



HELMUT SCHMIDT
UNIVERSITÄT

Universität der Bundeswehr Hamburg

Engineering Science

Bachelor of Science

Engineering Science: Defence Systems

Master of Science

□ Study Programme

Engineering Science (ES) is entirely taught in English and combines the fundamentals of engineering, especially in the fields of mechanical and civil engineering and electrical engineering, with selected fundamentals in information technology, enriched by applications from military engineering. Students complete a Bachelor's degree programme followed by a Master's degree programme, which focusses on defence systems.

The Bachelor's and Master's degree programmes are intensive study programmes. Students can graduate with a Bachelor of Science degree after 2 ¼ years and with a Master of Science degree after another 1 ¾ years. Students learn to think in interdisciplinary terms and in mechatronic systems contexts and to conceive, specify, design, test and inspect those systems as part of a frequently large and international team. Work focuses on the interaction of individual components and modules and the creation of a comprehensive system or subsystem, e.g. for military use or for improving civilian security.

The programmes prepare graduates for functional and leadership responsibilities in the armed forces and for activities in public service and (civilian) management positions. They are also a prerequisite for an academic career.

Academic training at Helmut Schmidt University (HSU) is complemented by mandatory interdisciplinary studies (ISA).

□ Structure

Programmes at HSU start in early October. The academic year is divided into trimesters (autumn, winter and spring). Each trimester consists of a twelve week lecture period. There are no lectures in the months of July, August and September. This time is used by students to prepare for and participate in examinations but also to complete (voluntary) internships, write research papers and theses, and to rest and relax.

The ES Bachelor's degree programme, like all other Bachelor's degree programmes offered at HSU, comprises seven trimesters and consists of required modules, compulsory elective subjects, and a Bachelor's thesis. The modules are organised and synchronised in such a way that they build on previously acquired knowledge.

Students who have not completed all academic requirements of the Bachelor's degree programme after seven trimesters can be admitted to the Master's degree programme on a provisional basis. Students who have obtained their Bachelor of Science with a grade of 3.0 or better by the end of the eighth trimester can continue their studies in the Master's programme.

Master's programmes start in early January, comprise five trimesters (eighth to twelfth trimester), and end with a Master's thesis.

□ Programme Contents

The Engineering Science Bachelor's programme provides students with fundamental technical, methodological and professional skills in two fields of engineering (Mechanical and Civil Engineering and Electrical Engineering) which are required for intermediate level functional and leadership tasks and for a consecutive Master's programme. As part of their academic training, students learn the fundamental principles of research and analytical skills. In addition, the programme enables students to understand complex technical systems, especially mechatronic ones, even in an international context.

The **Bachelor Study** of Engineering Science at the Helmut-Schmidt-University/University of the Bundeswehr Hamburg (HSU/UniBw H) lasts for seven trimesters, and consists of mandatory, and elective modules as well as the final Bachelor Thesis. In the mandatory modules the focus is put among others on „Programming and Computational Methods of Data Science“, „Fundamentals of Photonics“, „Sensors and Control Systems“, „Communication Systems“ und „Basics in Electrical and Mechanical Engineering“.

Four independent specializations are offered in the **Master's programme**. Students have to select one of them for their study programme. These areas are:

- High Performance Computing and Applications (HPC)
- Computational Material Design (CMD)
- Electro-Optics (EO)
- Effector, Protection and Security Technologies (EPS).

They last for five trimesters (eighth to twelfth trimester in total). The study terminates with a Master Thesis. Examples of modules in the four specialization areas are:

- Hardware Architecture of HPC Systems
- Special Application of HPC
- Materials Modelling (CMD)
- Simulation High Strain Deformation (CMD)
- Laser Technology (EO)
- Advanced Technical Optics (EO)
- Protection for Constructions (EPS)
- Biomechanics of Military Related Effects (EPS)

Graduates of the bachelor programme have the choice to continue their master's degree in any master programme of the Faculty of Electrical Engineering, as well as of the Faculty of Mechanical and Civil Engineering at the HSU/UniBw H.

Interdisziplinäre Studien

All programmes at HSU include interdisciplinary studies courses (ISA). They enable students to broaden their horizons and to acquire general professional skills that will be of great use in their careers as officers and later as civilian employee. The ISA courses address legal issues such as (defence) procurement, transportation law, and international law in the Bachelor's programme, as well as strategic, tactical, psychological and political aspects in the Master's programme.

Language Courses

The university's language centre offers courses in English, French, Spanish, Russian, Arabic and other modern foreign languages.

In the first year of the ES Bachelor's programme students will have German language classes two hours per week. In the second year students have German classes one hour per week. Additionally, they will have a class in English academic skills and academic writing.

Degrees

Students who successfully complete the Bachelor's programme are awarded the academic degree of a Bachelor of Science (B. Sc.).

Students who successfully complete the Master's programme are awarded the academic degree of a Master of Science (M. Sc.). Graduates with a Master's degree may later enroll in a doctorate programme.

Labour Market and Occupational Fields

Numerous functional and leadership positions in the armed forces, in the security and defence industry, in public administration, and in national and international rescue and relief organizations (fire services, NGOs) are open to graduates of ES. The standard degree at Helmut Schmidt University is a Master's degree. Even the Bachelor of Science, however, opens up interesting professional opportunities.

The number of transnational conflicts and hot spots is increasing as a result of economic globalisation and climate change. There is thus a growing demand for new national and interna-

tional approaches to solutions for security in the fields of politics, economy and science. ES graduates have a firm understanding of the principles of mathematics, science, electrical engineering, information technology, mechanical and civil engineering which are relevant to Defence Technology.

They are familiar with the fundamentals of systems technology, virtual techniques in Research and Development (R&D) and their interactions and interdependencies and are thus able to understand the phenomena and problems that arise in Defence Systems and model them in such a way that interference is minimised. This applies both in military and civilian settings. In military applications, it primarily applies to armaments. As a rule, excellent English language skills are required on account of increasing international cooperation and procurement.

Application

Applications from international armed forces are always welcome. Due to restrictions in German higher education law Helmut Schmidt University has to assess each and every individual application for a Bachelor's or Master's programme at an early point of time. Applications for Bachelor's programme should be submitted until May 1st, for a Master's programme until September 1st.

Application forms are available online at www.bundeswehrkarriere.de or at your nearest careers information office. For further information, please call our hotline on +49 (0)800 9800880.

Information for prospective civilian students and companies can be found at hsu-hh.de/hsm/ziviles-studium

Admission Requirements

The following requirements must be met for admission to a course of study:

1. a school-leaving certificate qualifying the holder to attend a university,
2. a very good knowledge of the English language equivalent to Standard Language Profile (SLP) level 3332 (professional).

An internship or preliminary practical course is not required for the ES programme.

The ES programme was designed for Bundeswehr students and students of foreign partner nations who cooperate closely with Germany in the fields of security and defence technology (NATO and Partnership for Peace nations). It is open to military personnel as well as employees of industrial companies and international relief and rescue organisations. Civilian students are sponsored by cooperating companies that provide industry scholarships to pay tuition fees.

Preparation for Studies

The ES programme requires logical thinking and practical technical knowledge. Prospective students are encouraged to refresh their knowledge of English, mathematics and physics and to take part in the preliminary online mathematics course, which is supported by mentors. This course is offered every year starting in early May at vorkurs.hsu-hh.de.

Further Information

On Helmut Schmidt University/University of the Federal Armed Forces Hamburg:

www.hsu-hh.de/et/studium/engineering-science

Advisory Services/ Contact Information

Contact for Academic Question

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The University

On the basis of the autonomy granted by the Bundeswehr and under the legal supervision of the Hamburg Ministry of Science, Research and Equality, Helmut Schmidt University/University of the Federal Armed Forces Hamburg performs the same tasks in research and education as public universities.

The four faculties of HSU offer 13 Bachelor's and 20 Master's degree programmes.

All programmes have been accredited by the ACQUIN Accreditation, Certification and Quality Assurance Institute. Given the favourable academic environment at HSU, all programmes are intensive study programmes in which students can acquire up to 75 credit points per year.

The campus of HSU is located in the east of Hamburg in the borough of Wandsbek. It is easy to reach both by public transport and by car. Travel time to the city centre of Hamburg is approximately 20 minutes.

All education and research facilities are situated close to one another and can be reached on foot in just a few minutes. About 80 percent of the students live in accommodation buildings located on campus or close by.

Overview Bachelor's Programme

First Year

Summer	1st Trimester (Autumn)	2nd Trimester (Winter)	3rd Trimester (Spring)
Preliminary Online Mathematics Course	Mathematics		
	Programming and Computational Methods of Data Science		
	Electrical Engineering		
	Engineering Mechanics		
	Material Science		
	Language Training (SLP 3332)		
6 CP	74 CP		

Autumn Trimester: 1 Oct – 31 Dec
 Winter Trimester: 1 Jan – 31 Mar
 Spring Trimester: 1 Apr – 30 Sep
 Summer: July, August, September
 CP = Credit Points

Second Year

Summer	4th Trimester (Autumn)	5th Trimester (Winter)	6th Trimester (Spring)	Summer	7th Trimester (Autumn)
		Thermal/Fluids Engineering			Student's Project & Thesis
	Control Systems	Sensor Systems	Practical Training		
	Electro Magnetics		Introduction to Electro-Optics		
	Communication Systems	Drives and Propulsion			
		Compulsory Elective Course	Compulsory Elective Course		
	Interdisciplinary Studies ⁵				
	Language Training (SLP 3332)				
	75 CP				Compulsory Elective Course
					Academic Language and Skills
					25 CP

Compulsory Elective Courses

- Vehicle Dynamics
- Mechatronics/Multibody Simulation
- Artificial Intelligence: Algorithms and Applications
- Quality and Knowledge Management
- Heat Transfer
- Production Engineering
- Sensors and Actuators

Overview Master's Programme

Fourth Year

8th Trimester (Winter)	9th Trimester (Spring)	Summer	10th Trimester (Autumn)	11. Trimester (Winter)	12th Trimester (Spring)	Summer
Mathematics (3 Lectures)			Operating Systems and Secure Computer Networks		MasterThesis	
Defence Systems and Technologies ¹			Defence Systems and Technologies ¹			
Electro-Optics ²			Electro-Optics ²			
HPC Systems and HPC Applications ³			HPC Systems and HPC Applications ³			
Computational Material Design ⁴			Computational Material Design ⁴			
Effector, Protection and Security Technologies			Effector, Protection and Security Technologies			
Interdisciplinary Studies ⁵			Interdisciplinary Studies ⁵			
45 CP			75 CP			

2, 3, 4: The students chose a main module out of 2, 3, 4 (16 CP); the sum of CP in the two remaining modules out of 2, 3, 4 has to be 20 CP.

1, 2, 3, 4: Except for Naval Shipbuilding and System Engineering for Land Vehicles all courses in these four modules 1, 2, 3, 4 have 4 CP.

** www.hsu-hh.de/asv/en/fspo-es-eng/

Specialization Areas (four modules of the selected area):

HPC Systems and HPC Applications (HPC)³

- Advanced Numerical Mathematics
- Hardware Architecture of HPC Systems
- HPC Techniques and Software Development
- Parallel Computing of Multi-Scale and Multi-Physics Problems
- Computational Fluid Dynamics
- Computational Electromagnetics
- Machine Learning
- Special Applications of HPC in Defence Technology

Computational Material Design (CMD)⁴

- Continuum Mechanics
- Materials Modelling
- Modelling Advanced Processing Technologies
- Simulating High Strain Deformation
- Computational Design of Surfaces and Interfaces
- Statistical Thermodynamics

Electro-Optics (EO)²

- High-Power Electromagnetics and Laser Systems
- Advanced Technical Optics
- Infrared Technologies and Applications
- Laser Technology
- Pulsed Power and Application
- Active Sonar

Effector, Protection and Security Technologies (EPS)

- Protection for Constructions I, II
- Design and Assessment of Protective Structures
- Biomechanics of Military Related Effects

Excerpt of modules, to be selected together with in the selected Specialization Area:

Defence Systems and Technologies (20 CP)¹

- Ballistics I, II
 - Ammunition and Weapon Technology
 - Fundamentals of Energetic Materials
 - Improvised Explosive Device disposal (IEDD)
 - Electrochemical Power Sources for Military Applications
 - Naval Shipbuilding
 - System Engineering for Land Vehicles
- + further modules in any trimester

The actual [Subject-Specific Programme and Examination Regulations](#)** (Fachspezifische Prüfungsordnung (FSPO)) regulates the mandatory choices, and distribution of credit points.

Interdisciplinary Studies (10 CP)⁵

The actual list of modules can be seen in the Enclosure No. 3 of the [Subject-Specific Programme and Examination Regulations](#)** (Fachspezifische Prüfungsordnung (FSPO)).

Editorial Information

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