Qualification goals for the M.Eng. Sustainability in Polymer Technology

Faculty of Mechanical Engineering and Mechatronics at
Deggendorf Institute of Technology

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Gender neutrality

The use of double forms or other labels for persons of female, male and diverse genders has been avoided to a large extent for the sake of better readability and clarity. All names for the different groups of university members refer equally to members of all genders in the respective groups.

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1 Objectives of the degree programme

The objective of the Faculty of Mechanical Engineering and Mechatronics is to provide students in the Master programme Sustainability in Polymer Technology with an advanced education based on scientific knowledge and methods through practice-oriented teaching. Graduates shall be qualified for independent professional practice as engineers in the field of polymer technology.

Through comprehensive education in the various aspects of plastics engineering, graduates are enabled to recognise the essential interrelationships between the fields of knowledge taught and to integrate them effectively.

Furthermore, they should gain the flexibility that is required to cope with the fast pace of advancing development. Education in the relevant disciplines shall also enable graduates to recognise the impact of engineering activities, particularly in the field of plastics engineering, on the environment and society, and to minimise adverse effects wherever possible.

The degree programme qualifies graduates for engineering activities in, among others, the following fields:

- Development (conceptualisation, design, calculation, simulation and construction of components, devices, systems and plants)´
- Manufacturing (work preparation, production, quality assurance)
- Project planning (system design of complex components, assemblies and plants)
- Sales (customer service and project handling)
- Disposal and recycling

Particular emphasis is placed on providing a broadly based, high-quality and interdisciplinary education that enables graduates to work both independently and as part of a team in a wide range of professional fields.
The integration of German B1 into the curriculum ensures that graduates are able to start their successful integration into the German labour market.

Communication and teamwork skills are developed and enhanced through seminars and project-based activities.

Information on the ´master's degree programme in Sustainability in Polymer Technology is published on the programme website and specified in the Study and Examination Regulations.

2 Learning outcomes of the programme

The learning outcomes to be achieved through the degree programme (here referred to as competence areas) can be divided into:

- Engineering fundamentals and methodological knowledge
- Key technical qualifications
- Application-specific systems knowledge
- Transferrable professional skills

The content of these competence areas is described below.

A detailed description of the *learning outcomes* can be found in the summaries of the respective modules in the programme module handbook.

a) Engineering fundamentals and methods

The modules Process and Control Engineering and Automation, Polymer Materials 1 and Polymer Processing form part of the engineering fundamentals and methods area. This foundational knowledge is indispensable for understanding most of the *key qualifications* in plastics engineering and is also essential for mastering other modules (such as Polymer Materials 2 and Lifetime Design and Reliability Assessment).

A further important aspect of the foundation modules relates to *lifelong learning*. We expect our graduates to be capable of independently familiarising themselves with new methods and application areas throughout their professional careers. As technological development progresses in increasingly rapid cycles, the ability to *acquire knowledge independently* is of particular importance in the modern engineering profession. Such independent acquisition of knowledge requires a sound command of engineering fundamentals and methods.

For this reason, basic modules form an integral part of the curriculum.

b) Technical key qualifications

Modern, complex systems and components are developed using application-independent *key qualifications (enabling qualifications).* The development of a specific application typically requires *several* key qualifications; conversely, *a single* key qualification is generally useful for development tasks across *multiple* application areas. For this reason, the teaching of key qualifications plays an important role within the curriculum. However, key qualifications can only be applied competently if their engineering foundations are sufficiently understood.

c) Application-specific systems knowledge

In addition to engineering fundamentals and application-independent key qualifications, graduates are also expected to acquire application-specific systems knowledge. Due to the three-semester structure of the programme, these modules are distributed across the first two semesters.

d) Transferrable professional skills

Alongside specialist education in engineering fundamentals, key qualifications and application-specific knowledge, the development of professional skills (professional or soft skills) is becoming increasingly important. The engineer working alone in an office on a technical problem is no longer representative of modern professional practice. Today's engineers work in teams, are proficient in commonly used software applications, present development work using modern media, possess strong communication skills, and understand and speak both English and German, as well as additional foreign languages where appropriate. Modules such as German, Quality Management and Development Strategies contribute to achieving these objectives.

The integration of a practice-oriented project assignment (Methodology in Research and Case Study) into the curriculum enables students to develop the interaction between specialist knowledge and professional skills (e.g. teamwork, communication skills, presentation skills and project management) prior to commencing their master's thesis.

Figure 1 illustrates how selected modules can be mapped to the competence areas described above:

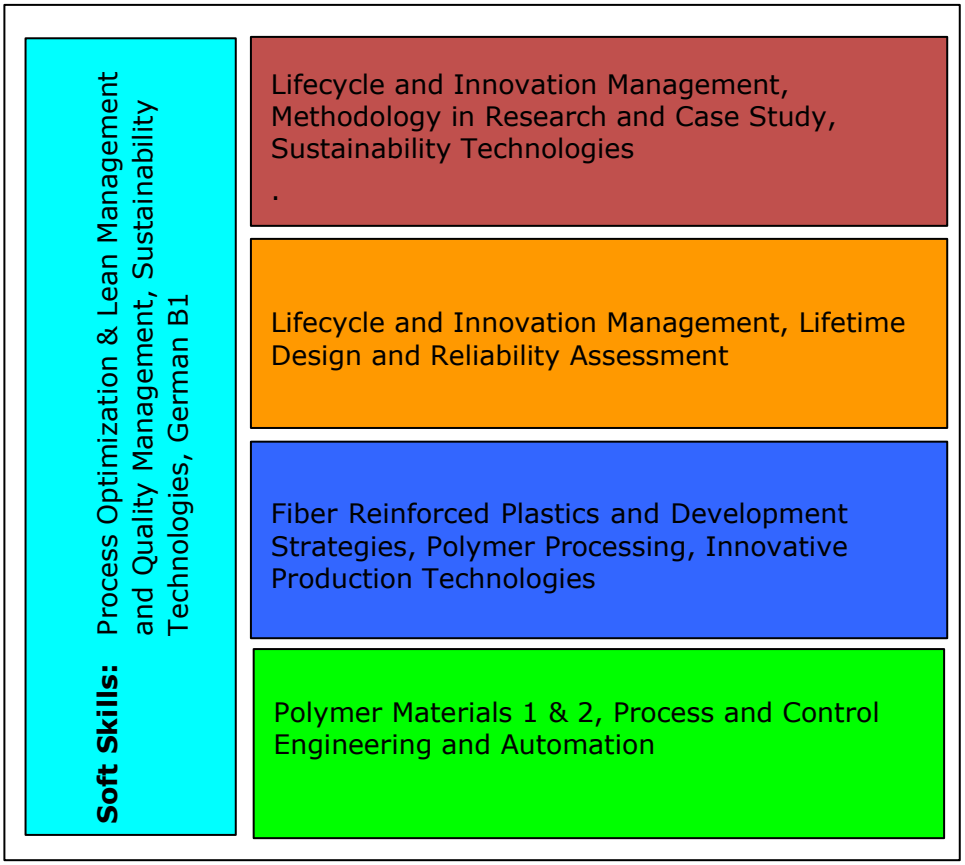

Figure 1: *Mapping of programme content to the corresponding competence areas*

3 Study objectives and qualification goals

Knowledge: Graduates possess advanced and comprehensive engineering knowledge in the fundamental disciplines and, in particular, in the respective focus areas shown in the table above.

Graduates are capable of independent work and responsible action in the respective professional fields. They recognise the need for continuous further development with changing work and learning content. Graduates know the terms and methods relevant to different fields.

The master's degree programme Sustainability in Polymer Technology offers graduates of a relevant bachelor's or *Diplom* programme the opportunity to deepen their existing knowledge in order to meet the demands of modern research challenges in a unique way.

The programme builds on the knowledge acquired in a bachelor's or *Diplom* programme in disciplines such as Mechanical Engineering, Mechatronics or Engineering Physics and further develops students' expertise in polymer technology, with a particular focus on the sustainable use of polymer materials. Upon completion of the programme, graduates are capable of undertaking demanding tasks in industrial polymer production and processing as well as conducting independent research in these fields. The programme focuses both on teaching application-oriented methods for understanding, analysing and interpreting relevant production and processing technologies and on ensuring effective communication between technical specialists as well as process and product developers.

Skills: Graduates are equipped to

- apply innovative methods to solve engineering problems, independently develop new methods and assess their limitations,
- understand, apply and professionally analyse complex new methods for problem-solving,
- classify knowledge from different fields and combine it in a problem-oriented manner when addressing complex challenges,
- apply and further develop their engineering judgement in order to devise practical solutions and concepts, including for new and unfamiliar problems,
- understand the phenomena and challenges that arise in different fields, and they are familiar with fundamental solution principles and are able to implement them in practical applications.

Competencies: Graduates acquire the competencies to

- methodically classify and systematically combine knowledge from various fields and handle complexity,
- develop suitable methods for designing and conducting detailed investigations as well as for developing commercially viable technical products for the global market,
- lead and shape teams and evaluate their deliverables and performances,
- rapidly familiarise themselves with new and unfamiliar tasks in a methodical and systematic manner,
- systematically reflect on non-technical impacts of engineering activities as well and use these findings responsibly when they work,

- evaluate the effectiveness and efficiency of existing methods and, if necessary, develop them further scientifically with the aim of drawing up optimally adapted solutions,
- conceptualise, execute and analyse detailed theoretical and experimental investigations of technical issues,
- present their ideas and findings orally and in writing in accordance with academic standards..

The programme objectives and learning outcomes are published on the programme website.

4 Learning outcomes of modules/module objectives/matrix of objectives

The individual modules, their detailed objectives and the competences to be acquired by graduates are described in the programme module handbook.
The following table illustrates the relationship between the individual modules and the objectives of the master's degree programme Sustainability in Polymer Technology described in the previous section.

Objectives matrix of the modules in the master's programme Sustainability in Polymer Technology

Module	Goals											
	Knowledge				Skills				Competencies			
	Scientific and Technological Basics	Engineering methodology	Engineering Practice and Product Development	General	Scientific and Technological Basics	Engineering methodology	Engineering Practice and Product Development	General	Scientific and Technological Basics	Engineering methodology	Engineering Practice and Product Development	General
Polymer Materials 1	xx	xx	x		xx	xx	x		xx	xx	X	
Polymer Materials 2	xx	xx	x		xx	xx	x		xx	xx	x	
Fiber Reinforced Plastics and Development Strategies	xx	xx	xx	x	xx	xx	xx	x	xx	xx	xx	x
Polymer Processing	xx	xx	x		xx	xx	x		xx	xx	X	
Process and Control Engineering and Automation	xx	xx			xx	xx			xx	xx		
Sustainability Technologies	x	x	X	xx	x	x	x	xx	x	x	X	xx
Innovative Production Technologies	xx	xx	xx		xx	xx	xx		xx	xx	xx	
Lifecycle and Innovation Management	x	x	xx	xx	x	x	xx	xx	x	x	xx	xx
Methodology in Research and Case Study Sustainability	x	x	xx	xx	x	x	xx	xx	x	x	xx	xx
Lifetime Design and Reliability Assessment	x	x	xx	x	x	x	xx	x	x	x	xx	x
Process Optimization & Lean Management + Quality Management			x	xx			x	xx			x	xx
German B1				xx				xx				xx
Master's Thesis		xx	xx	x		xx	xx	x		xx	xx	x
Master's Seminar		xx	xx	xx		xx	xx	xx		xx	xx	xx

Legend: xx strong correlation; x moderate correlation