Qualification goals for the degree programme B.Eng. Electromobility, Autonomous Driving and Mobile Robotics – International

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Gender neutrality

The use of double forms or other designations of female, male and other genders has been largely avoided in order to maintain legibility and clarity. All designations given to the various groups of university staff apply equally to all genders of the relevant groups.

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1 Aims of the degree programme

The aim of this degree programme is to provide international students with technical knowledge, abilities and skills in electromobility, autonomous driving and mobile robotics, along with in-depth knowledge of the German language.

The language training begins with language courses during the first three semesters and continues with their attendance of German-speaking lectures, commencing in the fourth semester. By being immersed in a German-language environment, students will acquire a profound understanding of the German language and thus be able to communicate in German, not only in professional surroundings but also actively socialise and participate in German everyday life.

Their technical training will range from the development and design of electronic circuits, including in power electronics, to optical technology and battery technologies, all the way through to the synthesis of control functions for autonomous driving and mobile robotics. Key elements of the degree programme content concern the hardware and software realisation, and validation of the designed control functions. Students will additionally become knowledgeable in the fields of image processing, electric drives as well as charging station technologies and hydrogen technology, which are increasingly coming to the fore. Topics covering computer science and microcomputer technology will also be taught, as will mathematics, statistics and stochastic.
The degree programme will also provide foundational knowledge of business management. Students' ability to perform scientific work and present findings will be trained in the form of seminars. By working in teams, students will foster their social skills.
The B.Eng Electromobility, Autonomous Driving and Mobile Robotics degree programme teaches the skills required in order to process new, complex tasks and problems encountered during the development and project planning of hardware and software for systems in the realms of autonomous driving and mobile robotics or electromobility, depending on the field of specialisation chosen. The course is thus intended to enable first-year students to acquire the corresponding knowledge and to reinforce this with theoretical and application-oriented knowledge so that they will be particularly well-equipped to satisfy the demands of modern development tasks in the high-tech fields of electromobility and autonomous driving. At the same time, the course will teach specialised electrotechnology and control engineering knowledge as well as methodological and personal skills to give students specific career guidance in the development, application, management, consulting or sale of hardware and

software. The degree will furthermore form the basis for post-graduate studies leading to a scientific career and serves as preparation for a master's degree course.
The bachelor's degree qualification is equivalent to Level 6 within the German Qualifications Framework (DQR) and Level 1 within the Qualifications Framework for German Higher Education Qualifications (QR DH) and qualifies the degree holder thereafter to apply for admission to a master's programme.

2 Learning outcomes for this degree programme

The German courses offered during the first three semesters enable international students to reach B2 language proficiency. Their participation in German-speaking lectures as of the fourth semester will broaden, consolidate and expand their linguistic abilities.
Through this bachelor's programme, students acquire and apply theoretical and application-oriented knowledge and abilities. The first four semesters of the bachelor's course will also enable them to expand their acquired specialist knowledge to include the field of specialisation of their choice: "Electromobility", "Autonomous Driving / Mobile Robotics". Students taking this bachelor's programme will acquire the ability to apply their knowledge and understanding to an activity or occupation and to find or further refine solutions to problems in their field, skills which will be promoted both during the practical semester and through the faculty and its lecturers. They will acquire knowledge of the methodological concepts and the latest research literature. Basic principles of engineering activity will be applied to real problems, including some derived from research projects and experiences from within the faculty so as to enable students to develop specialist knowledge and skills that will allow them to find solutions to problems that arise in the areas of design, testing, development and research. The ability to swiftly and systematically familiarise oneself with new areas will also be strengthened.

3 Study objectives and qualification goals

Knowledge:
Graduates of this degree programme will have a command of a broad range of German vocabulary and a broad understanding of spoken German, thus enabling them to express their thoughts in everyday situations as well as those requiring technical knowledge, and also to fully comprehend statements made in German by their opposite party.

They will command a critical understanding of the key theories, principles and methods of natural science and engineering. Graduates will have acquired extensive foundational knowledge of natural science and engineering, in particular in their chosen field of specialisation, whether "Electromobility" or "Autonomous Driving / Mobile Robotics". Their knowledge and understanding will enable them to keep up with the latest specialist literature, whilst also covering a certain body of knowledge of the current state of research. Graduates will have the ability to perform scientific work and take responsible actions unassisted in their individual occupations. They will recognise the need to continuously further develop their work and learning content. Graduates will be familiar with the relevant terminology and methods of the various areas. In addition to this, graduates will avail of business management knowledge.
Students specialising in "Electromobility" will acquire sound knowledge in the areas of power electronics, battery technologies and charging stations and be extensively proficient in numerous electromobility applications.
The "Autonomous Driving / Mobile Robotics" field of specialisation focuses on issues relating to control technology arising in autonomous systems found in vehicles and mobile robots as well as the model-based drafting and validation of such controls. Graduates will be knowledgeable of numerous applications found in autonomous driving and mobile robotics and also possess sound knowledge in the field of modern control technology.

Abilities: Graduates will be able to

- articulate matters of a technical and everyday nature actively and precisely
- passively comprehend, in full, statements given orally or in writing concerning matters of a technical or everyday nature
- gather, evaluate and interpret relevant information
- extrapolate scientifically sound judgements
- develop and analyse solution-based approaches that comply with the current state of science
- carry out application-oriented projects and contribute, in a team environment, to solving complex tasks
- articulate, within their sphere of action, professional and objective solutions to problems and justify these in discussions with expert representatives and specialist companies by providing theoretically and methodologically sound arguments
- justify their own work-related actions through theoretically and methodologically sound knowledge

Graduates specialising in "Electromobility" will have acquired the ability to process problems concerning power electronics, battery technologies and charging stations and to employ state-of-the-art techniques. They will additionally have acquired the ability to identify the applicability and usability of renewable energy sources and hydrogen technology.
Graduates specialising in "Autonomous Driving / Mobile Robotics" will have acquired the ability to analyse, structure and solve systematically practical problems that arise in control technology – in particular where autonomous systems, vehicles and mobile robots are concerned – in image processing, power electronics, model-based drafting and its validation, and also in contiguous domains.

Competencies: Graduates will be able to

- confidently master situations arising in a German-speaking environment, whether of a technical or everyday nature. At the same time, they will have the linguistic ability to participate in work-related and social interactions both actively and passively.
- gather, evaluate and interpret relevant information
- develop and implement solution-based approaches that comply with the current state of science within the realms of electromobility, autonomous driving and mobile robotics
- extrapolate scientifically sound judgements
- carry our application-oriented projects and contribute, in a team environment, to solving complex tasks
- deduce and define research questions
- articulate, within their sphere of action, professional and objective solutions to problems and to justify these in discussions with expert representatives and external companies by providing theoretically and methodologically sound arguments
- communicate and cooperate with other expert representatives and specialist companies with a view to solving tasks responsibly
- appropriately discern the parameters for professional conduct and justify their decisions on ethically responsible grounds
- set out and explain research findings

Graduates specialising in "Electromobility" have acquired and consolidated their expertise in the design of electromobility systems, in particular in the fields of power electronics, battery technologies, charging stations and hydrogen technology.

Graduates specialising in "Autonomous Driving / Mobile Robotics" have acquired expertise in assessing, structuring and solving systematically problems arising in model-based controller design and validation, autonomous driving and mobile robots, as well as a contiguous range of subjects.
By opting for the one field of specialisation or the other, graduates will acquire the skills that enable them to manage and control processes within an application-specific field of activity and thus acquire a higher, specific professional qualification.
They will also become knowledgeable of the basic principles of business management, whilst additionally furthering their linguistic proficiency.

The study objectives and learning outcomes relating to the degree programme are published on the web page for this degree programme (https://www.th-deg.de/em-b-en).

4 Learning outcomes of modules / module objectives / objectives matrix

The individual modules, their detailed goals, and the skills and competencies to be acquired by the graduates are outlined in the module handbook for the B.Eng. "Electromobility, Autonomous Driving and Mobile Robotics" degree programme.
The table below illustrates how the individual modules will correlate with the objectives of the B.Eng. "Electromobility, Autonomous Driving and Mobile Robotics" degree programme described in the section above.

Objective matrix – B.Eng. "Electromobility, Autonomous Driving and Mobile Robotics"												
Module	Objectives											
	Knowledge				Abilities				Competencies			
	Science and Technology Basics	Engineering-based Methods	Engineering Practice and Product Development	Cross-disciplinary	Science and Technology Basics	Science and Technology Basics	Engineering-based Methods	Cross-disciplinary	Science and Technology Basics	Engineering Practice and Product Development	Engineering Practice and Product Development	Cross-disciplinary
Mathematics 1	xx				xx				X			
Mathematics 2	xx				xx				X			
Physics 1	xx				xx				X			
Physics 2	xx				xx				X			
Basics of Electrical Engineering and Information Technology 1	x	xx			x	xx			X	x		
Basics of Electrical Engineering and Information Technology 2	x	xx			x	xx			X	x		
Basics of Electrical Engineering and Information Technology 3	x	xx			x	xx			X	x		
Statistics und Stochastic	xx				xx				X			
Material Engineering	x	xx			x	xx			X			
Electronic -Components		xx				xx				x		
Electrical Measurement Techniques		xx				xx				x		
Sensors / Optics		xx				xx				x		
Image Processing		xx				xx				x		
Control Technology 1		xx				xx				x		
Control Technology 2		xx				xx				x		
Electromagnetic Compatibility	x	xx			x	xx				x		
Electric Machines		xx				xx				x		
Power Electronics 1		xx				xx				x		
Microcomputer Technology		xx				xx				x		
Automotive Bus Systems		xx				xx				x		
Subject-specific Compulsory Elective Module (FWP)		xx		x		xx		x		x		
Internship		xx		x		xx		x		x		
Internship-Accompanying Seminar		xx		x		xx		x		x		
Field of Specialisation – Electromobility												
Power Electronics 2			xx				xx				xx	
Battery Technologies			xx				xx				xx	
Charging Stations, Hydrogen Technology			xx				xx				xx	
Field of Specialisation – Autonomous Driving / Mobile Robotics												
Model-Based Controller Design and Protection			xx				xx	x			xx	
Autonomous Driving			xx				xx				xx	
Mobile Robotics			xx				xx				xx	
Cross-Disciplinary Subjects												
German 1				xx				xx				xx
German 2				xx				xx				xx
German 3				xx				xx				xx
Key Skills				xx				xx				x
Compulsory Elective of a General Academic Nature (AWP)				xx				xx				x
Bachelor's Module Seminar				x				xx				xx

Key: xx strong relation; x medium relation