Module Guide
Sustainability in Polymer Technology

Faculty Mechanical Engineering and Mechatronics
Examination regulations 22.11.2024
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Table of Contents

SPT-01 Polymer Materials 1

Module code	SPT-01
Module coordination	Prof. Dr. Dmitry Rychkov
Course number and name	SPT-01 Polymer Materials 1
Lecturer	Prof. Dr. Dmitry Rychkov
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical Competence

Students

- describe basic concepts, historical developments, and classifications of polymeric materials.
- explain the molecular structure of polymers (macromolecular structure, molecular weight, conformation, configuration).
- distinguish between and explain the structure and properties of thermoplastics (amorphous/semi-crystalline), thermosets, and elastomers.
- describe intermolecular interactions and their influence on material properties.

- explain the function and mechanism of action of typical additives (e.g., flame retardants, stabilizers, fillers).
- explain the thermal properties of polymeric materials (e.g., glass transition, melting temperature) and their significance for processing and application.
- describe fundamental rheological relationships of polymer melts and viscoelastic effects.
- explain key plastics processing methods (extrusion, injection molding, blow molding, etc.) and their underlying physical principles.
- explain the mechanisms behind the development of orientation and anisotropy during processing.

Methodological Competence

Students

- analyze structure-property relationships in polymeric materials and deduce their behavior in practical applications.
- interpret measurement data from thermal analysis methods (DTA, DSC, TGA, TMA) for material characterization.
- apply fundamental rheological models (e.g., PowerLaw, Carreau-Yasuda) to describe flow processes.
- calculate and analyze simplified flow cases (e.g., pipe flow according to Hagen-Poiseuille, shear flow, Couette flow).
- analyze plastic processing processes (e.g., extrusion zones, injection molding cycle) while taking material and energy inputs into account.
- evaluate the influence of process parameters on component properties, particularly orientation, warpage, and anisotropy.
- use and interpret the results of simple simulation-based analyses (e.g., mold filling, orientation prediction).
- develop initial approaches to optimizing material selection and process control.

Personal Competencies

Students

- reflect on the significance of the fundamentals of materials science and rheology for the design of technical processes.
- evaluate the validity and limitations of theoretical models and experimental methods.
- develop a comprehensive understanding of the interactions between materials, processes, and component properties.
- work independently on the analysis of complex issues in polymer engineering.

Social Skills

Students

- discuss material and process engineering issues in a team setting with a sound technical foundation.
- explain and communicate complex concepts (e.g., rheology, processing, anisotropy) in an understandable manner.
- work cooperatively to analyze and solve technical problems.
- present results in a structured, audience-appropriate, and scientifically sound manner.
- reflect on different solution approaches within a team context.

Applicability in this and other Programs

SPT-07: Polymer Materials 2
SPT-13: Master's thesis

Entrance Requirements

none

Learning Content

- Introduction
- Historical Background
- Structure of Polymers
- Thermal Properties of Polymers
- Rheology pf Polymer Melts
- Introduction to Processing

Teaching Methods

seminar, lecture

Recommended Literature

- Tim A. Osswald, Allen Jonathan Román; Understanding polymer processing - processes and governing equations; Hanser Verlag München, 3.Aufl. 2025
- Ying Yan and Yiqi Wang; Recent Advances in Polymer Processing; MDPI Books 2024

SPT-02 Process and Control Engineering and Automation

Module code	SPT-02
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-02 Process and Control Engineering and Automation
Lecturer	Prof. Dr. Martin Schönegg
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	oral ex. 15 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical Skills

The aim of the lecture is to give an introduction to control engineering and automation which means for the students on the one hand to gain an overview of the topics single loop control and feedback loop control in principle and on the other hand to get experienced with common control systems, actuators and sensors in real systems. Furthermore, a very broad overview is given on computer controlled machines.

Methodological competence

The students understand the principles and differences of single loop control systems and feedback loop control systems. By means of an integrated practical training, including

three units, they are trained in the basics of pneumatics and designing of a pneumatic system (consisting of sources, drives, sensors and logic elements), corresponding to a simple control problem. The participants understand the principles of pro-grammable logic controllers (PLC).

Social competence

The students learn cooperation and mutual learning especially in the practical training units. Furthermore, they extend their English vocabularies by many technical terms and use them frequently in technical discussions.

Applicability in this and other Programs

SPT-06: Innovative Production Technologies

SPT-11: Process Optimization, Lean Management and Quality Management

SPT-13: Masters Thesis

Entrance Requirements

none

Learning Content

- Control Engineering Content:
- Control Systems
- Sensors and Actuators
- Signals and Systems
- Feedback Control Systems
- Computer-controlled Machines
- Automated Process Control

Teaching Methods

seminar

Recommended Literature

(recent books and articles will be discussed during the first class session)

SPT-03 Polymer Processing

Module code	SPT-03
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-03 Polymer Processing
Lecturer	Prof. Dr. Alexandru Sover
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical skills

The students have knowledge of the basics of polymeric materials, their properties and processing technolo-gies as well as their economic importance. They understand the main production methods and the possible applications. The students also gain knowledge about the intricacies of polymer recycling.

Methodological competence

The students can understand the difference between the essential polymeric materials and the processing technologies used for the production of different components.

Social competence

Teamwork and communication skills by solving tasks in small groups, self-reflection.

Applicability in this and other Programs

SPT-06: Innovative Production Technologies
SPT-11: Process Optimization, Lean Management and Quality Management

Entrance Requirements

none

Learning Content

- Introduction to plastics materials
- Development and economic importance of polymer materials
- Classification of plastics
- Rheology
- Processing of plastics: Extrusion; Injection Moulding; Thermoforming; Casting; Rapid prototyping
- Design and development of plastic components
- Plastic assembly techniques
- Applications with examples
- Recycling

Teaching Methods

seminar

Recommended Literature

- Klemens Kohlgrüber, Michael Bierdel, Harald Rust; Plastics compounding and polymer processing-fundamentals, machines, equipment, application technology; Hanser Munich 2022

SPT-04 Fiber Reinforced Plastics and Development Strategies

Module code	SPT-04
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-04 Fiber Reinforced Plastics and Development Strategies
Lecturer	Prof. Dr. Thomas Müller-Lenhardt
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Subject-matter and methodological expertise

Students

- possess detailed knowledge of industrial property rights, can conduct a patent search, and analyze the results
- possess specialized knowledge of research funding, can confidently select funding programs, and successfully apply the relevant tools

- understand the principles of design thinking, can confidently apply the relevant methods, and thus develop solutions to their own problems across various disciplines
- understand the interrelationships in cost management, can prepare cost estimates, and can analyze and evaluate existing estimates as well as explain their implications
- are familiar with strategies for selecting materials and can confidently apply them to their own problems, validate them accordingly, and engage in constructive debate within a team
- have a thorough understanding of the structure of fiber-reinforced composites and can confidently apply their comprehensive knowledge based on the latest scientific findings
- understand the micromechanical characteristics and behavior of fibers and matrices in composites and can, for example, analyze and describe damage patterns using scientific methods as part of damage analysis
- are familiar with typical semi-finished product systems for the manufacture of components made of fiber-reinforced composites and can select these for specific applications as well as justify their selection
- have a detailed understanding of the key manufacturing processes used to produce components made of fiber-reinforced plastics and can critically evaluate their applicability to their own projects and discuss them in a professional manner
- understand the advantages and disadvantages of fiber-reinforced plastics and can confidently assess them in specific contexts, thereby independently determining when the use of fiber-reinforced plastics makes sense from both a technological and economic perspective. Furthermore, appropriate recommendations for action can be derived.

Practical Competence

After completing the module and having acquired the subject-specific and methodological skills taught there, students will be able to understand, analyze, and discuss academic articles in the fields of business administration and engineering that are relevant to the module. Thanks to the practical skills they have acquired, they are also able to independently familiarize themselves with related fields, acquire further specialized and expert knowledge, and thus continuously expand their area of expertise. They will be able to confidently apply the skills you have learned and balance the technical requirements of the fiber-reinforced plastics industry - as well as those of related hybrid material systems and composites made from fiber-reinforced plastics - against the economic constraints of businesses. They will be able to explain the economic and technical interrelationships and the implications of decisions, thereby developing and presenting solutions that are attractive from a business perspective.

Social skills

The students

- can work in teams or groups and have internalized the design thinking mindset
- can critically evaluate the processes they have gone through.

Applicability in this and other Programs

SPT-10: Lifetime Design and Reliability Assessment

Entrance Requirements

Learning Content

The course consists of a lecture and a seminar. Lecture topics:

- Patent research
- Research funding
- Design thinking
- Cost management
- Material selection
- Fibers & matrix
- Fibers and matrix in composites
- Semi-finished fiber products
- Processing methods

Seminar content:

- Manufacturing of a FRP component using the hand-layup method

Teaching Methods

Lecture, seminar, group work

Recommended Literature

- SIMON, Dagmar, 2010. Handbuch Wissenschaftspolitik . 1. Auflage. Wiesbaden: VS, Verl. für Sozialwiss.. ISBN 978-3-531-15742-9, 3-531-15742-6
- Ohne Autor, 2018. Frascati-Handbuch 2015: Leitlinien für die Erhebung und Meldung von Daten über Forschung und experimentelle Entwicklung [online]. Paris: OECD Publishing PDF e-Book. ISBN 978-92-64-29163-8. available: https://doi.org/10.1787/9789264291638-de.
- PREUß, Stefanie, 2017. Drittmittel für die Forschung: Grundlagen, Erfolgsfaktoren und Praxistipps für das Schreiben von Förderanträgen

[online]. Wiesbaden: Springer Gabler PDF e-Book. ISBN 978-3-658-16452-2. available: https://doi.org/10.1007/978-3-658-16452-2.

- GERSTBACH, Ingrid, 2017. 77 Tools für Design Thinker: Insidertipps aus der Design-Thinking-Praxis . Offen-bach: GABAL. ISBN 978-3-86936-805-4, 3-86936-805-5
- GERSTBACH, Ingrid, 2017. Design Thinking im Unternehmen: ein Workbook für die Einführung von Design Thinking . 2. Auflage. Offenbach: GABAL. ISBN 978-3-86936-726-2, 3-86936-726-1
- KUMAR, Vijay, 2013. 101 design methods: a structured approach for driving innovation in your organiza-tion . Hoboken, N.J.: Wiley. ISBN 978-1-118-08346-8, 978-1-283-59885-9
- EHRLENSPIEL, Klaus, 2014. Kostengünstig Entwickeln und Konstruieren: Kostenmanagement bei der integrierten Produktentwicklung . 7. Auflage. Berlin [u.a.]: Springer Vieweg. ISBN 978-3-642-41958-4, 978-3-642-41959-1
- BENDEICH, Eugen und Beat Urs BIRKENMEIER, 2019. Kostenmanagement in Entwicklung und Konstruktion: Produktwert und Kosten gemeinsam optimieren . 1. Auflage. Würzburg: Vogel Communications Group. ISBN 978-3-8343-3407-7, 3-8343-3407-3
- RICHTER, Frank und andere, 2017. Kunststoffe auswählen . 1. Auflage. Würzburg: Vogel Business Media. ISBN 978-3-8343-3370-4, 3-8343-3370-0
- JACOBS, Olaf, 2016. Werkstoffkunde . 3. Auflage. Würzburg: Vogel Business Media. ISBN 978-3-8343-3350-6, 3-8343-3350-6
- EHRENSTEIN, Gottfried W., 2006. Faserverbund-Kunststoffe: Werkstoffe, Verarbeitung, Eigenschaften . 2. Auflage. München [u.a.]: Hanser. ISBN 978-3-446-22716-3, 3-446-22716-4
- NEITZEL, Manfred, 2014. Handbuch Verbundwerkstoffe: Werkstoffe, Verarbeitung, Anwendung . 2. Auflage. München: Hanser. ISBN 978-3-446-43696-1, 978-3-446-43697-8
- WITTEN, Elmar und Wolfgang ASSMANN, 2014. Handbuch Faserverbundkunststoffe / Composites: Grundlagen, Verarbeitung, Anwendungen . 4. Auflage. Wiesbaden: Springer Vieweg. ISBN 978-3-658-02754-4, 3-658-02754-1
- SCHÜRMANN, Helmut, 2007. Konstruieren mit Faser-Kunststoff-Verbunden . 2. Auflage. Berlin [u.a.]: Springer. ISBN 978-3-540-72189-5, 3-540-72189-4

SPT-05 Sustainability Technologies

Module code	SPT-05
Module coordination	Prof. Dr. Christine Wünsche
Course number and name	SPT-05 Sustainability Technologies
Lecturers	N.N. Prof. Dr. Christine Wünsche
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

The module provides in-depth knowledge of the ecological, social and economic aspects of sustainable technologies in plastics engineering. Students examine the historical development of the sustainability debate, the goals of Agenda 2030, fundamental sustainability models and the responsibilities of industry (CSR, ISO 26000). Using material flow analyses, life cycle assessments and case studies from the plastics industry, they learn to critically evaluate the sustainability of technical processes and identify potential for optimisation.

Technical skills:

Students

- describe the historical development of the sustainability debate and its significance for the plastics industry.
- explain the United Nations' Agenda 2030 and the 17 Sustainable Development Goals (SDGs) and their relevance to plastics engineering.
- compare different sustainability models, in particular the three-pillar model, and classify them in technical and industrial contexts.
- name and explain key concepts such as corporate social responsibility (CSR) and the requirements of DIN EN ISO 26000.
- analyse material flows and energy relationships using Sankey diagrams and the structure of sustainability and life cycle assessment reports
- assess sustainability-related case studies from the plastics industry, taking into account ecological, social and economic criteria.

Methodological competence

Students

- create simple material flow analyses and interpret them using suitable visualisation tools (e.g. Sankey diagrams).
- apply life cycle assessment (LCA) methods to plastics engineering products or processes.
- evaluate sustainability indicators and CSR reports based on normative specifications (including ISO 26000 and GRI standards).
- develop criteria catalogues for evaluating sustainable technologies in plastics engineering.
- derive strategic improvement opportunities for sustainability from data and reports.

Personal competence

Students

- reflect on their own professional responsibility in the context of sustainable value creation and resource conservation.
- assess ethical issues and possible conflicts of interest (economics, ecology, social issues) in an industrial environment.
- develop their own understanding of their role with regard to responsibility, transparency and sustainable action in a professional context.
- independently implement scientifically sound sustainability arguments in decision-making processes.

Social competence

Students

- discuss complex sustainability issues in teams and represent their positions in a technically sound and solution-oriented manner.
- present the results of analyses (e.g. material flows, LCA assessments) in a manner appropriate for specialist audiences and the general public.

- cooperate on an interdisciplinary basis to develop sustainable solutions to technical challenges.
- moderate discussions on areas of conflict in sustainability (e.g. recycling vs. energy consumption, bioplastics vs. land use).

Applicability in this and other Programs

SPT-09: Methodology in Research and Case Study Sustainability Technologies

SPT-13: Master's Thesis

Entrance Requirements

Learning Content

The lecture lays the foundation for the concept of sustainability and its influence on the plastics industry.

Key topics include:

- History of sustainability
- The UN's Agenda 2030 (17 Sustainable Development Goals (SDGs))
- Three-pillar model of sustainability
- Industry responsibility
  - Corporate social responsibility (CSR)
  - DIN EN ISO 26000: Guidance on social responsibility
- Material flows (Sankey diagrams) and sustainability reports (life cycle assessments, etc.)
- Case studies from the plastics industry

Teaching Methods

Lecture, seminar, group work, analysis of case studies

Recommended Literature

- Iris Prufé; "Nachhaltigkeit" UVK Verlagsgesellschaft mbH Konstanz, UVK/ Lucius München; 3. Auflage; 2017; 00/QT 000 P977(3)
- DIN EN ISO 26000 Leitfaden zur gesellschaftlichen Verantwortung; Deutsche Fassung EN ISO 26000:2021-4
- Peter Orth, Jürgen Bruder, Ulrich Liman, Manfred Rink; "Circular Economy of Plastics"; Springer Nature Switzerland; 1. Aufl.; 2025; DOI

SPT-06 Innovative Production Technologies

Module code	SPT-06
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-06 Innovative Production Technologies
Lecturer	Prof. Dr. Lucas Prasol
Semester	1
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical-Methodological Competence

Knowledge of innovative manufacturing processes and their function - specifically, the production of workpieces from specified materials under given conditions (geometry, surface finish) and their assembly into functional products. Knowledge of key concepts at the interface between manufacturing and digitalization.

Action-Oriented Competence

Students develop the ability to evaluate innovative production processes with regard to sustainability (resource and energy minimization), quality, economic efficiency, and flexibility.

Social Competence

Goal-oriented, collaborative development of solutions to problems within the context of current societal issues.

Applicability in this and other Programs

SPT-13: Masters Thesis

Entrance Requirements

Learning Content

- Production engineering within an industrial environment (product development, production planning, and manufacturingincluding support functions) viewed through the lens of a sustainable circular economy and innovative production technologies.
- Manufacturing processes in accordance with DIN 8580 (primary forming, forming, separating, joining, coating, and modifying material properties), including associated manufacturing systems comprising machine tools, workpiece and tool clamping, workpiece handling, and CNC technology.
- Digitally integrated production within the context of the ongoing transformation of industrial manufacturing.

Teaching Methods

Lecture, seminar, group work

Recommended Literature

- Birgit Awiszus, Prof. Dr.-Ing. habil. Jürgen Bast, Dr.-Ing. Thomas Hänel, Dr.-Ing. Mario Kusch (Hrsg.); Grundlagen der Fertigungstechnik; Hanser, München, 7. Aufl., 2020

SPT-07 Polymer Materials 2

Module code	SPT-07
Module coordination	Prof. Dr. Dmitry Rychkov
Course number and name	SPT-07 Polymer Materials 2
Lecturer	Prof. Dr. Dmitry Rychkov
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical Expertise

Students

- explain the physical and thermodynamic principles underlying the solidification of thermoplastics and thermosets.
- describe and distinguish between crystallization processes, morphological development, and cross-linking reactions in polymeric materials.
- Explain the mechanisms underlying the development of residual stresses and warpage in polymer components.
- Explain the viscoelastic behavior and time-temperature relationships of polymer materials.

- Describe mechanical testing methods (tensile, creep, and dynamic mechanical testing) and their significance.
- Explain and distinguish between failure mechanisms (brittle/ductile, creep, fatigue, impact loading).
- Explain the effects of structure, fillers, and reinforcements on mechanical properties.
- Describe the electrical, optical, permeation, and acoustic properties of polymeric materials, as well as their physical principles.
- Explain the effects of environmental factors on polymers (aging, chemical degradation, thermal degradation).

Methodological Competence

Students

- analyze solidification processes, taking into account heat transfer, crystallization, and cross-linking reactions.
- apply models to describe residual stresses and distortion (with and without phase change).
- interpret experimental data from mechanical tests (tensile test, creep test, DMA).
- use viscoelastic models (Maxwell, Kelvin, standard models) to describe time-dependent material behavior.
- analyze and evaluate failure mechanisms using fundamental fracture mechanics concepts (e.g., stress intensity factor, energy release rate, J-integral).
- evaluate the influence of material structure and processing on mechanical performance and service life.
- analyze the properties of fiber-reinforced and filled polymers, taking anisotropic effects into account.
- evaluate transport and barrier properties (diffusion, permeation) for application-relevant questions.
- develop approaches for optimizing polymer systems in terms of both materials and processes with regard to mechanical performance and durability.

Personal Competencies

Students

- reflect on the significance of material behavior and failure mechanisms for the design of safe and sustainable components.
- evaluate the limitations of theoretical models and experimental methods in comparison to real-world applications.
- develop a comprehensive understanding of the relationships between processing, structure, properties, and failure.
- work independently on complex problems in materials science.

Social Skills

Students

- critically discuss complex issues in materials science and process engineering with a sound technical foundation.
- present different approaches to improving material properties and component performance.
- collaborate on the analysis of failure cases and the development of improvement strategies.
- present results from analyses and modeling in a structured manner tailored to the audience.

Applicability in this and other Programs

SPT-13: Master's thesis

Entrance Requirements

Successful completion of the course "Polymer Materials I" is recommended.

Learning Content

- Solidification of Polymers
- Mechanical Behavior of Polymers
- Failure and Damage of Polymers
- Electrical Properties of Polymers
- Optical Properties of Polymers
- Permeability Properties of Polymers
- Acoustic Properties of Polymers

Teaching Methods

seminar

Recommended Literature

- George Youssef; Applied mechanics of polymers - properties, processing, and behavior; Elsevier Amsterdam, Kidlington, Cambridge 2022
- Omar Mukbaniani, Tamara Tatrishvili, Marc J. M. Abadie; Advanced Polymer Structures: Chemistry for Engineering Applications; Apple Academic Press 2024

- Andrey V. Dobrynin; Polymer Physics Disentangled: an introduction for scientists and engineers; Oxford University Press, Oxford 2026

SPT-08 Lifecycle and Innovation Management

Module code	SPT-08
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-08 Lifecycle and Innovation Management
Lecturers	Prof. Dr. Peter Fröhlich N.N. Prof. Dr. Christian Wilisch
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Subject-Specific and Methodological Competence

- Students possess a solid and specialized knowledge of innovation management and have a deep understanding of its concepts and theories (planning, implementation, and monitoring of innovative ideas and technologies within an organization). They are aware of the role and significance of innovation management within an organization.
- Students have acquired in-depth and specialized knowledge of the subject and have developed a comprehensive understanding of the application,

benefits, and analysis of market and customer needs, as well as how these can be used to generate new ideas and develop products and services (user-centered design).
- They have developed a detailed understanding of the concept of open innovation and of collaboration within networks (collaboration with external partners).
- They will understand how trend and technology management is carried out, be able to apply this knowledge theoretically to various tasks in innovation management, and select the appropriate tools. This also involves understanding trend and technology management and applying it in a practical manner to identify trends and technologies at an early stage.

Practical Skills

Through their specialized knowledge, students understand how innovation and technology management is structured and integrated within organizations. They are able to apply methods and tools in a theoretical context and use them in activities such as strategic planning, idea generation, evaluation, and selection, as well as user engagement. In addition, they learn to leverage open innovation and collaboration with external partners to drive innovation, and to apply methods and tools for trend and technology management. They have also developed a basic understanding of futures studies and its application in business.

Social Skills

Students are able to independently structure and solve problems, present and discuss them in an interdisciplinary context, thereby honing their teamwork and communication skills in particular. They can effectively support the professional development of others by applying the skills they have acquired.

Applicability in this and other Programs

SPT-13: Masters thesis

Entrance Requirements

Learning Content

The module consists of seminar-style instruction and interactive learning units. Seminar-style instruction:

- Fundamentals of Innovation and Technology Management
- Trend and Technology Management as Methods of Strategic Foresight
- Creativity Methods and Techniques
- Idea Evaluation and Selection
- Open Innovation and Innovation in Networks

- Scenario Planning

Group work and interactive learning activities to supplement and reinforce seminar instruction.

Teaching Methods

Lecture, seminar, group work

Recommended Literature

- VAHS, Dietmar und Alexander BREM, 2023. Innovationsmanagement: von der Idee zur erfolgreichen Vermarktung . 6. Auflage. Stuttgart: Schäffer-Poeschel. ISBN 978-3-7910-4278-7, 3-7910-4278-5
- lecture notes

SPT-09 Methodology in Research and Case Study Sustainability Technologies

Module code	SPT-09
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-09 Methodology in Research and Case Study Sustainability Technologies
Lecturers	N.N. Prof. Dr. Roland Platz Prof. Dr. Dmitry Rychkov Prof. Dr. Christian Wilisch
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Technical Expertise

Students ...

- describe key concepts of sustainable technologies in plastics engineering (circular economy, bioeconomy, resource efficiency).

- explain the scientific principles underlying selected application areas (e.g., recycling technologies, bio-based polymers, energy-efficient processing).
- discuss current industrial solutions using real-world case studies (e.g., ChemCycling, Borcycle, PlantBottle).
- distinguish between various end-of-life strategies, recycling technologies, and design approaches with regard to sustainability.
- describe the methodological foundations of sustainability assessment (e.g., life cycle assessment, carbon footprint, circularity metrics).

Methodological Competence

Students ...

- analyze complex case studies covering the entire life cycle of polymer products (raw materials, use, end-of-life).
- apply scientific methods for sustainability assessment (e.g., LCA, material flow analysis, qualitative assessment models).
- evaluate technological solutions in terms of ecological, economic, and social criteria.
- compare alternative materials, processes, and strategies (e.g., recycling vs. biodegradability, mechanical vs. chemical).
- identify trade-offs between sustainability dimensions (e.g., performance vs. environmental impact).
- develop innovative solutions and suggestions for improvement for sustainable technologies in plastics engineering.
- apply theoretical concepts to real-world industrial problems (case studies).
- organize and synthesize complex information into sound recommendations for action.

Personal Competence

Students ...

- reflect on their own role as engineers in the context of the sustainable transformation of the plastics industry.
- assess the social and environmental responsibilities associated with technological decisions.
- develop a critical awareness of the uncertainties and limitations of assessment methods (e.g., LCA assumptions).
- work independently and systematically on open-ended, complex problems without predetermined solutions.
- reflect on their own learning process in the context of project-based work.

Social Skills

Students ...

- work cooperatively in interdisciplinary teams to address complex case studies.

- critically discuss and analyze different approaches to solutions in an evidence-based manner.
- justify decisions by incorporating scientific, economic, and social perspectives.
- present results in a structured, audience-appropriate, and persuasive manner (e.g., presentation, report).
- facilitate decision-making processes and take into account the perspectives of various stakeholders.

Applicability in this and other Programs

SPT-13: Master's thesis

Entrance Requirements

Learning Content

On the basis of a selected application example, the students are supposed to carry out independ literature research, if necessary independent small subtasks,etc. and work on the topic themselves by means of literature research.

Case Study Topics Sustainability in Polymer Technology

1. Circular Economy in Polymer Manufacturing
Designing a closed-loop system for polymer production and end-of-life recycling. Example Cases: BASF ChemCycling, Borealis Borcycle project. Key Themes: Chemical recycling, product design for recyclability, life cycle assessment (LCA).

2. Biodegradable and Bio-Based Polymers: From Lab to Market
Evaluating the environmental and economic viability of bio-based polymers (PLA, PHA, PBS). Example Cases: NatureWorks Ingeo, Novamont Mater-Bi®. Key Themes: Feedstock sustainability, biodegradability standards, market adoption barriers.

3. Sustainable Additives and Fillers for Polymer Composites
Using renewable or recycled fillers (e.g., cellulose, hemp fibers, waste glass) to enhance polymer performance. Example Cases: Wood-plastic composites, recycled glass fiber composites. Key Themes: Material performance vs. sustainability, processing challenges, circular composite design.

4. Microplastic Reduction and Advanced Wastewater Filtration
Developing or assessing polymer-based filtration technologies to capture microplastics. Example Cases: Textile fiber shedding reduction, membrane filtration systems. Key Themes: Environmental monitoring, filtration efficiency, polymer degradation behavior.

5. Sustainable Packaging Innovations

Redesigning packaging materials to reduce carbon footprint and improve recyclability. Example Cases: Coca-Cola PlantBottle, Loops reusable packaging system. Key Themes: LCA of packaging materials, compostability vs. recyclability, consumer behavior.

6. Energy-Efficient Polymer Processing Technologies
Reducing the energy intensity of polymer manufacturing through process optimization. Example Cases: Reactive extrusion, microwave-assisted polymerization, additive manufacturing. Key Themes: Process intensification, renewable energy integration, carbon footprint analysis.

7. End-of-Life Strategies for Thermoset Polymers and Composites
Developing sustainable solutions for non-recyclable polymer systems (e.g., epoxy, CFRP). Example Cases: Recyclamine® technology, solvolysis of carbon fiber composites. Key Themes: Chemical recycling, design for disassembly, industrial symbiosis.

Teaching Methods

Guided processing of seminar topics in study groups. Accompanying events / presentations depending on the selected topic area.

Recommended Literature

- BASF ChemCycling LCA Meta Study (2023) (URL: https://plastics-rubber.basf.com/global/en/plastics-hub/chemcycling/lca-for-chemcycling (13.05.2026))
- Sarah L. Nordahla and Corinne D. Scown; Recommendations for life-cycle assessment of recyclable plastics in a circular economy; Chem. Sci., 2024, 15 , 9397; DOI: 10.1039/d4sc01340a
- Ana Fonseca et. al.; Life Cycle Assessment of PLA Products: A Systematic Literature Review; Sustainability 2023, 15 (16), 12470; DOI: 10.3390/ su151612470
- other publications

SPT-10 Lifetime Design and Reliability Assessment

Module code	SPT-10
Module coordination	Prof. Dr. Roland Platz
Course number and name	SPT-10 Lifetime Design and Reliability Assessment
Lecturers	N.N. Prof. Dr. Roland Platz Prof. Dr. Christian Wilisch
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

In the module students learn to follow developments in the areas of operational safety and occupational safety over the course of time. Functional safety is classified in the comprehensive field of process and machine safety. The students work out general objectives and influencing factors for the application of safety technology.

Students learn about European treaties as the basis for directives, harmonized standards and occupational safety. In this context, the European legislative procedure, with regard to the development of technical guidelines and standards, will be presented.

Within the framework of this module, the students will become familiar with relevant technical guidelines with regard to the development of safe machines and processes.

A detailed examination of the Machinery Directive provides students with the necessary basic knowledge. Students learn about current developments in existing safety standards and guidelines. This results from the strong overlapping of IT security and machine security in the future in terms of industry 4.0, with the use of cyber-physical systems.

The students can understand the processes involved in the development of standards. They recognize the importance of harmonizing standards that should be applied with regard to the development of processes/machines in order to achieve conformity with European safety directives.

The learning section also introduces national and international organizations for standardization. In the course of a standards research, relevant standards from the areas of safety and functional safety are identified.

The students learn the meaning and the procedure for a CE-certification. In the context of the explanation of the CE certification process, the detailed consideration of risk analysis and risk reduction takes place on the basis of relevant, international standards EN ISO 12100 and EN ISO13849 at selected study examples. In the course of this work, the use of special software for the systematic evaluation of safety functions will be presented.

The participants of the module gain an insight into the application of statistical methods in the fields of safety engineering and reliability analyses. An overview of relevant parameters and distribution functions is given by the analysis of exemplary data sets.

In the lecture, the students work out general objectives and influencing factors in the application of safety engineering.

Using an example project along ISO 26262, the students learn how to apply a product in consideration of the prescribed methods.

Within the framework of this module, students are introduced to relevant technical guidelines with regard to the development of safe products and their development processes and tools.

Students learn about current developments in existing safety standards and guidelines. This results from the future strong overlap of IT security and product security in the course of industry 4.0, when using cyber-physical systems.

The students learn the meaning and the procedure with a development tool certification.

The participants of the module gain an insight into the application of methods in the areas of security technology. An overview of relevant parameters and distribution functions is given by analyzing exemplary data sets.

After completing the module, the students have achieved the following learning objectives.

Professional competence:

- The students have built up a sound basic knowledge in the field of safety engineering, in particular functional safety.

- The students know and apply the legal framework and processes with regard to the creation of technical guidelines and the resulting harmonized standards, as well as the implementation of the European requirements at national level.
- The students are familiar with the current European directives (Machinery Directive, Low Voltage Directive and Electromagnetic Compatibility Directive) and understand their influence on development work and plant procurement.
- Students are familiar with the basic technical standards that must be taken into account when integrating safety functions. In this context, the EN ISO 12100 and EN ISO 13849 standards play a particularly important role in the module.
- The students are familiar with the technical process of CE-certification and understand the effects on the development process and machine procurement. They are aware of the legal obligations that apply in the course of CE-certification.
- The students know and understand the legal framework and processes related to the creation of technical products.
- The students are familiar with the basic technical standards that must be taken into account when integrating safety functions. In this context, the ISO 26262 standards play a particularly important role in the module.
- The students know the technical process of a safety-relevant development and understand the effects on the development process and the responsibility of customers and suppliers. They are aware of the legal obligations
- Students have a basic knowledge of statistical analysis of data sets in the field of safety engineering and reliability analysis.

Methodological competence:

- The students acquire the ability to conduct a targeted research of standards and guidelines.
- With their basic knowledge of directives, standardization and CE-certification, students are able to carry out a basic risk analysis in accordance with the EN ISO 12100 standard. In addition, the students have the methodological competence to design safety-related parts of control systems (SRP/CS) according to the required performance level PLr using appropriate safety software (SISTEMA).
- With the technical basic knowledge about guidelines and standards it is possible for the students to implement the methodical competence of the safety-related parts of control systems.

Personal competence:

- The students acquire skills and strategies with which they can constantly update their knowledge with regard to safety technology in the rapid technological upheaval in the course of Industrialization 4.0.
- In the course of the module, students will be able to reflect on their responsibilities, which must be taken into account when designing new processes, machines or products with regard to safety aspects.

Social competence:

- Students acquire the ability to work together in mixed development teams, with special emphasis on clear communication and conflict management.

Applicability in this and other Programs

- Knowledge of standardization and standards research
- Statistical methods
- Methods for designing safe machines and processes

Entrance Requirements

Learning Content

- Safety technology and occupational safety in the course of time
- Basics and terms of safety engineering
    - Distinction between system and functional safety
    - Goals and influencing factors in the development of safety concepts
- Legal framework in Europe with regard to safety technology
- Safety and health at work on the basis of European treaties
- Development of safety standards on the basis of European directives
- Future developments regarding the combination of IT security and functional security
- European directives for the development of safe machines
- Relevant Functional Safety Guidelines
- Machinery Directive 2006/42/EC
- Standards for safety technology
- Historical development in the field of standardization
- Definitions and terms from the field of standardization
- Significance, application and development of standards
- Harmonized standards
- International and national standard organizations
- Hierarchies and groupings of standards
- Presentation and comparison of standards in the field of functional safety.
- Practical approach to standards research. Exercises
- CE-certification

- CE-certification process
- Effects and influence of CE-certification on the development process and machine procurement
- Legal liabilities due to CE-certification and advantages of the CE-certification process at a glance
- Risk analysis according to the EN ISO 12100 standard using examples
- Risk reduction and design of safety functions in accordance with the EN ISO 13849 standard on the basis of examples
- Statistical methods in the field of safety engineering and reliability analysis
- Utilisation of a project example: Electrical steering without a redundant mechanical gear
- Functional Safety vocabulary
- Management of functional safety
    - Project independent safety management
    - Safety management during concept phase and development
    - Safety management activities after start of production
- Concept phase
    - Item definition
    - Initialisation of the safety life cycle
    - Safety integrity level analysis and risk assessment
    - Functional safety concept
- System product development
    - System development and integration
    - Product development hardware
    - Start of hardware development
    - Hardware safety requirements analysis
    - Hardware design
    - Quantitative requirements for random errors
    - Evaluation of random error effects on the safety goals
    - Hardware integration and test
    - Product development software
    - Start of software development
    - Software safety requirements specification
    - Software architecture and design
    - Software implementation
    - Software module test
    - Software integration and test
    - Software validation against the safety requirements
- Production and use
    - Production
    - Use, service and end of useful life
- Supporting processes

    - Interfaces
    - Specification of safety requirements
    - Configuration and change management
    - Verification
    - Documentation
    - Software tools qualification
    - Qualification of hardware components
    - Qualification of software components
- ASIL and SIL safety-oriented analysis
    - Decomposition and tailoring
    - Co-existence criteria
    - Error dependencies
    - Safety analysis
- Guideline support to use for ISO 262626 based on ISO/TS 16949 and IEC 61508.

Teaching Methods

The module provides a framework for self-organized learning to help students develop their professional and methodological skills.
In addition to theoretical inputs, interaction exercises and problem-solving tasks are used as central methods. Through guided work assignments, students are actively involved in the development of learning content. Practical exercises and the presentation of the results enable the students to understand topics in depth. In addition, their communication and team skills are promoted.

Remarks

Exercises on risk analysis and the design of safety functions are intended to deepen the knowledge acquired in the lecture and to apply newly acquired skills in a practical manner. Tasks are developed in working groups and then presented.

The presentation of solutions and the discussion of the results impart skills which are indispensable to the modern working environment of an engineer.

Recommended Literature

- Funktionale Sicherheit von Maschinen : praktische Anwendung der DIN EN ISO 13849 praktische Anwendung der DIN EN ISO 13849; Gregorius, Carsten; Berlin; Beuth Verlag; 2016; ISBN: 9783410252498
- Zertifizierung im Rahmen der CE Kennzeichnung Konformitätsbewertung und Risikobeurteilung nach der Maschinenrichtlinie 2006/42/EG und

anderen europäischen Richtlinien; Schneider Andre; Berlin; VDE Verlag; 2018; ISBN 978-3-8007-4473
- Funktionale Sicherheit von Maschinen und Anlagen : Umsetzung der Europäischen Maschinenrichtlinie in der Praxis ; [Inhalt: ISO 13849-1, IEC 62061]; Gehlen; Erlangen; Publicis Publ.; 2010; ISBN: 9783895783661
- Handbook of reliability, availability, maintainability and safety in engineering design; Stapelberg; London; Springer; 2009; ISBN: 9781848001749
- Reliability engineering; Rao, Singiresu; Boston; Pearson; 2015 ; ISBN: 9780136015727
- Automotive SPICE® in der Praxis: Interpretationshilfe für Anwender und Assessoren von Markus Müller (Autor), Klaus Hörmann (Autor), Lars Dittmann (Autor), Jörg Zimmer (Autor), ISBN-13: 978-3864903267
- ISO 26262
- IEC 61508
- Norm EN ISO12100
- Norm EN ISO 13849
- Maschinenrichtlinie 2006/42/EC

SPT-11 Process Optimization, Lean Management and Quality Management

Module code	SPT-11
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-11 Process Optimization, Lean Management and Quality Management
Lecturers	N.N. Prof. Dr. Stefan Slama Prof. Dr. Christian Wilisch
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	Portfolio (With planned room)
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

Knowledge skills

Students are becoming familiar with expert knowledge and scientific concepts and methods in the field of Lean Production and Manufacturing Excellence. They understand the most important aims of production without waste of resources, lean thinking in

processes and organization, helpful tools and they will know methods and tasks to solve problems in efficiency.

Professional skills

Students are able to solve tasks autonomous and are able to asses problems in the field of Lean Production

Social skills

The students are able to discuss case study results in groups, achieve consensus by critical but constructive discussions and present final work results as a team, also their research study project.

Applicability in this and other Programs

SPT-13: Masters thesis

Entrance Requirements

Learning Content

- Definition, Meaning, Opportunities, Method Overview and Structure of Lean Production
- Team Work, 5S, Standards
- Muda Elimination, TPM (Total Productive Maintenance), JIT (Just In Time)
- Employee Involvement, Quality First, etc.
- Strengthening of key aspects with additional trainings and exercises in team-work, critically considerations of effects / needs and presentation of results

Teaching Methods

Seminar

Recommended Literature

- Thomas Janoski, Darina Lepadatu (ed.); The Cambridge international handbook of lean production; Cambridge University Press; 2021
- Jörg Niemann, Benedikt Reich, Carsten Stöhr; Lean Six Sigma - Methods for Production Optimization; Springer Berlin Heidelberg; 2024

SPT-12 Compulsory Language: German or another foreign language

Module code	SPT-12
Module coordination	Tanja Mertadana
Course number and name	SPT-12 Compulsory Language: German or another foreign language
Lecturer	Dozierende für AWP und Sprachen
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 60 hours Total: 120 hours
Type of Examination	See examination schedule AWP and languages, written ex. 90 min.
Duration of Examination	90 min.
Weighting of the grade	5 out of 90
Language of Instruction	German

Module Objective

The module German B1/ part 1 + 2 focuses on improving students' communication skills and expanding their vocabulary range. It also aims to broaden their comprehension of more complex texts communicated in writing and orally, such as articles and reports. The module furthermore trains their ability to comprehend and engage in longer conversations and discussions on a variety of topics.

This module covers the first part of the level B1.

The main emphasis of the module is to improve students' verbal skills so as to enable them to express opinions, ideas and experiences. By writing coherent texts, such as reports, letters or argumentation will be applied as means of further enhancing their writing skills. The module will also involve deepening students' grammar knowledge and expanding their range of vocabulary. This will enable them to apply the acquired linguistic skills to practical situations, such as in presentations, role plays or group discussions. Their intercultural skills will be broadened, enabling them to communicate in international environments. The course incorporates a diverse range of activities; group work, pair work, role plays, discussions, listening and reading comprehension. The aim of the module is to prepare students for real-life situations.

Specifically, students completing the module will achieve the following learning outcomes:

Professional skills

At Level B1, students should be able to:

- Read texts of a more complex nature and comprehend specific information contained in them.
- Actively engage in discussions and conversations, exchange views and opinions and present arguments.
- Give an account of a variety of topics, both orally and in writing, such as advantages and disadvantages, technological developments or future trends.
- Apply and comprehend subject-specific terminology and vocabulary.
- Hold basic presentations and answer questions on these.

Methodological skills

Methodological skills here refer to students' ability to apply a variety of learning and working methods so that they may further build on their linguistic and subject-specific knowledge.

- Application of various learning strategies in order to broaden and deepen their vocabulary and knowledge of grammatical structures.
- Use of authentic materials, such as specialist articles, presentations or videos for self-research and learning purposes.
- Independently plan, organise and carry out written tasks and projects.
- Treat complex listening exercises, e.g. expert interviews or discussions.
- Work in collaboration and interactively with other students in group work and projects.

Social skills

Social skills here refer to students' ability to conduct themselves appropriately, communicate effectively and work in groups when engaging in social interactions.

- Effective oral communication in a variety of contexts, e.g. in presentations, discussions or group work.
- Ability to actively listen and respond appropriately to opinions and viewpoints expressed by other students.

- Collaboration in group projects and teamwork in order to collectively solve tasks.
- Intercultural sensitivity and the ability to work with students of various cultural backgrounds.

Personal skills

Personal skills here refer to students' individual abilities, attitudes and traits that enable them to achieve their goals, further their personal development and operate successfully.

- Independence and personal initiative when learning German.
- Organisational skills in order to plan and accomplish tasks and projects.
- Tenacity and perseverance on the road to achieving the learning goals and overcoming challenges.
- Critical thinking and the ability to form and uphold their own opinions.
- Confidence in their own abilities and their application of learnt knowledge.

Applicability in this and other Programs

Not applicable in other degree programmes.

Entrance Requirements

To participate in this module, students must be able to furnish proof that they have attained Level A2 German proficiency.

Learning Content

Grammar and vocabulary form the core elements of this course. The following key aspects are covered during the course: Regional and cultural studies, intercultural competence and pronunciation. Holidays/travel, technology/devices, complaints, job hunting and the environment are just some of the topics covered during this course. Additional topics will furthermore be incorporated in keeping with current literature and real-life developments. The following is an extract of the grammar topics that will be covered:

- Infinitive clauses
- Subordinate clauses
- Passive voice
- Connectors
- Prepositions
- Pronominal adverbs
- n-declension
- Subjunctive II

Teaching Methods

The teaching methods applied will focus on improving the four main language skills (listening, speaking, reading and writing). Examples of the applied learning methods include various forms of group, individual and collaborative work, mini-presentations, exercises involving intensive reading and listening, role plays and grammar games, loci method, dictation exercises, translations, peer feedback, working with learning stations, and various writing activities designed to consolidate the content learnt. It is also envisaged that projects will be carried out using the scenario method.

Students will be given weekly assignments for self-study.

Remarks

In all language courses, students will be required to meet a minimum compulsory attendance rate of 75%.

Recommended Literature

Textbook:

Netzwerk neu B1.1, Kurs- und Übungsbuch mit Audios und Videos, Klett Verlag Lektionen 1-6 (ISBN 978-3-12-607170-3)

Recommended reading:

Grammatik aktiv: A1-B1, Cornelsen Verlag (ISBN 978-3-06-122964-1)

Übungsgrammatik für die Grundstufe: Lösungsheft, Hueber Verlag (ISBN 978-3-922989-70-7)

Fit in Grammatik B1, Hueber Verlag (ISBN 978-3-19-607493-2)

Deutsch als Fremdsprache, Übungsgrammatik für die Grundstufe Niveau A2-B2, Liebaug-Dartmann (ISBN 978-3-922989-70-7)

Wortschatz & Grammatik B1: Buch (deutsch üben), Hueber (ISBN 978-3194874930)

Deutsch intensiv Wortschatz B1: Das Training, Klett (ISBN 978-3126750769)

SPT-13 Master's Thesis

Module code	SPT-13
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-13 Master's Thesis
Lecturer	N.N.
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	0
ECTS	25
Workload	Time of attendance: 0 hours self-study: 750 hours Total: 750 hours
Type of Examination	master thesis
Weighting of the grade	25 out of 90
Language of Instruction	English

Module Objective

The Master's programme Sustainability in Polymer Technology is completed with a Master' thesis. The students have to prove that they can work on a certain task independently and successfully within a given period of time and that they can apply scientifically founded theoretical and practical knowledge to solve a problem. After successful completion of the Master' thesis, the students are able to independently work on complex scientific/ technical tasks. They solve problems with the help of digital methods and tools and master networked, cyberphysical systems.

The module content taught during the course of study is applied in the form of scientific work. The problem has to be analyzed, structured and worked on independently within a given time frame. This trains the ability to independently work on technical problems of a larger coherent topic and to prepare the results in scientific form. The aim is, among other things, to deepen and apply the ability to document the results transparently.

In addition to the Master's thesis (25 ECTS), the Master's colloquium (5 ECTS) is also part of this module. The master's seminar consists of two parts that must be passed to successfully complete the module. To prepare for the master's thesis, participation in the seminar series "Career Start into German Technology Companies" is mandatory. The seminars / workshops are offered as block events during the first two semesters of study. The events cover a variety of topics that are of great importance for the preparation of the Master's thesis. In addition to scientific working methods, students are also introduced to application processes and the general conditions of the German labour market and its entry after graduation. The second part of the Master's seminar consists of the colloquium. After submitting the Master's thesis, it is presented in a presentation of about 15 minutes and then defended. The colloquium is assessed with 5 ECTS.

Professional competence

The students are enabled to familiarize themselves with technical tasks in depth, to analyze problems independently and to solve them.

After completing the module, students will be able to work on a problem from the extensive field of mechatroic and cyber-physical systems in a scientifically sound manner.

Methodological competence

The ability to independently work on and solve an extensive problem from the engineering sciences on a scientific basis is the overriding goal of methodological competence.

Personal competence

Independent, self-responsible and self-disciplinary scientific, methodical processing of a practice-relevant, delimitable (sub)project in a study programme-related environment as well as written, independent documentation in the form of scientific work train and required personal competences.

Social competence

The students improve their social and interface competence through intensive communication with the supervisors at the Technical University and in the cooperating industrial company.

Applicability in this and other Programs

The Master's programme Sustainability in Polymer Technology enables students to work scientifically. The Master's degree entitles the holder to a subsequent doctorate.

Entrance Requirements

Admission requirements are the successfully completed case studies including the scientific elaboration of the project topics.

The registration for the Master's thesis requires that at least 45 ECTS credits have been achieved. See study and examination regulations (SPO).

Learning Content

The topic of the Master's thesis will be set by a professor of the participating universities or by a cooperating company. In addition, the students are entitled to propose their own topics. A DIT professor is responsible for supervision and content support.

The Master' thesis is included:

- Presentation of the state-of-the art in science and technology of the topic being worked on
- Description of the methodology and the course of the own theoretical and experimental procedure including concept development
- Decision making regarding the most favourable problem solution
- The integration of the own work into the work of the supervising institutes/ faculties and possible industry partners.
- Report on own publications
- Report on the applications/possible applications for funding within the scope of the topic
- Creation of test setups and programs
- Execution of measurements and test runs including their evaluation
- Scientific documentation of the technical results achieved and their evaluation
- study of literature

By writing a Master' thesis, students should demonstrate their ability to apply the knowledge and skills acquired during their studies to an independent scientific thesis.

The Master' thesis is followed by a colloquium as an oral examination. The students present their Master' thesis and defend it.

Teaching Methods

Guidance to independent work according to scientific methods by the respective supervisor.

seminars, workshops,

colloquium

Remarks

The subject content of the Master' thesis can be chosen freely and individually by students. The topic must be recognised by the supervising professor. Furthermore, it is possible to work on a topic in cooperation with a company and to work on a research topic at the faculty.

Recommended Literature

Literature selected by the student for the specific subject area.

Support for scientific work:

Eco, Umberto: How to write a scientific thesis; 13th edition; UTB Verlag; Vienna; 2010.

Scheld, Guido: Instructions for the preparation of internship, seminar and diploma theses as well as bachelor and master theses; 7th edition; Fachbibliothek Verlag; Büren; 2008.

Rossig, Wolfram; Prätsch, Joachim: Scientific works: Guidelines for term papers, bachelor's and master's theses, diploma and master's theses, dissertations; 7th edition; team printing; Weyhe; 2008.

Standop, Ewald; Meyer, Matthias: The form of scientific work; 18th edition; Quelle & Meyer; Wiebelsheim; 2008.

SPT-14 Master's colloquium

Module code	SPT-14
Module coordination	Prof. Dr. Christian Wilisch
Course number and name	SPT-14 Master's colloquium
Lecturer	N.N.
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	postgraduate
Semester periods per week (SWS)	0
ECTS	5
Workload	Time of attendance: 0 hours self-study: 150 hours Total: 150 hours
Type of Examination	colloquium
Weighting of the grade	5 out of 90
Language of Instruction	English

Module Objective

The Master's programme Sustainability in Polymer Technology is completed with a Master' thesis. The students have to prove that they can work on a certain task independently and successfully within a given period of time and that they can apply scientifically founded theoretical and practical knowledge to solve a problem. After successful completion of the Master' thesis, the students are able to independently work on complex scientific/ technical tasks. They solve problems with the help of digital methods and tools and master networked, cyberphysical systems.

The module content taught during the course of study is applied in the form of scientific work. The problem has to be analyzed, structured and worked on independently within a given time frame. This trains the ability to independently work on technical problems of a larger coherent topic and to prepare the results in scientific form. The aim is, among other things, to deepen and apply the ability to document the results transparently.

In addition to the Master's thesis (25 ECTS), the Master's colloquium (5 ECTS) is also part of this module. The master's seminar consists of two parts that must be passed to successfully complete the module. To prepare for the master's thesis, participation in the seminar series "Career Start into German Technology Companies" is mandatory. The seminars / workshops are offered as block events during the first two semesters of study. The events cover a variety of topics that are of great importance for the preparation of the Master's thesis. In addition to scientific working methods, students are also introduced to application processes and the general conditions of the German labour market and its entry after graduation. The second part of the Master's seminar consists of the colloquium. After submitting the Master's thesis, it is presented in a presentation of about 15 minutes and then defended. The colloquium is assessed with 5 ECTS.

Professional competence

The students are enabled to familiarize themselves with technical tasks in depth, to analyze problems independently and to solve them.

After completing the module, students will be able to work on a problem from the extensive field of mechatroic and cyber-physical systems in a scientifically sound manner.

Methodological competence

The ability to independently work on and solve an extensive problem from the engineering sciences on a scientific basis is the overriding goal of methodological competence.

Personal competence

Independent, self-responsible and self-disciplinary scientific, methodical processing of a practice-relevant, delimitable (sub)project in a study programme-related environment as well as written, independent documentation in the form of scientific work train and required personal competences.

Social competence

The students improve their social and interface competence through intensive communication with the supervisors at the Technical University and in the cooperating industrial company.

Applicability in this and other Programs

The Master's programme Sustainability in Polymer Technology enables students to work scientifically. The Master's degree entitles the holder to a subsequent doctorate.

Entrance Requirements

Admission requirements are the successfully completed case studies including the scientific elaboration of the project topics.

The registration for the Master's thesis requires that at least 45 ECTS credits have been achieved. See study and examination regulations (SPO).

Learning Content

The topic of the Master's thesis will be set by a professor of the participating universities or by a cooperating company. In addition, the students are entitled to propose their own topics. A DIT professor is responsible for supervision and content support.

The Master' thesis is included:

- Presentation of the state-of-the art in science and technology of the topic being worked on
- Description of the methodology and the course of the own theoretical and experimental procedure including concept development
- Decision making regarding the most favourable problem solution
- The integration of the own work into the work of the supervising institutes/ faculties and possible industry partners.
- Report on own publications
- Report on the applications/possible applications for funding within the scope of the topic
- Creation of test setups and programs
- Execution of measurements and test runs including their evaluation
- Scientific documentation of the technical results achieved and their evaluation
- study of literature

By writing a Master' thesis, students should demonstrate their ability to apply the knowledge and skills acquired during their studies to an independent scientific thesis.

The Master' thesis is followed by a colloquium as an oral examination. The students present their Master' thesis and defend it.

Teaching Methods

Guidance to independent work according to scientific methods by the respective supervisor.

seminars, workshops,

colloquium

Remarks

The subject content of the Master' thesis can be chosen freely and individually by students. The topic must be recognised by the supervising professor. Furthermore, it is possible to work on a topic in cooperation with a company and to work on a research topic at the faculty.

Recommended Literature

Literature selected by the student for the specific subject area.

Support for scientific work:

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