Annex 3 to the specific part of the examination regulations for the „Sustainable Engineering of Products and Processes“ course of studies with the qualification “Bachelor of Science” at Technische Universität Braunschweig

Programme learning outcomes

The internationally oriented bachelor's degree programme "Sustainable Engineering of Products and Processes" is designed to broaden the perspectives of engineering studies to include overarching, systemic problems in engineering and sustainable approaches to solving them. It forms the basis of a scientifically sound education that conveys the fundamentals of mechanical engineering and related disciplines required for the consideration of sustainable engineering issues. The bachelor's degree programme is designed to enable students to pursue a master's degree programme that is more in-depth and research-oriented. In addition, it should enable an early entry into professional life (professional qualification). Specifically, the abilities of the graduates can be characterized by the following qualities:

Graduates are able to

1. select and apply mathematical and scientific methods to analyse problems in their basic structure and to trace application-related problems back to mathematical models and to solve the mathematical relationships used in them.
2. analyse technical processes and problems using common information technology hardware and software and apply basic mathematical methods for computer-aided modeling, optimisation and simulation.
3. describe the system properties as well as the system behaviour of technical systems and to implement suitable measures for a targeted influencing of the system behaviour by control or regulation concepts.
4. explain relevant key figures of material and energy transformations on the basis of thermodynamic relationships and analyse, model and evaluate technical systems using balance equations.
5. create technical drawings in accordance with standards and to analyse, model, dimension and design simple technical components or systems with the help of engineering methods of mechanics, fluid mechanics and design theory and to evaluate them in terms of their functional reliability.
6. name the areas of application and characteristics of various materials used in mechanical engineering and to select suitable materials for the respective application.
7. recognize systemic relationships on the basis of concrete questions and to evaluate synthesis problems with balanced consideration of technical, economic, ecological, social and ethical constraints over the entire life cycle.
8. outline examples of sustainable business models, identify the legal and geopolitical constraints relevant to the specific problem, formulate and evaluate the requirements for sustainable products and processes, and convincingly represent the unity of ecology, economy, and social concerns in relation to technical problem solving.
9. analyse and model problems related to the design of sustainable products and processes on the basis of acquired basic engineering knowledge and in-depth specialist knowledge in a selected field of technology, to develop application-related solutions and to select suitable sustainable technologies for the solution.

10. evaluate the design and performance of machines, plants and processes with special regard to their sustainability, to critically reflect on the methods used and to develop alternatives if necessary.
11. conduct laboratory-scale experiments independently or in small groups and to interpret and discuss the results.
12. work independently in German and English on engineering-scientific questions and to take on the resulting tasks, if necessary in intercultural teams organised on the basis of a division of labour, to research, to take up the results of others, to compare them with each other, to present them to target groups and to communicate the results and their justification in terms of sustainability to a non-specialist public in an understandable way.
13. describe the basic processes in manufacturing companies, to explain interactions with adjacent company units and to classify their own positions.
14. apply their theoretical knowledge in an industrial environment, taking into account economic, ecological and social constraints.
15. plan their own learning processes independently, to carry out corresponding work steps in a structured manner and thus to react flexibly, in the sense of "lifelong learning", to changing framework conditions and uncertainties.
16. use interdisciplinary qualifications in the context of a professional activity to master interdisciplinary challenges and to recognize and take into account international and cultural aspects in their problem-solving activities.