

Faculty of Engineering
Where engineers are made

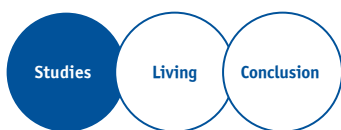
INTERNATIONAL STUDIES IN ENGINEERING MASTER PROGRAMS

UNIVERSITÄT
DUISBURG
ESSEN

Offen im Denken



General Information



Program Start

The regular beginning of the program is annually in October (winter semester). Admission for the master program is also possible for summer semester (April).

Duration of the Program

The curriculum of ISE is designed as a consecutive bachelor master program with duration for the master program of 2 years (4 semesters).

Semester

The academic year is divided into semesters:

- Winter semester: From October to March
- Summer semester: From April to September

Lecture period

The lecture period in winter usually starts in October and ends in February. In summer, the lecture period usually starts in April and ends in July. During the winter semester, there is a break of around two weeks during the winter holidays.

Exam period

The examination period always starts right after the lecture period and lasts for approx. 7 weeks.

Language of Instruction

The language of instruction is half German and half English. This means that approximately 50% of the courses are taught in German and the other 50% are taught in English. The language of a certain examination is the same as the language of instruction in the corresponding lecture.

Admission requirements

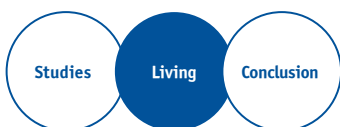
Bachelor's degree in an appropriate subject area, with adequate length of studies and with an average mark of at least 3.0 issued in Germany or a foreign equivalent

Language requirements for enrolment:

When enrolling, applicants must prove that they have knowledge of the German and English language according to the completed level B2 of the European Framework of Reference for Languages (CEFR).

Fees

All students must pay a social contribution of around 350€ per semester. The social fee includes a semester ticket covering public transport, subsidized meals in the canteen of the university and other services.



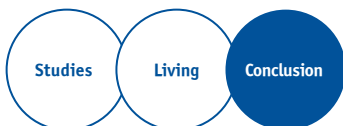
Cost of living

With an estimated 1,200€ monthly budget, you'll find in Duisburg and the surrounding area an affordable place to live, with great public transport and student-friendly housing.

Accommodation

Accommodation is possible both in student housing run by the Studierendenwerk and in accommodation offered on the housing market. The rent for a room in a student hall of residence is around 350€ to 500€ euros per month.

More information under: <https://www.uni-due.de/scies/accommodation.shtml>



Accreditation

The University of Duisburg-Essen has been system-accredited.



Study Program

The ISE studying program offers degrees with professional qualification as a Bachelor of Science (B.Sc.) with high knowledge base and practical content, as well as degree courses in Master of Science (M.Sc.) with advanced essentials, where students are given the possibility to choose between a scientific or an application-oriented area of specialization of the previously completed bachelor degree. Studies in the ISE program consist of eight different master degree courses, where some master courses are divided into profiles for a certain specialization.

- Automation and Safety
- Communications Engineering
- Computational Mechanics
- Embedded Systems Engineering
- Management and Technology of Water and Waste Water
- Mechanical Engineering
- Metallurgy and Metal Forming
- Power Engineering

Course of study

All master degree courses follow the same structure and consist of core subjects, advanced theories, profile subjects, electives and the master thesis. The mandatory core subjects are obligatory for all students and provide in-depth knowledge in the specific discipline. The subjects of a profile specialize in a specific area within this discipline. The electives can be chosen out of any discipline in engineering.

Conclusion

In both industry and universities, there is a worldwide and long-term need for engineering graduates. The ISE program corresponds to global market conditions and was designed to match the job requirements for graduates. It particularly offers subjects of specific international relevance. Apart from the technical qualification, the linguistic and cultural aspects offer special advantages for graduates in a global job market and qualify them for responsible positions in international companies or for a continuation of their academic career, e. g. when heading for a Ph.D.

M.Sc. Automation and Safety

The topics of process monitoring, fault diagnosis and fault-tolerant systems are becoming increasingly important in research and industrial applications. This is due to the constantly growing requirements for high system reliability and availability. In the context of Industry 4.0 in particular, there are innovative applications in control and regulation technology that go beyond traditional areas of application such as mechatronics. These include distributed systems and working methods that have emerged through the merging of traditional specialist areas.

The Master's degree course builds on the knowledge acquired in the Bachelor's degree course in Electrical, Electronic and Communications Engineering. Students deepen their knowledge of automation and control engineering methods and their implementation in computer-aided systems. A further focus is on the mathematical modeling and simulation of automated processes. Through interdisciplinary courses in the natural sciences, electrical engineering, mechanical engineering and computer science, students acquire the necessary knowledge to work on challenging problems and solve complex automation tasks.

The career prospects for graduates are diverse. Possible areas of employment include design, planning and project management in fields such as automation technology, process technology, production control, energy technology, building control technology, traffic control and automation in the automotive and aviation industries. The course is ideal for anyone who wants to specialize in future-oriented automation and control engineering technologies and gain a foothold in an innovative professional field.

Specialization Safe Systems

	Module	Credits
1	Mathematics E4	5
	Numerical Mathematics	6
	Theory of Statistical Signals	5
	Functional Safety	5
	Process Automation	5
	Advanced Control and Diagnosis Lab 1	2
	Non-Technical Subjects M	4
2	Advanced Control and Diagnosis Lab 2	4
	Diagnosis and prognosis	6
	Cognitive Technical Systems	5
	Fault Diagnosis and Fault Tolerance in Technical Systems	5
	Control Theory	5
	Elective M-AS(SaSyS)	5
3	System Reliability and Limp-Home Strategies	5
	Distributed Systems	6
	Safe Systems	8
	Elective M-AS(SaSyS)	10
4	Master-Thesis (including colloquium)	30

Specialization Automation and Control Engineering

	Module	Credits
1	Mathematics E4	5
	Modeling and Simulation of Dynamic Systems	5
	Numerical Mathematics	6
	Theory of Statistical Signals	5
	Non-Technical Subjects M	3
	Elective M-AS(ACE)	5
2	Fault Diagnosis and Fault Tolerance in Technical Systems	5
	Modern Control Systems	5
	Cognitive Technical Systems	5
	Advanced Control Lab	5
	State and Parameter Estimation	5
	Elective M-AS(ACE)	5
3	Nonlinear Control Systems	5
	Distributed Systems	6
	Process Automation	5
	Robust Control	5
	Elective M-AS(ACE)	5
4	Master-Thesis (including colloquium)	30

M.Sc. Communications Engineering

This Master's degree program builds on the foundations of the Bachelor's degree program in Electrical, Electronic and Communications Engineering and teaches advanced theories and techniques of analog and digital information transmission. Areas of application include wireless and optical signal transmission. Students deepen their knowledge of higher mathematics and numerical methods, which are essential for understanding key topics such as electromagnetic field theory and the fundamentals of electrical engineering and information technology. Particular emphasis is placed on technical content that opens up access to the world of communication technology. During their studies, students acquire the ability to analyze theoretically challenging tasks and solve complex problems that require advanced tools such as modeling, synthesis and simulation.

Graduates are ideally prepared for research tasks in the field of innovative communication technologies, particularly in wireless transmission and high-frequency technology. They are qualified to transfer these technologies into industrial practice, to take on management positions in the development and operation of communication systems or to work in demanding project planning. There are also career opportunities in product development, research and sales. The degree course is aimed at anyone who wants to pursue a career in a future-oriented field of technology and work at the interface between research and industrial application.

Communications Engineering

	Module	Credits
1	Mathematics E4	5
	Theory of Statistical Signals	5
	Electromagnetic Field Theory 1	6
	Non-Technical Subjects M	8
	Elective M-ComE	5
2	Radio Propagation Channels	5
	Electromagnetic Field Theory 2	6
	Coding Theory	5
	RF Circuits and Power Devices	5
	Transmission Technology	5
	Quantum Communication 2	5
3	Quantum Information Theory	5
	Optical Communications Technology	5
	Microwave Theory and Techniques	5
	Practical Project in Communications Engineering	5
	Elective M-ComE	10
4	Master-Thesis (including colloquium)	30

M.Sc. Computational Mechanics

This course combines theoretical modeling, numerical methods and experimental applications in an interdisciplinary way. The focus is on a fundamental concept that enables reliable analysis of problems based on complex continuum mechanical models, numerical methods and experimental techniques. The areas of application range from civil and mechanical engineering to medicine (biomechanics) and biology (evolution simulations). With the increasing use of computer-aided strategies to solve practical problems, this area is becoming more and more important.

The curriculum includes topics such as applied mechanics, materials science fundamentals and other engineering content. The aim of the course is to provide students with sound theoretical knowledge so that they can not only apply complex computer-aided calculation methods responsibly, but also develop them further.

Graduates learn to recognize typical areas of application and limitations of computational models as well as to effectively use and further develop current computational systems. The focus is on the combination of theoretical modeling, experimental verification and simulation-based application. The course is ideal for engineers who want to expand their skills in modern, future-oriented technologies and work in an interdisciplinary manner in theory and practice.

	Module	Credits
1	Continuum Mechanics	6
	Tensor Calculus	6
	Introduction to Numerical Methods	6
	Computer Languages for Engineers	6
	Non-Technical Subjects M	4
2	Thermodynamics of Materials	6
	Finite Element Method Foundation	6
	Non-Technical Subjects M	4
	Elective M-CM	15
3	Nonlinear Finite Element Method	6
	Testing of Metallic Materials	5
	Elective M-CM	20
4	Master- Thesis (including colloquium)	30

M.Sc. Embedded Systems Engineering

The Master's degree program in Embedded Systems Engineering teaches skills for the integration of hardware and software in computer-aided systems for a wide range of applications. These range from telecommunications technologies such as smart-phones and front-end computers to robotics with distributed sensor and actuator systems and applications in automotive and automation technology. Embedded, high-performance computer systems are increasingly shaping not only industrial production but also everyday life and are among the key technologies of the future.

The course prepares graduates to meet the requirements of this key technology and to develop innovative products for a global market. To this end, students acquire in-depth knowledge in the areas of hardware and software, supplemented by computer-aided development and testing methods. Students acquire the ability to master complex decision-making processes in the development and production of modern technologies.

Due to the universal application possibilities of embedded systems in almost all engineering disciplines, there are excellent career prospects. In the fields of electrical engineering, mechanical engineering and IT in particular, graduates have a wide range of career paths open to them, often in managerial positions. The course is aimed at anyone who wants to play an active role in the development of future-oriented technologies and expand their skills in an innovative and growth-oriented professional field.

Embedded Systems Engineering

	Module	Credits
1	Numerical Mathematics	6
	Digital Circuit Technology	5
	Measurement and Sensor Systems	5
	Active Electronic Implants	5
	Non-Technical Subjects M	4
	Elective M-ESE	5
2	Automotive Electronics	5
	System Technologies	5
	Non-Technical Subjects M	4
	Elective M-ESE	15
3	Distributed Systems	6
	Advanced Sensors - Applications, Interfacing and Signal Processing	5
	Elective M-ESE	20
4	Master-Thesis (including colloquium)	30

M.Sc. Management and Technology of Water and Waste Water

This degree program combines two areas of knowledge that have often been considered separately in the past: Process engineering and management. Building on the fundamentals of natural sciences and engineering, in-depth knowledge of business administration and water management is taught, supplemented by advanced engineering topics with a focus on water treatment, water treatment and wastewater technology.

The interdisciplinary approach qualifies graduates for demanding management positions. Potential employers include water companies, water boards and planning offices. The fields of activity lie at the interface of process engineering, water technology and water management. Examples of possible areas of employment include the planning and development of water and wastewater treatment plants, plant construction, the operation of such plants and the implementation and evaluation of quality management systems for drinking water suppliers.

The course is aimed at students who want to combine technical expertise with business knowledge and work in a future-oriented field. With a clear focus on the sustainable use and treatment of water resources, it offers an ideal foundation for a career in a globally relevant professional field.

Management and Technology of Water and Waste Water

	Module	Credits
1	Water - Natural Science Fundamentals	5
	Waste Water Treatment	5
	Urban Water Supply and Distribution	3
	Quality Management in Water Supply	4
	Water Treatment 1	5
	Non-Technical Subjects M	4
	Elective M-MTW3	5
2	Water Treatment 2	5
	Mechanical Process Engineering for Water Treatment Processes	5
	Practical Course Water Technology	5
	National and International Water Management incl. excursion	5
	Sustainable Water Management	3
	Elective M-MTW3	5
3	Water Procurement	3
	Adsorption Technology	5
	Design of Water Treatment Systems: System Equipment Components, Instrumentation and Control Technology	5
	Membrane Technology for Water Treatment	5
	Elective M-MTW3P	8
	Elective M-MTW3	5
4	Master-Thesis (including colloquium)	30

M.Sc. Mechanical Engineering

Mechanical and plant engineering is one of the largest and most future-proof high-tech sectors in Germany. By combining mechanical engineering with electrical engineering, measurement and control engineering and information technology, new products and processes are constantly being developed. The Master's degree course in Mechanical Engineering is divided into seven specializations, each with a different focus:

The General Mechanical Engineering specialization offers a broad, traditional education in mechanical engineering. In addition to a sound technical basis, the curriculum includes elective options that allow students to individually design their profile.

The Mechatronics specialization combines traditional mechanical engineering with electrical engineering and information technology. Students learn the basics of developing and manufacturing mechatronic systems in which mechanical, electrical and electronic components are integrated in innovative modules.

Global markets and value chains require new and efficient material flows. In the Production and Logistics specialization, students acquire methods and techniques for planning, developing and controlling production and logistics processes in supply chains. The course combines technical aspects with organizational and economic requirements and prepares students for interdisciplinary activities.

In view of the global climate problem and scarcity of resources, energy and environmental technology plays a key role. The specialization qualifies students for the development of resource-saving systems and technologies to reduce environmental pollution in soil, water and air.

Maritime systems are among the most complex large-scale structures and facilities built by humans. What these systems have in common is that, on the one hand, they contain a high degree of specific, closely interlinked, complex subsystems and need to be operated with a high degree of efficiency, but on the other hand, they have to cope with the harsh environmental conditions at sea. The Sustainable and Autonomous Maritime Systems specialization addresses the need for highly qualified engineers. The

solid foundation of general mechanical engineering is enhanced by industry-specific knowledge in the field of ship and offshore technology.

The Maritime Systems Safety specialization addresses issues relating to the safety of maritime systems. Building on a Bachelor's degree in engineering, specific content of safety-relevant areas of ship and offshore technology as well as knowledge of risk assessment, functional safety, diagnosis of systems, system reliability, control engineering and process control technology are taught.

The Turbomachinery specialization focuses on the physical relationships of energy conversion in the form of shaft power, e.g. for power generation and the conveyance of media. In addition to product development using the latest manufacturing methods, this also includes the thermodynamic, aerodynamic and rotor-dynamic design of turbomachinery with the aid of current development and research tools.

Specialization Mechatronics

	Module	Credits
1	Control Theory	6
	Manufacturing Technology	5
	Computer Aided Engineering (CAE)	5
	Elective Mathematical Methods M-ME(M)	5
	Elective M-ME	5
	Non-Technical Subjects M	4
2	Machine Learning	5
	Elective Mathematical Methods M-ME(M)	5
	Elective Mechatronical Applications M-ME(M)	5
	Elective System Dynamics M-ME(M)	5
	Elective M-ME	10
3	Elective Mechatronical Applications M-ME(M)	5
	Elective System Dynamics M-ME(M)	5
	Elective M-ME	20
4	Master-Thesis (including colloquium)	30

Specialization General Mechanical Engineering

	Module	Credits
1	Manufacturing Technology	6
	Control Theory	6
	Computer Aided Engineering (CAE)	5
	Elective Advanced Energy and Process Engineering M-ME(GME)	5
	Elective M-ME	5
	Non-Technical Subjects M	4
2	Energy Economics and Sector Coupling	5
	Kinematics of Robots and Mechanisms	5
	Heat and Mass Transfer	5
	Elective Advanced Energy and Process Engineering M-ME(GME)	5
	Elective Mechatronical Applications M-ME(GME)	5
	Elective Production and Materials M-ME(GME)	5
3	Elective Mechatronical Applications M-ME(GME)	5
	Elective Production and Materials M-ME(GME)	5
	Elective M-ME	20
4	Master-Thesis (including colloquium)	30

Specialization Maritime Systems Safety

	Module	Credits
1	Advanced Control and Diagnosis Lab 1	2
	Design of sustainable and autonomous maritime systems 2	5
	Functional Safety	5
	Motions of sustainable and autonomous maritime systems 1	5
	Process Control Engineering	5
	Theory of Statistical Signals	5
	Non-Technical Subjects M	4
2	Advanced Control and Diagnosis Lab 2	4
	Diagnosis and prognosis	5
	Machine Learning	5
	Control Theory	5
	Structural analysis of sustainable maritime systems 2	5
	Elective M-ME MSS	5
3	Finite Element Method 1	5
	Rule development and application	5
	Safety and risk analysis of sustainable and autonomous maritime systems	5
	System reliability and limp-home strategies	5
	Elective M-ME MSS	10
4	Master-Thesis (including colloquium)	30

Specialization Production and Logistics

	Module	Credits
1	Manufacturing Technology	5
	Information Systems of Logistics	5
	Computational Network Analysis	5
	Strategic Logistics Planning	5
	Elective Logistics and Material Flow M-ME (PL)	5
	Non-Technical Subjects M	5
2	Modeling of Logistics Systems	5
	Elective Logistics and Material Flow M-ME (PL)	5
	Elective Product Engineering M-ME (PL)	10
	Elective Production Technology and Management M-ME (PL)	5
	Elective M-ME	5
3	Elective Logistics and Material Flow M-ME (PL)	5
	Elective Product Engineering M-ME (PL)	5
	Elective Production Technology and Management M-ME (PL)	10
	Elective M-ME	10
4	Master-Thesis (including colloquium)	30

Specialization Sustainable and Autonomous Maritime Systems

	Module	Credits
1	Advanced Control and Diagnosis Lab 1	2
	Design of Sustainable and Autonomous Maritime Systems 2	5
	Hydrodynamics of Sustainable Maritime Systems 2	5
	Motions of Sustainable and Autonomous Maritime Systems 1	5
	Elective M-ME SAMS	5
	Elective M-ME	5
	Non-Technical Subjects M	4
2	Advanced Control and Diagnosis Lab 2	4
	Computational Fluid Dynamics for Incompressible Flows	5
	Kinematics of Robots and Mechanisms	5
	Machine Learning	5
	Structural Analysis of Sustainable Maritime Systems 2	5
	Elective M-ME SAMS	5
3	Finite Element Method 1	5
	Offshore Renewable Energy Converters	5
	Safety and Risk Analysis of Sustainable and Autonomous Maritime Systems	5
	Elective M-ME SAMS	5
	Elective M-ME	10
4	Master-Thesis (including colloquium)	30

Specialization Turbomachinery

	Module	Credits
1	Control Theory	6
	Manufacturing Technology	5
	Reactive Flows	5
	Computer Aided Engineering (CAE)	5
	Elective M-ME	5
	Non-Technical Subjects M	4
2	Energy conversion machines	5
	Heat and Mass Transfer	5
	Elective Advanced Energy and Process Engineering M - ME(GME)	5
	Elective Production and Materials M-ME(GME)	5
	Elective Turbomachinery M-ME (TM)	5
	Elective M-ME	5
3	Elective Advanced Energy and Process Engineering M - ME(GME)	5
	Elective Production and Materials M-ME(GME)	5
	Elective Turbomachinery M-ME (TM)	10
	Elective M-ME	10
4	Master-Thesis (including colloquium)	30

M.Sc. Metallurgy and Metal Forming

The Master's degree course in Metallurgy and Metal Forming teaches the metallurgical and metal-physical fundamentals for the production, processing, heat treatment and refinement of metallic materials. The aim is to enable students to independently develop, optimize and implement processes and materials in practice. In addition to in-depth courses in the fields of metallurgy, plastics mechanics and thermodynamics, the course also includes content on process simulation, data processing and project management. This combination of technical and management-oriented skills optimally prepares graduates for demanding management positions.

The Master's degree qualifies students for attractive careers in the iron and steel industry as well as in the metalworking industry. The degree program provides an excellent basis for advancing innovative technologies in the metallurgical industry and mastering the challenges of modern production processes.

	Module	Credits
1	Process Simulation in Metallurgy and Metal Forming	5
	Metallurgical Thermochemistry	5
	Waste Water Treatment	5
	Theory of Plasticity and Forming Mechanism	5
	Thermal Process Engineering	5
	Non-Technical Subjects M	5
2	Finite Element Method 1	5
	Casting and Solidification of Steel	5
	Recycling of Oxidic and Metallic Materials	5
	Elective M-MMF	15
3	Testing of Metallic Materials	5
	Thermodynamics and Kinetics of Metallurgical Reactions	5
	Elective M-MMF	20
4	Master-Thesis (including colloquium)	30

M.Sc. Power Engineering

The Master's degree course in Power Engineering prepares students for challenging tasks in management, research and development in the field of power engineering. Building on the foundations of the Bachelor's degree in Electrical Engineering, students acquire in-depth knowledge of mathematics, statistics, electromagnetic field theory and power engineering. The course focuses on high-voltage and energy technology as well as the business aspects of developing and operating energy systems. The course is rounded off with selected topics from the field of renewable energy technology.

Graduates of the course are excellently prepared for research into innovative technologies in energy engineering, particularly with regard to different energy sources and economic aspects. They are able to transfer research results to industrial applications, develop innovative energy supply concepts and put them into practice. In addition, the course qualifies students for management positions in industry, particularly in the development and operation of energy generation and supply systems. With a focus on renewable energies and sustainable technologies, graduates actively contribute to shaping the energy supply of tomorrow.

	Module	Credits
1	Mathematics E4	5
	Numerical Mathematics	6
	Power System Analysis	5
	Fundamentals of High-Voltage Engineering	5
	Electromagnetic Field Theory 1	6
	Non-Technical Subjects M	4
2	Systems for Generating and Storing Electrical Energy	5
	High Voltage Devices	5
	Power Industry	5
	Power System Operation and Control	5
	Power Electronics	5
	Non-Technical Subjects M	4
3	Information Technology in Electrical Power Systems	5
	Elective M-PE	25
4	Master-Thesis (including colloquium)	30

University of Duisburg-Essen

Faculty of Engineering

Postal Address

University of Duisburg-Essen
Faculty of Engineering
Forsthausweg 2
47057 Duisburg

Contact

Support Center for (International)
Engineering Students

Campus Duisburg:

SG 119
Geibelstr. 41
47057 Duisburg

Telefon: +49 203 379 - 3776
E-Mail: scies@uni-due.de

Campus Essen:

V15 R04 H40
Universitätsstr. 15
45141 Essen

Telefon: +49 201 183 - 6500
E-Mail: scies-essen@uni-due.de



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