

Faculty of Computer Science and Mathematics

Master of Science in Mobile and Embedded Systems

Information about the degree programme

Programme profile on the web:
www.uni-passau.de/en/msc-mes

About the programme

Embedded systems are a crucial component in a vast range of domains and applications, e.g. in traffic and transportation systems, energy systems and power grids, home automation, telecommunications, health and medical technology as well as entertainment electronics. They are ubiquitous in our personal lives, as they are built into everything from cars to toothbrushes, and in industry, from highly sophisticated production plants down to the simplest measurement system.

Such novel embedded systems require special approaches for intelligent data collection, often using sensor technology, and efficient data processing to facilitate new and innovative functionality. A key characteristic of these systems is that they communicate both with the people who use them and with other technical systems, with which they are connected either directly or via the Internet. Satellite navigation systems, for example, can use real-time traffic jam data gleaned from the mobile phone data of other road users to calculate the optimal route.

Today, some 98 percent of all processors produced worldwide are not used in conventional desktop or notebook computers, but can be found in almost all other technical devices we use on a daily basis. As a result, the innovative and economic potential of embedded systems is enormous: Germany is the third-largest market for embedded systems, behind the United States and Japan, with a total annual market revenue of approximately 19 billion euros. In Germany alone, three million high-tech jobs are directly or indirectly dependent on this technology.

Embedded systems play a pivotal role in many areas of application, e.g. in the automotive and engineering sectors, in aviation and space exploration as well as in innovative industries such as environmental technology, power generation, health care and medical technology.

At the same time, there is a shortage of qualified specialists in the field. On the one hand this is due to a dearth of engineers in general; on the other, there are very few specialised degree programmes that impart the necessary expertise and competencies for the up-and-coming field of technology that is Embedded Systems. The M.Sc. Mobile and Embedded Systems is one of the few programmes that addresses this shortage and trains tomorrow's specialists for this important market of the future.

Degree awarded

Master of Science (M.Sc.)

Programme starts in

April (summer semester) and October (winter semester) each year.

Language of instruction

This degree programme is taught entirely in English.

Programme duration and credit points

Standard duration: four semesters (two years)
Maximum duration: six semesters (three years)
The coursework of the programme amounts to 120 ECTS credits.
(European Credit Transfer and Accumulation System; 1 ECTS credit = approx. 30 hours of coursework).

Double degree option

Students enrolled in this degree programme have the option of gaining an additional master's degree from Ecole Supérieure des Communications de Tunis (SUP'COM) in Tunisia. At the time of writing, only those students from SUP'COM who are enrolled in the Telecommunications master's programme are eligible for the M.Sc. degree from Passau under the double degree arrangement.

How to apply

To be eligible for this master's programme at the University of Passau, you need:

- 1) a first university degree (bachelor's degree, *Magister*, *Diplom*, state examination or equivalent) in computer science, mobile and embedded systems, computer engineering, electrical engineering, information and communication systems, biomedical technology or a related subject, earned after a three-year full-time programme of study.

The minimum mark/grade/result for your first degree should be 2.7 or better according to the German marking system (or the relevant foreign equivalent).

As part of the degree programme you should have gained at least 110 ECTS credits (or equivalent) in one of the above subjects. In particular, a minimum of 50 ECTS credits must come from computer science and 15 ECTS credits from electrical and electronic engineering or information technology. For graduates with four-year non-ECTS degrees, the 50 ECTS credit requirement is deemed to be met if one-quarter of their credit points were earned through computer science-related courses.

- 2) English language skills at level B2 of the Common European Framework of Reference for Languages (CEFR). Unless English is your native language or the language of instruction for your secondary schooling or your first degree programme, you should provide an English language certificate such as:
 - Test of English as a Foreign Language (TOEFL) with a minimum score of 567 (paper-based), 240 (computer-based) or 87 (internet-based)
 - International English Language Testing Systems (IELTS) with a minimum score of 5.5
 - Cambridge English Language Assessment at Advanced (CAE) or Proficiency (CPE) level.

Your application should be accompanied by:

- a chronological curriculum vitae
- certificates documenting your first degree

For details on deadlines, the required documents and to begin the application process, visit www.uni-passau.de/en/apply.

If you cannot provide your final degree certificate and transcripts for your first degree at matriculation, you should write to the Board of Examiners, requesting an extension of the submission period for the missing documents: depending on the decision of the Board of Examiners, you may then be admitted on condition that you hand in the certificate by the end of the second week of lectures of your degree programme.

Please note that you must have completed all assessments related to your first degree prior to the start of lectures of the degree programme you are applying for. In any event, you should still provide a (preliminary) transcript/student record that shows an average mark of, or equivalent to, 2.7 (German marking scale).

The deadline for applications for the programme starting in the winter semester is 30 June; for the summer semester it is 15 January. This is the latest date by which your application must reach either the University or Uni-assist, as the case may be, and late applications will not be processed for the respective starting semester. Applications are processed when they arrive. We strongly urge all candidates who require a visa for studying in Germany to apply 4-6 weeks earlier than the respective deadline to leave sufficient time for the visa process following the university application.

For further details, contact the Student Registration Office, phone +49 851 509 1127 or 1128, or send an e-mail to registry@uni-passau.de.

Career prospects

Constant technological change and innovations create new exciting lines of work in trade and industry, in the services, financial services and consulting sector, in public administration, and in the field of research. A master's degree in Mobile and Embedded Systems qualifies you for the job market or to proceed with an academic career. As a computer science specialist, you are qualified to take up IT-related executive positions or undertake independent research, e.g. as part of doctoral study.

Modules and examinations

The core modules of the Mobile and Embedded Systems programme are:

- Mobile and Embedded Systems Seminar
- Master's thesis presentation

The compulsory elective modules are divided into the following specialisations:

- Human-Computer Interaction (HCI)
- Systems Engineering (SE)
- Data Processing, Signals and Systems (DPSS)

and the general module group:

- 'General subjects'.

Students choose one of the first three listed specialisation groups (HCI, SE or DPSS) as their main specialisation. The specialisation must be indicated when requesting the transcript.

Coursework, assessments and deadlines

The final mark for the degree is determined on the basis of the module assessments completed throughout the programme; there is no 'final examination' for the entire degree programme.

The module details, including assessment type and duration, are described in the module catalogue, which is made available to students when the courses start at the beginning of the semester. In some cases, multiple types of assessment are indicated in the module catalogue; for these modules, which type of assessment will be used is determined at the start of the semester and announced on the noticeboards and the faculty web pages.

Students are expected to pass all required module assessments and the master's thesis by the end of the fourth semester. Those who are unable to complete the required assessments in time are automatically given a two-semester grace period to complete the assessments by the sixth semester without any detriment. Failure to complete all required module assessments by the end of the sixth semester results in the student failing the degree programme. Having failed the programme once, students may complete or resit/repeat missing or failed module assessments until the end of the eighth semester to successfully complete the degree programme after this second attempt. All failed module assessments may be repeated up to two times. In the case of a failed master's thesis, one further attempt may be made at writing the thesis; however, this must be on a different topic from the first one.

Master's thesis

Students may commence writing the master's thesis if they meet the thesis requirements and have accumulated a minimum of 60 ECTS credits on the programme.

Students are given six months to complete their thesis, which should be written in German or English.

Candidates who receive a pass mark on their thesis are awarded 27 ECTS credits. Moreover, candidates will give a presentation on their master's thesis, for which they receive another 3 ECTS credits.

Attaining a pass mark

To successfully complete the programme, students must accumulate at least 120 ECTS credits by gaining a pass mark (4.0 or better) on their thesis, on all core modules and on the compulsory elective modules, of which:

- 30 ECTS credits must stem from the student's chosen main specialisation
- 15 ECTS credits must stem from each of the remaining two specialisation groups

ECTS credits are awarded only for successfully completed modules, i.e. modules in which the student has gained a pass mark.

Examinations and credit transfers

The Examinations Office has overall responsibility for all examinations-related matters and issues your final degree certificate, diploma supplement and transcript of records upon written request.

Please address any examination-related enquiries concerning this programme to:

Ms Gerlinde Lang
Examinations Office 1
Administration building, 1st floor
Innstr. 41
94032 Passau
Germany

Phone: +49 851 509 1198
gerlinde.lang@uni-passau.de

Further information and forms (currently only available in German):
www.uni-passau.de/index.php?id=21061

Upon request, previous coursework and assessments completed elsewhere as part of a related programme of study may be counted towards the master's degree. Credit transfer requests, complete with all relevant documents, should be sent to the Examinations Office.

Regulations and module catalogue

Please visit www.uni-passau.de/index.php?id=560 for the study and examination regulations and the module catalogue for the M.Sc. Mobile and Embedded Systems programme.

Additional qualifications

If you complete additional assessments in modules that do not form part of the required modules for the degree programme, you may request that a separate transcript be issued. The marks gained on these additional modules do not count towards the final average mark of your degree.

Course catalogue, Stud.IP and HISQIS

At German universities, students have to sign up for each course (e.g. seminar or tutorial) which they need to complete as part of their degree programme – this is not done automatically! The course catalogue lists all courses taught in the current semester: <http://www.uni-passau.de/index.php?id=22128&L=1>.

Students should use Stud.IP, one of the University's virtual learning environment (VLE) systems, to register for the required modules. Moreover, Stud.IP gives you access to module-related content, timetable functions, updates on the module sessions and allows you to engage with lecturers and fellow students via the notice boards. Finally, Stud.IP is used for CampusCard (i.e. the student ID card) management functions. The username and password used for Stud.IP are identical to your campus computer network credentials.

www.zim.uni-passau.de/en/systems-login.

HISQIS, another VLE system, is the platform students use to register for module and language examinations and to obtain student enrolment certificates and similar documents. The username and password used for HISQIS are identical to your campus computer network credentials. The Examinations Office has more details on HISQIS and how to use it: www.uni-passau.de/index.php?id=162.

Placement tests for language courses

Students who wish to register for a foreign language course and have existing language skills must take a placement test. The results will determine at which level they will join the relevant language course. Students who have pre-existing language skills for a language for which no placement tests are carried out should arrange a face-to-face consultation with the relevant language lecturer well in advance of the start of courses.

The placement test dates are published on the Language Centre website: www.sprachenzentrum.uni-passau.de/en/placement-tests.

Important: Many placement tests are conducted online and may take place before the Orientation Week.

International Students' Orientation Weeks	<p>During the last two weeks of each semester break, the International Office holds the International Students' Orientation Weeks. These are open to all international students starting out at the University – and like the 'O-Woche' (see below), which is open to all students, they are designed to help you settle in quickly.</p> <p>Being specially designed for international students, the International Students' Orientation Weeks include English guided tours of the town, campus and university facilities as well as short-term German language and area studies courses – and usually one or two multi-day outings to interesting places in Germany. The International Students' Orientation Weeks start before, and coincide with, the regular O-Woche and include a number of shared events.</p> <p>More details on the International Students' Orientation Weeks: www.uni-passau.de/en/intl-orientation-weeks</p>
Orientation Week ('O-Woche')	<p>An Orientation Week organised by the student committee of the Faculty of Computer Science and Mathematics (Fachschaft Info) takes place in the week prior to the start of lectures. During the 'O-Woche', as it is also called in German, new students can get help setting up their timetables and are offered guided tours of the library and the University facilities, among other things. All new students are strongly encouraged to make use of this orientation offer.</p> <p>More details on the O-Woche: www.uni-passau.de/en/study/getting-started/orientation-weeks and www.fim.uni-passau.de/studium/fuer-studienanfaenger/o-woche (in German)</p>
Academic Advice Service	<p>The Academic Advice Service provides information on the admissions process and module options of the degree programme and answers general questions about studying at the University of Passau:</p> <p style="padding-left: 40px;">Academic Advice Service Administration building, 1st floor Innstr. 41 94032 Passau Germany</p> <p style="padding-left: 40px;">+49 851 509 ext. 1150, 1151, 1152 or 1153 Office hours: Wednesday 9 a.m. – 12 noon or by appointment</p> <p style="padding-left: 40px;">E-mail: advice@uni-passau.de www.uni-passau.de/en/academic-advice</p>
Programme Adviser	<p>Please contact the programme convenor if you have in-depth questions, particularly if you are at an advanced stage of the programme:</p> <p style="padding-left: 40px;">Professor Fabian Wirth Room 226 Innstr. 33 94032 Passau Germany</p> <p style="padding-left: 40px;">Phone: +49 851 509 3360 E-mail: fabian.wirth@uni-passau.de</p>
Studying or working abroad	<p>For help preparing for your studies or internship abroad, please contact:</p> <p style="padding-left: 40px;">International Office Administration building, 1st floor Innstr. 41 94032 Passau Germany</p> <p style="padding-left: 40px;">+49 851 509 ext. 1160, 1162, 1163, 1165 or 1167 www.uni-passau.de/en/international</p>

Centre for Careers and Competencies (ZKK)

The Centre for Careers and Competencies provides students with a comprehensive offering of transversal skills seminars and a vast range of resources and services to facilitate job orientation, internship search and career entry. Through the ZKK, students can find out about internships, student jobs and employment vacancies, as well as apply for scholarships for internships abroad. Furthermore, the competencies seminars and IT courses help students to develop crucial transversal skills and competencies. This is rounded off by the ZKK's seminars on job applications and information on career entry in Germany and abroad, which are tailored to students' needs. For details, visit www.uni-passau.de/en/zkk.

Student Services Association (Studentenwerk)

The student services association website gives you all the information you need concerning student life (e.g. student finance/BAföG loans and grants, accommodation, cultural promotions, studying as a parent, refectory and cafeterias etc.): www.stwno.de/en

Programme structure

The curriculum is divided into core (compulsory) modules and compulsory elective modules. A set number of ECTS credits is awarded when you achieve a pass mark in each module.

The following three specialisations are offered:

- Human-Computer Interaction
- Systems Engineering
- Data Processing, Signals and Systems

You will choose one of these as your main specialisation. The module catalogue lists the modules offered for the individual specialisations, their assessment details as well as their ECTS credit load. To pass the degree programme, you have to gain a total of 120 ECTS credits, of which at least 90 ECTS credits must stem from the taught modules, as follows:

- 8 ECTS credits from the core modules.
- 30 ECTS credits from your chosen main specialisation (electives and compulsory electives).
- 15 ECTS credits from **each of the two** remaining specialisations (electives and compulsory electives).
- 25 ECTS credits from any of the specialisation groups or the general subjects module group.

Finally, your master's thesis will contribute 27 ECTS credits, and the presentation of your thesis 3 ECTS credits.

Subject areas

Core modules (compulsory):

- Mobile and Embedded Systems Seminar
- Master's thesis presentation

Human-Computer Interaction (HCI) specialisation:

This specialisation comprises the following eleven areas:

- Mobile Human-Computer Interaction
- Visual Analytics
- Social and User-Centred Aspects of Web-based Information Systems
- Programming Applications for Mobile Interaction
- Spatial Augmented Reality
- Mixed Reality
- Empirical Methods for Computer Scientists
- Affective and Behavioural Computing
- Psychology of Human-Machine Interaction (for M.Sc. Mobile and Embedded Systems)
- Introduction to Media Psychology
- HCI Research Internship

Systems Engineering (SE) specialisation:

This specialisation comprises the following nine areas:

- Robust System Design
- Electronic Design Automation
- Software Verification
- Intelligent Systems (block seminar)
- Functional Safety
- Software Product-Line Engineering
- Embedded Systems Programming, Queuing Systems
- SE Research Internship

Data Processing, Signals and Systems (DPSS) specialisation:

This specialisation comprises the following thirteen areas:

- Wearable and Implantable Computing
- Machine Learning and Context Recognition
- Advanced Context Pattern Analysis
- Context Recognition Architectures
- Fourier and Laplace Transformation
- Intelligent Audio Analysis
- Intelligent Systems (Lab Course)
- Text Mining
- Mathematical Systems Theory
- Control and Robotics
- Networked Control Systems
- Optimization
- DPSS Research Internship

'General subjects' module group:

This specialisation comprises the following seven areas:

- Scientific Methods and Technical Writing
- Semantic Technologies
- Computer Networking and Energy Systems
- Wireless Security
- Efficient Algorithms
- Stochastic Processes
- Stochastic Simulation