen profile on basis of mandatory as well as on elective courses.

The profile course Experience design 2, Staging Change focuses on the particular challenge of experience design to evoke transformation at different scales of change: individuals, systems, organizations and society. Drawing upon theories of behavioural and organizational change, students explore how the design process can be applied in order to understand, prototype and sustain meaningful change. Introducing current techniques in transformation design, the course challenges students to design tools, processes, or strategies that encourage change at the personal to the social levels.

During the semester the students have the opportunity of further developing skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors. The student can choose among continuing the track from second semester (entrepreneurship or more thorough research activities), or change track to the other option.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context. The course Globalization and entrepreneurship 3 integrates internationalization theories, models of globalization, entrepreneurship and new digital business models. The course hence constitutes a foundation for understanding international efforts of firms as well as the new global market conditions in which new products are developed, introduced and consumed. The course, Open Innovation, provides an insight into the literature on open innovation, inter-organisational relations and market analyses. These particular themes are especially relevant in situations where a firm is operating in markets that are new. The course therefore combines new theories of innovation, entrepreneurship and market analysis.

### **COMPETENCE GOALS**

The competence goals for the third semester Product Value Creation are as follows:

- Understanding the theories in designing for change.
- Being able to facilitate experiences that move people towards desirable outcomes.
- Being able to identify why and explain how the company establishes, develops, maintains, and controls inter-organisational relationships for value creation.
- Being able to describe and evaluate the main managerial decisions regarding collaborative relationships with other organisations.
- Understanding the premises of open innovation and the implications for the management of innovation.
- Being able to describe and outline a market analysis for a new market.
- Being able to identify global market opportunities and threats for business strategy and product development.
- Being able to analyse and assess new digital and global business models - e- and m-commerce.
- Being able to assess the impact of globalisation trends for business establishment and strategy.

- Being able to analyse the consequences of particular globalization effects on SME's.
- Being able to identify and suggest implementations of strategy changes for businesses.
- Being able to identify significant legal problems when establishing international businesses or enterprises.
- Being able to identify and describe the main legal aspects of doing international business transactions.

## **MODULES**

The third semester contains the following modules:

Constituent modules are:

PDCPRO3 – Project (5 ECTS)\*

PDCOI – Open Innovation and New Markets (5 ECTS)

PDCGLO3 – Globalization and Entrepreneurship 3 (5 ECTS)

PDCXBD2 – Experienced Based Designing 2 (5 ECTS)

Elective modules, 10 ECTS

PDCINCO – In-company Period (15 ECTS)

\*) Students may choose to replace PDCPRO3 (5 ECTS) and two elective modules (10 ECTS) with PDCINCO (In-company Period).

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§12 Description of the 3rd Semester** – Profile Product Value Creation for students with other background than Bachelor of Science in Engineering (Product Development and Innovation)

### **SEMESTER THEME**

Market and Value Creation

### **VALUE ARGUMENT**

In this semester the student will continue to develop the competencies within the chosen profile on basis of mandatory as well as on elective courses.

The profile course Experience design 2, Staging Change focuses on the particular challenge of experience design to evoke transformation at different scales of change: individuals, systems, organizations and society. Drawing upon theories of behavioural and organizational change, students explore how the design process can be applied in order to understand, prototype and sustain meaningful change. Introducing current techniques in transformation design, the course challenges students to design tools, processes, or strategies that encourage change at the personal to the social levels.

During the semester the students have the opportunity of further developing skills and insight within the actual research area or, as another option, develop the competencies in entrepreneurship in a more practical way, supported by a team of supervisors. The student can choose among continuing the track from first semester (entrepreneurship or more thorough research activities), or change track to the other option.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context. The course Globalization and entrepreneurship 3 integrates internationalization theories, models of globalization, entrepreneurship and new digital business models. The course hence constitutes a foundation for understanding international efforts of firms as well as the new global market conditions in which new products are developed, introduced and consumed. The course, Open Innovation, provides an insight into the literature on open innovation, inter-organisational relations and market analyses. These particular themes are especially relevant in situations where a firm is operating in markets that are new. The course therefore combines new theories of innovation, entrepreneurship and market analysis.

### **COMPETENCE GOALS**

The competence goals for the third semester Product Value Creation are as follows:

- Understanding the theories in designing for change.
- Being able to facilitate experiences that move people towards desirable outcomes.
- Being able to identify why and explain how the company establishes, develops, maintains, and controls inter-organisational relationships for value creation.
- Being able to describe and evaluate the main managerial decisions regarding collaborative relationships with other organisations.
- Understanding the premises of open innovation and the implications for the management of innovation.
- Being able to describe and outline a market analysis for a new market.
- Being able to identify global market opportunities and threats for business strategy and product development.
- Being able to analyse and assess new digital and global business models - e- and m-commerce.

- Being able to assess the impact of globalisation trends for business establishment and strategy.
- Being able to analyse the consequences of particular globalization effects on SME's.
- Being able to identify and suggest implementations of strategy changes for businesses.
- Being able to identify significant legal problems when establishing international businesses or enterprises.
- Being able to identify and describe the main legal aspects of doing international business transactions.

## **MODULES**

The third semester contains the following modules:

Constituent modules are:

PDCPRO2 – Project (10 ECTS)\*

PDCOI – Open Innovation and New Markets (5 ECTS)

PDCGLO3 – Globalization and Entrepreneurship 3 (5 ECTS)

PDCXBD2 – Experienced Based Designing 2 (5 ECTS)

Elective modules, 5 ECTS

\*) Students may choose to replace PDCPRO2 (10 ECTS) and one elective module (5 ECTS) with PDCINCO (In-company Period, 15 ECTS).

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to supply with further basic competencies supporting the chosen profile.

## **§13 Description of the 4th Semester** – Profile Product Value Creation regardless of academic background

### **SEMESTER THEME**

Master's Thesis

### **VALUE ARGUMENT**

The Master's thesis concludes the Master's programme

The thesis project is a working process that documents the student's competencies attained during his/her work on a course-relevant and interdisciplinary subject.

### **COMPETENCE GOALS**

The competence goal for the fourth semester Product Value Creation is as follows:

- Accounting for relevant skills based on the highest level of international research within the subject area of the PDI programme.

### **MODULES**

The fourth semester contains the following module:

Constituent module is:

PDCTH – Master Thesis (30 ECTS)

## **§14-18 Profile: Technology Entrepreneurship and Business Development**

**§14 Description of the 1st Semester** – *Technology Entrepreneurship and Business Development for Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn*

### **SEMESTER THEME**

Technological Entrepreneurship and Management

### **VALUE ARGUMENT**

The first semester introduces the students to some of the key profile courses. The profile courses focus on:

- Identifying the distinguishing characteristics of innovation management and entrepreneurship practices in early stage technology-based businesses.
- Developing an entrepreneurial mindset by working on a specific new business idea and acquiring the generative entrepreneurial skills and practices characterizing successful entrepreneurs and innovators.
- Using theoretical approaches, frameworks and models to provide sound answers to the Why?, What?, How?, Who?, and When? questions related to the launch and growth of a technology venture on the basis of the new business idea.
- Understanding the drivers of pricing, cost structuring and revenue growth of new technology ventures.
- Using lean entrepreneurship and prototyping techniques to align technology development and business model development with emerging sustainable competitive advantages.
- Adopting a business ecosystem approach to the management of commercialization of new technological products and services.
- Participating in the Venture Cup Idea competition to get valuable feedback and possibly win a financial award that could help the progress of the technology-based entrepreneurial business project.
- Designing and building a supporting supply chain (business ecosystem) that supports the companies' overall market strategy.
- Aligning firm's product design and operational activity system to its value chain / ecosystem
- Emphasizing the global dimensions of technology entrepreneurship, value chain/ecosystem and market development.

The central courses which form the common area between the different profiles link the profile to the general business, product development and supply chain processes in a global context.

There will be a discussion of the many complex issues involved in globalisation processes as forming a common understanding of technology innovation, entrepreneurship, business ecosystem development and globalization.

The first semester develops the understanding of how technology, product and business development are linked together in order to create successful business opportunities with a global market reach. The focus is on technology entrepreneurship and management of innovation which are addressed from an ecosystem perspective. The aim is development of a solid theoretical foundation as well as critical insights into the practical problems of value creation and value capture in technology-intensive business environments on a global scale.

In this semester the students have the opportunity of: a) acquiring the skills to develop insights within the actual applied research area; b) developing the competencies in technology innovation, entrepreneurship and new business development on a global scale in a more practical way, supported by a supervisor and business mentors using all the resources of the local entrepreneurial ecosystem.

Students should start their own entrepreneurial projects/ventures in this semester and will be expected/encouraged to participate in the Venture Cup Idea competition in order to get valuable feedback from professional business mentors and possibly win a financial award that will support the progress and establishment of their new ventures.

## **COMPETENCE GOALS**

The competence goals for the first semester Technology Entrepreneurship and Business Development profile are as follows:

- Being able to understand the specifics of entrepreneurship and innovation management practices in technology-driven business environments.
- Being able to articulate and implement Lean startup techniques including business modeling, designing prototypes and minimum viable products by running experiments aiming at customer development and new technology venture establishment.
- Being able to use an ecosystem approach to the management of technological product commercialization in early stage businesses by taking into account all relevant financial aspects.
- Being able to use the set of tools, models, approaches, and theories that can be used to increase the competitiveness of market offers and attract key resources and partners to deliver these market offers to customers.
- Acquiring the proper communication and championing skills that would enable the adoption of new technological products, services and technology-enabled practices.
- Being able to engage with other graduate students, talented individuals, business and technology experts, who are part of the local business ecosystem, in conceptualizing, creating and driving new technology-based business opportunities.
- Being able to explain how new product development and commercialization strategies interact with emerging supply chains, business ecosystems and global market niches.
- Being able to understand the multiple complex issues involved in the development of global market niches with special attention to business and consumer culture.

## **MODULES**

The first semester contains the following modules:

Constituent modules are:

PDCTEBD1 – Technology Entrepreneurship and Business Development (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 – Globalisation of Markets (5 ECTS)

PDCXPEP – Prototyping as a Tool in the Entrepreneurial Process (5 ECTS)

PDCCPTO Consumer Product Testing and Optimization (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.



## **§15 Description of the 1st Semester – Technology Entrepreneurship and Business Development for non PDI Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn**

### **SEMESTER THEME**

Technological Entrepreneurship and Management

### **VALUE ARGUMENT**

The first semester introduces the students to some of the key profile courses. The profile courses focus on:

- Identifying the distinguishing characteristics of innovation management and entrepreneurship practices in early stage technology-based businesses.
- Developing an entrepreneurial mindset by working on a specific new business idea and acquiring the generative entrepreneurial skills and practices characterizing successful entrepreneurs and innovators.
- Using theoretical approaches, frameworks and models to provide sound answers to the Why?, What?, How?, Who?, and When? questions related to the launch and growth of a technology venture on the basis of the new business idea.
- Understanding the drivers of pricing, cost structuring and revenue growth of new technology ventures.
- Using lean entrepreneurship and prototyping techniques to align technology development and business model development with emerging sustainable competitive advantages.
- Adopting a business ecosystem approach to the management of commercialization of new technological products and services.
- Participating in the Venture Cup Idea competition to get valuable feedback and possibly win a financial award that could help the progress of the technology-based entrepreneurial business project.
- Designing and building a supporting supply chain (business ecosystem) that supports the companies' overall market strategy.
- Aligning firm's product design and operational activity system to its value chain / ecosystem
- Emphasizing the global dimensions of technology entrepreneurship, value chain/ecosystem and market development.

The central courses which form the common area between the different profiles link the profile to the general business, product development and supply chain processes in a global context.

There will be a discussion of the many complex issues involved in globalisation processes as forming a common understanding of technology innovation, entrepreneurship, business ecosystem development and globalization.

The first semester develops the understanding of how technology, product and business development are linked together in order to create successful business opportunities with a global market reach. The focus is on technology entrepreneurship and management of innovation which are addressed from an ecosystem perspective. The aim is development of a solid theoretical foundation as well as critical insights into the practical problems of value creation and value capture in technology-intensive business environments on a global scale.

In this semester the students have the opportunity of: a) acquiring the skills to develop insights within the actual applied research area; b) developing the competencies in technology innovation, entrepreneurship and new business development on a global scale in a more practical way, sup-

ported by a supervisor and business mentors using all the resources of the local entrepreneurial ecosystem.

Students should start their own entrepreneurial projects/ventures in this semester and will be expected/encouraged to participate in the Venture Cup Idea competition in order to get valuable feedback from professional business mentors and possibly win a financial award that will support the progress and establishment of their new ventures.

## COMPETENCE GOALS

The competence goals for the first semester Technology Entrepreneurship and Business Development profile are as follows:

- Being able to understand the specifics of entrepreneurship and innovation management practices in technology-driven business environments.
- Being able to articulate and implement Lean startup techniques including business modeling, designing prototypes and minimum viable products by running experiments aiming at customer development and new technology venture establishment.
- Being able to use an ecosystem approach to the management of technological product commercialization in early stage businesses by taking into account all relevant financial aspects.
- Being able to use the set of tools, models, approaches, and theories that can be used to increase the competitiveness of market offers and attract key resources and partners to deliver these market offers to customers.
- Acquiring the proper communication and championing skills that would enable the adoption of new technological products, services and technology-enabled practices.
- Being able to engage with other graduate students, talented individuals, business and technology experts, who are part of the local business ecosystem, in conceptualizing, creating and driving new technology-based business opportunities.
- Being able to explain how new product development and commercialization strategies interact with emerging supply chains, business ecosystems and global market niches.
- Being able to understand the multiple complex issues involved in the development of global market niches with special attention to business and consumer culture.

## MODULES

The first semester contains the following modules:

Constituent modules are:

PDCTEBD1 – Technology Entrepreneurship and Business Development (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 (5 ECTS)

PDCXPEP – Prototyping as a Tool in the Entrepreneurial Process (5 ECTS)

PDCCPTO Consumer Product Testing and Optimization (5 ECTS)

Elective modules equivalent of 5 ECTS

## CONTEXT

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **6 Description of the 2<sup>nd</sup> Semester** – Profile Technology Entrepreneurship and Business Development

### **SEMESTER THEME**

Technological Innovation Management in a Global World

### **VALUE ARGUMENT**

The second semester introduces the students to more fundamental disciplines of the study programme while enhancing their profile competencies within the context of intrapreneurship and innovation management practices of established organizations and existing startups aiming at a global market reach.

Furthermore, basic courses in product/process platform design and technological change processes will be offered. The understanding gained from these courses provides the students with the foundation for coping with the courses defined as profile courses in the third semester (In Company Period, Global Business Models or Technology Entrepreneurship B2B project).

The course Globalisation and Entrepreneurship 1 continues the track from the previous semester. This semester the course provides the students with foundational skills in the understanding of the legal aspects as well as business aspects of global entrepreneurship. The students are given the opportunity of developing skills in as well as insight into the actual research area and developing the competencies in intrapreneurship and new product development and innovation in a more practical way, supported by a team of internal or external supervisors. Thereby the students are provided with a strong basis of skills focusing on the development of technology-based business opportunities in established firms.

The electives offered will give the students a chance to acquire complementary competencies in specific areas as an important support to the profile courses.

Students will be expected to engage in intrapreneurial technology innovation projects in an established firm or an existing startup in order to implement and practice the theoretical knowledge and analytical skills acquired during the current and previous semester. Having started their own entrepreneurial projects/ventures in the previous semester students will also be encouraged to participate in the Venture Cup Startup competition in order to get valuable feedback from professional business mentors and possibly win a financial award that will support the growth of their new ventures.

### **COMPETENCE GOALS**

The competence goals for the second semester are as follows:

- Being able to understand and apply relevant theory, models, concepts and methods to the shaping of products as well as technological change processes and business development activities in global environments.
- Being able to formulate and drive new intrapreneurship projects focusing on new product ideation, business opportunity development, product design and customer development in existing startups and established technology firms.
- Being able to define relevant research problems within the central subject areas such as technological change processes. This course is dedicated to introducing a deeper scientific theoretical background at the master level as an add-on linking the special topic of the study programme to competencies acquired by the student at bachelor level.
- Being able to integrate relevant theoretical sources when answering research problems
- Being able to apply the gained knowledge to real-life cases.

- Being able to present findings and, structure presentations, as well as shaping research-based assignments.

## **MODULES**

The second semester contains the following modules:

Constituent modules:

PDCMPD Modularization and Platform Design (5 ECTS)

PDCGLO1 – Globalization and Entrepreneurship (5 ECTS)

PDCTMTC – Theories and Methods of Technological Change (5 ECTS)

PDCTIBD – Technology Intrapreneurship and Business Development (5 ECTS)

Elective modules equivalent of 10 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The enhanced option for electives course will provide an opportunity for students to acquire further basic competencies in accordance with their personal preferences and chosen profile. Adding a second elective in the curriculum is a programme feature that enables the students to personalise the programme.

## **§17 Description of the 3rd Semester – Profile Technology Entrepreneurship and Business Development**

### **SEMESTER THEME**

Value Creation in the Global Market Place

### **VALUE ARGUMENT**

In this semester the students will continue to develop the competencies within the chosen profile on the basis of a combination of compulsory and elective courses. There is however a stronger empirical component in the programme profile focusing on student involvement in company projects (such as the In-company Period course, as an opportunity to engage in the intrapreneurial and new product development practices of an existing firm) or students' own technology entrepreneurship projects or new ventures (such as Technology Entrepreneurship and Business Development 2). The second option assumes that the students have already advanced their entrepreneurial project to the extent that they could be evaluated on the basis of how well they used the acquired knowledge and skills to grow their new ventures.

During the semester the students have the opportunity of further developing their knowledge and skills in the actual research area as well as to develop their competencies in entrepreneurship in a more practical way, supported by a supervisor and an external network of business mentors associated with the PDI program and the SDU Idea House in the Cortex park. They will get a strong basis for further development of their ability to articulate and develop technology-based business opportunities. The students can choose among a stronger empirical involvement in entrepreneurial activities or a stronger focus on a specific technology entrepreneurship and innovation research theme as a preparation for the Master Thesis in the next (last) semester.

The central courses which form the common area between the profiles link the specialisation of the profile to the general business and product development processes in a global context. The course Globalization and entrepreneurship 3 integrates internationalization theories, models of globalization, entrepreneurship and new digital business models. Hence, the course constitutes a foundation for understanding international efforts of firms as well as the new global market conditions in which new products are developed, introduced and consumed. The course, Open Innovation, provides an insight into the literature on open innovation, inter-organisational relations and market analyses. These particular themes are especially relevant in situations where a firm is operating in markets that are new or emerging. The course therefore combines new theories of innovation, entrepreneurship and market analysis.

### **COMPETENCE GOALS**

The competence goals for the third semester Technology Entrepreneurship and Business Development are as follows:

- Using the knowledge, theories, models, frameworks and entrepreneurial skills acquired within the PDI program to enable the growth of a new technology venture.
- Using the knowledge, theories, models, frameworks and practical skills acquired within the PDI program to drive a technology innovation or intrapreneurial project in an established company.
- Being able to perform an in depth literature review in order to formulate a Master Thesis project including clearly defined objective, relevance, deliverables, contributions and methodology.
- Being able to identify why and explain how the company establishes, develops, maintains, and controls inter-organisational relationships for value creation.

- Being able to describe and evaluate the main managerial decisions regarding collaborative relationships with other organisations.
- Understanding the premises of open innovation and the implications for the management of innovation.
- Being able to describe and outline a market analysis for a new technological product or service in a new or emerging market.
- Being able to identify new global market entrepreneurial opportunities and threats for business strategy and product development.
- Being able to analyse and assess new digital and global business models - e- and m-commerce.
- Being able to assess the impact of globalisation trends for new business establishment and strategy.
- Being able to analyse the consequences of particular globalization effects on technology-based business startups and SME's.
- Being able to identify and suggest implementations of strategy changes for businesses.
- Being able to identify relevant legal problems when establishing international businesses or enterprises.
- Being able to identify and describe the main legal aspects of doing international business transactions and partnership development.

## **MODULES**

The third semester contains the following modules:

Constituent modules are:

PDCTEBD2 – Technology Entrepreneurship and Business Development 2 (10 ECTS)

PDCOI – Open Innovation and New Markets (5 ECTS)

PDCGLO3 – Globalization and Entrepreneurship 3 (5 ECTS)

Elective modules equivalent of 10 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will provide an opportunity for students to acquire further competencies supporting and complementing the chosen profile.

## **§18 Description of the 4th Semester** – Profile Technology Entrepreneurship Development regardless of academic background

### **SEMESTER THEME**

Master's Thesis

### **VALUE ARGUMENT**

The Master's thesis concludes the Master's program.

The thesis project is based on a working process including three main aspects: technological/engineering aspect, business/marketing aspect and research aspect. The project activities and final report document the student's competencies attained during his/her work on a program profile-relevant and interdisciplinary subject.

### **COMPETENCE GOALS**

The competence goal for the fourth semester Technology Entrepreneurship and Business Development as follows:

- Accounting for course relevant skills based on the highest level of international research within the subject area of the PDI program.

### **MODULES**

The fourth semester contains the following module:

Constituent module is:

PDCTH – Master's Thesis (30 ECTS)

## **§19-26 Profile: Sustainable Product Development**

### **§19 Description of the 1st Semester – Sustainable Product Development for Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn**

#### **SEMESTER THEME**

Sustainability and product development

#### **VALUE ARGUMENT**

The first semester introduces the students to key concepts with regards to sustainable product development. The key courses focus on:

- The immense effects humans have on the global ecosystems, what the effects are and what are the potential underlying causes.
- Limits to growth, the IPAT equation, relationship between economic growth and environmental impact
- How product development can lead to innovative solutions which address some of the imminent sustainability issues.
- Provide a solid background of product development methodologies that focus in particular on sustainability.
- The practical deployment of methodologies to develop products, systems or services that address known sustainability issues.

The main courses students attend in the first semester provide a solid ground of knowledge with regards to sustainability. This involves sustainability on a global scale but also and in particular product development.

Tools are provided to visualise and describe fundamental issues with regards to sustainability. Students learn relevant terminology and are introduced to various aspects of scientific fields concerning sustainability. This is of high importance in modern society as interdisciplinary work is often commissioned and knowing how a subject can transfer between disciplines and how the topic is handled within that area is of high value. Limits to growth is discussed as are how such factors need to be considered in the global production chain.

During this semester, the students further develop skills useful to sustainable product development. Current relevant topics such as Cradle to Cradle, Biomimicry and Natural Capitalism are introduced and students are provided with tools to implement such philosophies into product development. Students will have competencies in developing solutions from the ground up, based on fulfilling the needs of the three pillars of sustainability but also redesigning products with such objectives in mind.

This semester focuses on three objectives that all correlate, a) providing comprehensive knowledge about sustainability issues, 2) methods and concepts to develop solutions addressing such issues, and finally 3) the practical know-how to conduct such developments.

Students are exposed to different subject areas within the realm of sustainability, most of which are to be addressed in future research projects. This allows the students to address given topics within projects conducted during the first semester.

#### **COMPETENCE GOALS**

The competence goals for the first semester Sustainable Product Development profile are as follows:



- Being able to understand sustainability and what the concept entails.
- Being able to describe the causes and effects of many major current sustainable issues faced (e.g. climate change, child labour, wealth division).
- Being able to describe and understand major philosophies with regards to sustainable product development.
- Being able to execute a design solution that effectively addresses a given local, regional or global sustainability issue.
- Being able to analyse implementation challenges and how provide methods for how to overcome them.
- Being able to formulate a CSR policy within an organisation.
- Being able to construct instruments to measure the CSR performance of organisations.

## **MODULES**

The first semester contains the following modules:

Constituent modules are:

EM-GLSU – Global sustainability (5 ECTS)

PDCDFE – Product and Supply Chain Design for Environment (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 – Globalisation of Markets (5 ECTS)

PDCCPTO – Consumer Product Testing and Optimization (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§20 Description of the 1st Semester** – Sustainable Product Development for non Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn

### **SEMESTER THEME**

Sustainability and Product Development

### **VALUE ARGUMENT**

The first semester introduces the students to key concepts with regards to sustainable product development. The key courses focus on:

- The immense effects humans have on the global ecosystems, what the effects are and what are the potential underlying causes.
- Limits to growth, the IPAT equation, relationship between economic growth and environmental impact
- How product development can lead to innovative solutions which address some of the imminent sustainability issues.
- Provide a solid background of product development methodologies that focus in particular on sustainability.
- The practical deployment of methodologies to develop products, systems or services that address known sustainability issues.

The main courses students attend in the first semester provide a solid ground of knowledge with regards to sustainability. This involves sustainability on a global scale but also and in particular product development.

Tools are provided to visualise and describe fundamental issues with regards to sustainability. Students learn relevant terminology and are introduced to various aspects of scientific fields concerning sustainability. This is of high importance in modern society as interdisciplinary work is often commissioned and knowing how a subject can transfer between disciplines, and how the topic is handled within that area is of high value. Limits to growth is discussed as are how such factors need to be considered in the global production chain.

During this semester, the students further develop skills useful to sustainable product development. Current relevant topics such as Cradle to Cradle, Biomimicry and Natural Capitalism are introduced and students are provided with tools to implement such philosophies into product development. Students will have competencies in developing solutions from the ground up, based on fulfilling the needs of the three pillars of sustainability but also redesigning products with such objectives in mind.

This semester focuses on three objectives that all correlate, a) providing comprehensive knowledge about sustainability issues, 2) methods and concepts to develop solutions addressing such issues, and finally 3) the practical know-how to conduct such developments.

Students are exposed to different subject areas within the realm of sustainability, most of which are applicable to be addressed in future research projects. This allows the students to address given topics within projects conducted during the first semester.

### **COMPETENCE GOALS**

The competence goals for the first semester Sustainable Product Development profile are as follows:

- Being able to understand sustainability and what the concept entails.
- Being able to describe the causes and effects of many major current sustainable issues faced (e.g. climate change, child labour, wealth division).

- Being able to describe and understand major philosophies with regards to sustainable product development.
- Being able to execute a design solution that effectively addresses a given local, regional or global sustainability issue.
- Being able to analyse implementation challenges and how provide methods for how to overcome them.
- Being able to formulate a CSR policy within an organisation.
- Being able to construct instruments to measure the CSR performance of organisations.

## **MODULES**

The first semester contains the following modules:

Constituent modules are:

EM-GLSU – Global sustainability (5 ECTS)

PDCDFE – Product and Supply Chain Design for Environment (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 – Globalisation of Markets (5 ECTS)

PDCCPTO – Consumer Product Testing and Optimization (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§21 Description of the 1st Semester** – Sustainable Product Development for non Bachelors of Science in Engineering (Product Development and Innovation) – enrolment spring

### **SEMESTER THEME**

Formulation and Modelling

### **VALUE ARGUMENT**

The second semester allows the students to further develop skills for visualising environmental problems. The key courses focus on:

- Construct dynamic mathematical models for environmental applications.
- Analysis of environmental mathematical models.
- Research activities based on the students interests within the sustainability area.
- Legal issues with regards to product development.
- Definition of intra, inter and interactional properties of organisations.
- Theories in technology innovation management

During this semester, students are exposed in some detail, to mathematical methods used to analyse environmental problems. Such skills are useful in a variety of fields relating to sustainability, environmental applications in particular. Project 1 allows students to conduct research within their area of interests, further deepening their knowledge within that particular field. The project 1 is supervised by a professor from the faculty with a substantial background within the given field, exposing the student to the most recent methods and materials in relation to the chosen topic.

The students will become knowledgeable about the establishment of enterprises, the rules of such establishment and various potential business models. How to analyse business opportunities, define business models and locate financing opportunities is also taught on this semester.

Electives for this semester allow the students to go into more detail with a subject of interest. The electives are designed for the students to get a technical hold of a given subject. In a practical manner the knowledge will assist the students in developing successful, sustainable solutions. The elective Material Flow Analysis (MFA) provides the students with an understanding of the systematic assessment of flows and stocks of resources within a system. MFA serves as a solid background for life cycle assessments.

Other electives allow the students to gain further insight into important aspects of sustainable product development, such as the effects of supply chain management and the effects of management of waste. All the factors introduced to the students, such as supply chain management, material flows and waste management can be influenced by the initial design of products, systems or services. This knowledge further deepens the understanding on how product designs have an impact on different phases within the product lifecycle.

Upon completion of the second semester the students have gained comprehensive knowledge about the formulation of problems in mathematical terms, the process of realising product solutions within a business context and the ability to visualise the flow of materials throughout the value chain.

### **COMPETENCE GOALS**

The competence goals for the second semester Sustainable Product Development profile are as follows:

- The ability to formulate environmental scenarios mathematically.
- The ability to analyse environmental mathematical models.
- The ability to conduct independent research work.

- Knowing major factors for the commercialisation of new solutions.
- The ability to identify major legal issues to new product development.
- The ability to formulate waste streams, material flows or the supply chain with environmental implications in focus.

## **MODULES**

The first semester contains the following modules:

Constituent modules are:

PDCPRO1 – Project 1 (5 ECTS)

PDCTMTC – Theories and Methods of Technological Change (5 ECTS)

PDCMPD – Modularization and Platform Design (5 ECTS)

PDCGLO1 – Globalization and Entrepreneurship 1 (5 ECTS)

PDCLCA1 – Basics in Life Cycle Assessment (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§22 Description of the 2nd Semester** – Sustainable Product Development for Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn

### **SEMESTER THEME**

Formulation and Modelling

### **VALUE ARGUMENT**

The second semester allows the students to further develop skills for visualising environmental problems. The key courses focus on:

- Construct dynamic mathematical models for environmental applications.
- Analysis of environmental mathematical models.
- Research activities based on the students interests within the sustainability area.
- Legal issues with regards to product development.
- Definition of intra, inter and interactional properties of organisations.
- Theories in technology innovation management

During this semester, students are exposed in some detail, to mathematical methods used to analyse environmental problems. Such skills are useful in a variety of fields relating to sustainability, environmental applications in particular. Project 1 allows students to conduct research within their area of interests, further deepening their knowledge within that particular field. The project 1 is supervised by a professor from the faculty with a substantial background within the given field, exposing the student to the most recent methods and materials in relation to the chosen topic.

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Other electives allow the students to gain further insight into important aspects of sustainable product development, such as the effects of supply chain management and the effects of management of waste. All the factors introduced to the students, such as supply chain management, material flows and waste management can be influenced by the initial design of products, systems or services. This knowledge further deepens the understanding on how product designs have an impact on different phases within the product lifecycle.

Upon completion of the second semester the students have gained comprehensive knowledge about the formulation of problems in mathematical terms, the process of realising product solutions within a business context and the ability to visualise the flow of materials throughout the value chain.

### **COMPETENCE GOALS**

The competence goals for the 2nd semester Sustainable Product Development profile are as follows:

- The ability to formulate environmental scenarios mathematically.
- The ability to analyse environmental mathematical models.

- The ability to conduct independent research work.
- Knowing major factors for the commercialisation of new solutions.
- The ability to identify major legal issues to new product development.
- The ability to formulate waste streams, material flows or the supply chain with environmental implications in focus.

## **MODULES**

The second semester contains the following modules:

Constituent modules are:

PDCPRO1 – Project 1 (5 ECTS)

PDCTMTC – Theories and methods of technological change (5 ECTS)

PDCMPD – Modularization and platform design (5 ECTS)

PDCGLO1 – Globalization and entrepreneurship 1 (5 ECTS)

PDCLCA1 – Basics in Life Cycle Assessment (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§23 Description of the 2nd Semester** – Sustainable Product Development for non Bachelors of Science in Engineering (Product Development and Innovation) – enrolment autumn

### **SEMESTER THEME**

Formulation and Modelling

### **VALUE ARGUMENT**

The second semester allows the students to further develop skills for visualising environmental problems. The key courses focus on:

- Construct dynamic mathematical models for environmental applications.
- Analysis of environmental mathematical models.
- Research activities based on the students interests within the sustainability area.
- Legal issues with regards to product development.
- Definition of intra, inter and interactional properties of organisations.
- Theories in technology innovation management

During this semester, students are exposed in some detail, to mathematical methods used to analyse environmental problems. Such skills are useful in a variety of fields relating to sustainability, environmental applications in particular. Project 1 allows students to conduct research within their area of interests, further deepening their knowledge within that particular field. The project 1 is supervised by a professor from the faculty with a substantial background within the given field, exposing the student to the most recent methods and materials in relation to the chosen topic.

The students will become knowledgeable about the establishment of enterprises, the rules of such establishment and various potential business models. How to analyse business opportunities, define business models and locate financing opportunities is also taught on this semester.

Electives for this semester allow the students to go into more detail with a subject of interest. The electives are designed for the students to get a technical hold of a given subject. In a practical manner the knowledge will assist the students in developing successful, sustainable solutions. The elective Material Flow Analysis (MFA) provides the students with an understanding of the systematic assessment of flows and stocks of resources within a system. MFA serves as a solid background for life cycle assessments.

Other electives allow the students to gain further insight into important aspects of sustainable product development, such as the effects of supply chain management and the effects of management of waste. All the factors introduced to the students, such as supply chain management, material flows and waste management can be influenced by the initial design of products, systems or services. This knowledge further deepens the understanding on how product designs have an impact on different phases within the product lifecycle.

Upon completion of the second semester the students have gained comprehensive knowledge about the formulation of problems in mathematical terms, the process of realising product solutions within a business context and the ability to visualise the flow of materials throughout the value chain.

### **COMPETENCE GOALS**

The competence goals for the second semester Sustainable Product Development profile are as follows:

- The ability to formulate environmental scenarios mathematically.
- The ability to analyse environmental mathematical models.



- The ability to conduct independent research work.
- Knowing major factors for the commercialisation of new solutions.
- The ability to identify major legal issues to new product development.
- The ability to formulate waste streams, material flows or the supply chain with environmental implications in focus.

## **MODULES**

The second semester contains the following modules:

Constituent modules are:

PDCPRO1 – Project 1 (5 ECTS)

PDCTMTC – Theories and methods of technological change (5 ECTS)

PDCMPD – Modularization and Platform Design (5 ECTS)

PDCGLO1 – Globalization and entrepreneurship 1 (5 ECTS)

PDCLCA – Basics in Life Cycle Assessment (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§24 Description of the 2nd Semester** – Sustainable Product Development for non Bachelors of Science in Engineering (Product Development and Innovation) – enrolment spring

### **SEMESTER THEME**

Sustainability and Product Development

### **VALUE ARGUMENT**

The second semester introduces the students to key concepts with regards to sustainable product development. The key courses focus on:

- The immense effects humans have on the global ecosystems, what the effects are and what are the potential underlying causes.
- Limits to growth, the IPAT equation, relationship between economic growth and environmental impact
- How product development can lead to innovative solutions which address some of the imminent sustainability issues.
- Provide a solid background of product development methodologies that focus in particular on sustainability.
- The practical deployment of methodologies to develop products, systems or services that address known sustainability issues.

The main courses students attend in the second semester provide a solid ground of knowledge with regards to sustainability. This involves sustainability on a global scale but also and in particular product development.

Tools are provided to visualise and describe fundamental issues with regards to sustainability. Students learn relevant terminology and are introduced to various aspects of scientific fields concerning sustainability. This is of high importance in modern society as interdisciplinary work is often commissioned and knowing how a subject can transfer between disciplines and how the topic is handled within that area is of high value. Limits to growth is discussed as are how such factors need to be considered in the global production chain.

During this semester, the students further develop skills useful to sustainable product development. Current relevant topics such as Cradle to Cradle, Biomimicry and Natural Capitalism are introduced and students are provided with tools to implement such philosophies into product development. Students will have competencies in developing solutions from the ground up, based on fulfilling the needs of the three pillars of sustainability but also redesigning products with such objectives in mind.

This semester focuses on three objectives that all correlate, a) providing comprehensive knowledge about sustainability issues, 2) methods and concepts to develop solutions addressing such issues, and finally 3) the practical know-how to conduct such developments.

Students are exposed to different subject areas within the realm of sustainability, most of which are applicable to be addressed in future research projects. This allows the students to address given topics within projects conducted during the first semester.

### **COMPETENCE GOALS**

The competence goals for the second semester Sustainable Product Development profile are as follows:

- Being able to understand sustainability and what the concept entails.
- Being able to describe the causes and effects of many major current sustainable issues faced (e.g. climate change, child labour, wealth division).

- Being able to describe and understand major philosophies with regards to sustainable product development.
- Being able to execute a design solution that effectively addresses a given local, regional or global sustainability issue.
- Being able to analyse implementation challenges and how provide methods for how to overcome them.
- Being able to formulate a CSR policy within an organisation.
- Being able to construct instruments to measure the CSR performance of organisations.

## **MODULES**

The second semester contains the following modules:

Constituent modules are:

EM-GLSU – Global sustainability (5 ECTS)

PDCDFE – Product and Supply Chain Design for Environment (5 ECTS)

PDCMT – Management of Technology (5 ECTS)

PDCGLO2 – Globalization and Entrepreneurship 2 – Globalisation of Markets (5 ECTS)

PDCCPTO – Consumer Product Testing and Optimization (5 ECTS)

Elective modules equivalent of 5 ECTS

## **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## §25 Description of the 3<sup>rd</sup> Semester – Sustainable Product Development

### SEMESTER THEME

Environmental Impacts and Assessments

### VALUE ARGUMENT

The third semester allows the students to develop skills to systematically analyse environmental implications of products, systems or services. The key courses focus on:

- Construction of life cycle scenarios of products, systems or services
- Assessment of environmental impacts from product designs
- Base decisions on life cycle assessments
- International businesses and markets
- Theories behind open innovation
- Gaining practical working experience or extended research project

During the third semester students are exposed to life cycle assessment (LCA). LCA is a much used methodology used to analyse environmental effects of products, systems or services. Having a good hold of LCA provides the students with the ability to perform complex analysis on how products behave during their lifecycle in environmental terms. Furthermore, students acquire skills to provide recommendations based on the findings from the LCA.

During this semester the students are exposed to current theories with regards to globalization and market identification.

The knowledge accumulated by the students throughout the study period will also be put to use in an industrial setting if the students decide to conduct an In-company Period. During this period, the students conduct a project within a company and gain a meaningful experience from the industry. The students can however also choose to conduct a 10 ECTS research project within the university. This may be used to increase the students understanding of a certain topic. If the students decide to do the Project 2 research, they are obligated to choose an elective course as well. This course can be used to compliment the research being undertaken by the students.

Upon completion of the third semester the students have gained a sought after specialization with solid competences to develop solutions in a sustainable manner, often addressing sustainability issues. The students will be able to take on the thesis project where the range of skills acquired during the first three semesters can be put to use.

### COMPETENCE GOALS

The competence goals for the third semester Sustainable Product Development profile are as follows:

- The ability to analyse product life cycle from cradle to grave.
- The ability to demonstrate thorough knowledge about LCA theories and methods.
- The ability to conduct a consequential or attributional LCA and provide recommendations based on the findings.
- The ability to demonstrate how to identify global market opportunities.
- The ability to demonstrate the ability to carry out independent research projects or work within an organization.

### MODULES

The third semester contains the following modules:

Constituent modules are:

PDCOI – Open Innovation and New Markets (5 ECTS)

PDCGLO3 – Globalization and Entrepreneurship 3 (5 ECTS)

The student can then choose between the following:

PDCPRO2 – Project 2 (10 ECTS) and Elective (5 ECTS)

Or

PDCINCO – In-company Period (15 ECTS)

Elective modules equivalent of 10 ECTS

### **CONTEXT**

The constituent modules will align the student to the main objectives of the PDI programme. The electives will give an opportunity to provide additional complementary basic competencies supporting the chosen profile.

## **§26 Description of the 4th Semester** – *Profile Sustainable Product Development regardless of academic background*

### **SEMESTER THEME**

Master's Thesis

### **VALUE ARGUMENT**

The Master's thesis concludes the Master's program.

The thesis project is based on a working process including three main aspects: technological/engineering aspect, business/marketing aspect and research aspect. The project activities and final report document the student's competencies attained during his/her work on a program profile-relevant and interdisciplinary subject.

### **COMPETENCE GOALS**

The competence goal for the fourth semester Sustainable Product Development as follows:

- Accounting for course relevant skills based on the highest level of international research within the subject area of the PDI program.

### **MODULES**

The fourth semester contains the following module:

Constituent module is:

PDCTH – Master's Thesis (30 ECTS)

## §27 Qualifying Degrees for Admission

### 27.1 Qualifying degrees

Based on 27.2 – 27.4 the university has assessed that the below degrees qualify for admission to Master of Science in Engineering (Product Development and Innovation). The list is not exhaustive.

Following degrees qualify for admission to the academic profile *Product Value Creation*

- BSc in Engineering (Product Development and Innovation) – University of Southern Denmark (legal entitlement for admission)
- BSc in Engineering (Innovation and Business) – University of Southern Denmark
- Business Development Engineer (BDE) – Aarhus University
- BEng in Integrated Design (Integreret Design) – University of Southern Denmark
- BEng in Mechanical Engineering (Maskinteknik) – University of Southern Denmark
- BEng in Interaction Design (Interaktivt Design) – University of Southern Denmark

Following degrees qualify for admission to the academic profile *Technology Entrepreneurship and Business Development*

- BSc in Engineering (Product Development and Innovation) – University of Southern Denmark (legal entitlement for admission)
- BSc in Engineering (Innovation and Business) – University of Southern Denmark
- BEng in Global Management and Manufacturing – University of Southern Denmark
- BEng in Integrated Design (Integreret Design) – University of Southern Denmark
- BEng in Manufacturing and Management (Produktionsteknik) – University of Southern Denmark
- Business Development Engineer (BDE) – Aarhus University

Following degrees qualify for admission to the academic profile *Sustainable Product Development*

- BSc in Engineering (Product Development and Innovation) – University of Southern Denmark (legal entitlement for admission)
- BEng in Global Management and Manufacturing – University of Southern Denmark ( incl. 5 ECTS basic Statistics)
- BEng in Manufacturing and Management (Produktionsteknik) – University of Southern Denmark ( incl. 5 ECTS basic Statistics)
- BEng in Integrated Design (Integreret Design) – University of Southern Denmark ( incl. 5 ECTS basic Statistics)

### 27.2 Level and content of qualifying degrees

Qualifying bachelor and professional bachelor degrees in the scientific and technical area where the level and content of the scientific and technical courses correspond to a bachelor of science in

engineering degree or a bachelor of engineering degree in the subject area of the MSc in Engineering (Product Development and Innovation) programme.

### 27.3 Academic content of qualifying degree

MSc in Engineering (Product Development and Innovation) admits applicants with a bachelor degree or a professional bachelor degree in product development and innovation cf. 27.2 provided that the degree covers:

Subject knowledge	Extent
Broad introduction to the product development process	no less than 30 ECTS
Thorough introduction to CAD systems, materials and manufacturing processes	no less than 20 ECTS
Broad introduction to engineering subjects such as robotics, sensors, electronics and project management	no less than 25 ECTS
Introduction to business processes	no less than 15 ECTS

### 27.4 Additional courses

Should the applicant's degree fail to meet the requirements mentioned in 27.1 - 27.3, it is possible to acquire the necessary skills through additional courses offered at the University of Southern Denmark. The extent of additional courses cannot exceed 15 ECTS.

Additional courses have to be taken after admission to the programme. The courses can be taken during the first two semesters of the programme and must be passed by the end of the first year of study. Additional courses are restricted to courses offered by the University of Southern Denmark as summer courses or parallel to the first year of the master programme.

### 27.5 Admission with a foreign degree

Applicants with a bachelor degree or professional bachelor degree from a foreign university who meet the requirements of 27.2 and 27.3 are eligible for admission subject to an academic assessment and comparison of whether the applicant's academic qualifications correspond to those of qualifying Danish degree.

### 27.6 Possible exemptions

Applicants whose bachelor degree or professional bachelor degree fails to meet the terms stated in 27.1 – 27.5 are not eligible for admission.

Applicants who do not hold a bachelor degree or a professional bachelor degree but who have the academic qualifications equivalent thereto are eligible for admission should their qualifications, based on an academic assessment and comparison, correspond to those of a qualifying Danish degree.

#### Two-year transitional arrangement regarding additional courses:

Completed and passed additional courses, i.e. single courses from existing bachelor programmes, may be included in the application for admission until 31 August 2016.



## **§28 Language Requirements**

### **English Language Skills**

Native English speaking applicants or applicants with a bachelor degree taught exclusively in English do not have to provide evidence of their English language skills.

Non-native English speaking applicants from a country within the European Union or the EEA are not required to pass an IELTS or a TOEFL test, if they can demonstrate knowledge of English corresponding with English at B level, as a minimum.

Applicants from a country outside the European Union or the EEA, however, must pass an IELTS or a TOEFL test with a minimum result of 6.5 in the IELTS test or a minimum result of 88 in the TOEFL test.

## **§29 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.

## **§30 Entry into Force and Amendments**

1. Approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering 20<sup>th</sup> August 2010.
2. Curriculum 2014 approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 10 October 2014 (Version 1.0).
3. Curriculum 2015 approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 12 November 2014 (Version 1.0).
4. Amendments approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 24 September 2015 (Version 1.1).
5. Curriculum 2016 approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 11 December 2015 (Version 1.0).
6. Amendments approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 13 April 2016 (Version 1.0).
7. Amendments approved by the Academic Study Board of the Faculty of Engineering and the Director of Studies on behalf of the Dean of the Faculty of Engineering on 24 October 2016 (Version 1.1).