Faculty of Computer Science and Mathematics

Master of Science in Computational Mathematics

Information about the degree programme

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

Last revised in June 2019. The information contained in this document is subject to change.
In addition to being a science in its own right, mathematics plays a fundamental role in the quantitative areas of practically all other academic disciplines, particularly in the natural sciences, engineering, business administration, economics, medicine and psychology. Mathematical results permeate nearly all facets of life and are a necessary prerequisite for the vast majority of modern technologies – and as our IT systems become increasingly powerful, we are able to mathematically handle enormous amounts of data and solve ever more complex problems.

Those studying this programme learn to conduct independent scientific work, critically appraise and classify new scientific discoveries and apply them when solving specific, complex theoretical or practical problems. Special emphasis is placed on developing students’ ability to formalise given problems in a way that facilitates algorithmic processing as well as enabling them to choose or develop, and subsequently apply, suitable algorithms to solve problems in an appropriate manner. The degree programme is theoretical in its orientation, with strongly application-oriented components. Students can gain advanced knowledge in the mathematical areas of Cryptography, Computer Algebra, Algorithmic Algebra and Geometry, Image and Signals Processing, Statistics and Stochastic Simulation, Dynamical Systems and Control Theory as well as gain expert knowledge in the Computer Science fields such as Data Management, Machine Learning and Data Mining. Furthermore, students will have the chance to learn how to apply their knowledge in areas as diverse as Marketing, Predictive Analytics, Computational Finance, Digital Humanities, IT Security and Robotics.

As English is the lingua franca in the field of mathematics and the literature used is usually only available in English, the degree programme is entirely English-taught, with some exceptions in the elective modules.

<table>
<thead>
<tr>
<th>Programme start</th>
<th>The M.Sc. Computational Mathematics programme commences in April (summer semester) and October (winter semester) each year.</th>
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</thead>
<tbody>
<tr>
<td>Programme duration and credit points</td>
<td>Standard duration: four semesters’ full-time study, not counting semesters out/on leave; the maximum duration is six semesters. The programme carries a total workload of 120 ECTS credits (European Credit Transfer and Accumulation System: 1 ECTS credit equates to approx. 30 hours of work, including self-study).</td>
</tr>
<tr>
<td>Degree awarded</td>
<td>Master of Science (M.Sc.)</td>
</tr>
<tr>
<td>Career prospects</td>
<td>Mathematicians continue to have outstanding career prospects, as they are highly sought after wherever high-level analytical thinking skills are a requirement. Their potential occupational fields are therefore less limited than is the case with medical doctors or engineers, who specialise in a specific sub-field of their discipline. Outside of academic and research organisations, mathematicians find employment in nearly all private- and public-sector organisations. Nowadays, mathematicians' work typically makes heavy use of computing technology. Traditionally, mathematicians are employed in the pharmaceutical industry, the financial industry, insurance companies, consulting and business intelligence, market research, logistics, information technology and in the research and development departments of high-tech companies. For more information on the occupational profile of mathematicians, visit the German Federal Employment Office (Agentur für Arbeit) website at <a href="http://berufenet.arbeitsagentur.de">http://berufenet.arbeitsagentur.de</a> (this website is in German). For English speakers, the Prospects UK website has pertinent information on job options for mathematicians: <a href="https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree/mathematics">https://www.prospects.ac.uk/careers-advice/what-can-i-do-with-my-degree/mathematics</a>.</td>
</tr>
</tbody>
</table>
Applying for a place on the programme

You are eligible for this degree programme if you have an undergraduate/first university degree (Bachelor’s, Magister, Diplom, state examination or equivalent) in mathematics or a related discipline with a mathematics component of at least 110 ECTS credits, earned as part of a programme of study with a standard length of three years, with a final average mark/grade of 2.7 under the German marking system or the relevant equivalent grade in a foreign marking system. Applicants who have not attained a minimum grade of, or equivalent to, 2.7 may still apply if they are among the best 70% of graduates of their cohort.

Unless English is the language of instruction for your prior university or secondary education, you should provide a language certificate at level B2 of the Common European Framework of Reference for Languages (CEFR). Similarly, unless German is the language of instruction for your prior university or secondary education, you should provide proof of German language skills at level A1 CEFR (i.e. beginner’s level). If you do not have German language skills at the time of application or enrolment you will not be rejected on these grounds; however, you will complete a compulsory, free German language course during the first two semesters of the programme.

If you cannot provide your final bachelor’s (or equivalent) university degree certificate and transcript/final student record at the time of application or enrolment, you may submit a written request to the Board of Examiners, asking for an extension of the submission deadline by which you have to submit your first degree certificate and outlining the reasons why you are unable to provide them at the current time. The Board of Examiners will grant you a deadline up to no later than the fifth week of lectures of the first semester. For this to be approved, you must have already completed all coursework and assessments for your first degree at the beginning of the degree programme at the University of Passau and have submitted a (preliminary) transcript showing a (preliminary) grade of 2.7, or a foreign equivalent grade.

Visit www.uni-passau.de/en/apply for details on the application process and to start your application. The deadline for applications for a place on the programme is 15 January for entry in April (summer semester), or 30 June for the October (winter semester) intake. These are strict cut-off deadlines and your application must be received by these dates to be considered.

For more information, please contact the Student Registration Office (www.uni-passau.de/en/student-registration-office) in the Administration building, Innstrasse 41, phone +49 851 509 ext. 1127 or 1128 or send an e-mail to registry@uni-passau.de.

Programme structure and assessments

The curriculum is modularised. Each module is a complete unit of study, consisting of one or more courses (i.e. lectures, seminars or tutorials) on the same or a closely related topic. Every module has a specific ECTS credit value which reflects the time students are expected to spend on coursework – including both contact hours and self-study – to successfully complete the module. While many modules run for a single semester, it is possible for a module to span more than one semester. Modules typically conclude with an assessment, which is carried out during or at the end of the semester in which you complete the module.

In order to complete your programme within the standard duration of four semesters, you should aim to obtain approximately 30 ECTS credits each semester.

The degree programme is divided into core modules and compulsory elective modules.

The core modules are:
- Mathematics seminar module 1 (5 ECTS credits)
- Mathematics seminar module 2 (5 ECTS credits)
- Presentation of your master’s thesis (3 ECTS credits)

The compulsory elective module groups are:
1) Algebra, Geometry and Cryptography
2) Mathematical Logic and Discrete Mathematics
3) Analysis, Numerics and Approximation Theory
4) Dynamical Systems and Optimisation
Programme structure and assessments (cont'd)

5) Stochastics, Statistics
6) Data Analysis and Data Management and Programming
7) Applications
8) Key Competencies and Language Training

If you have completed more modules than are required to achieve the overall 120 ECTS credits, you should inform the Examinations Office which modules are to count towards your final grade. For more about the programme structure, please see the appendix and/or visit the website of the Faculty of Computer Science and Mathematics: www.fim.uni-passau.de/en/study.

Regulations and module catalogue

The module catalogue contains detailed module descriptors, including required assessments. It is available for download from the following web page: www.fim.uni-passau.de/en/study/module-catalogues

The general study and examination regulations for the faculty’s master’s programmes and the subject-specific study and examination regulations for the degree programme, which together govern the required assessments and examination modalities to successfully complete the programme, are available for download from the programme profile page (please check the ‘Downloads’ box to the right): www.uni-passau.de/en/msc-compmaths.

Guidance interview

During your first year on the programme, you are required to complete a guidance interview with a module convenor – a professor who is in charge of one of your modules. A record will be issued as proof that you have completed this interview.

Master's thesis

To be permitted to commence writing the Master’s thesis, you need to have accumulated a minimum of 60 ECTS credits on the degree programme. You will be given six months to write the thesis, which should be written in German or English. Once you achieve a pass mark on your thesis, you are awarded 27 ECTS credits.

Degree requirements

To successfully complete the programme, you have to earn 13 ECTS credits in the core modules and for the thesis presentation; furthermore, you are required to achieve a pass mark on your thesis, for which you will gain 27 ECTS credits. Finally, you must accumulate a minimum of 80 ECTS credits from compulsory elective modules.

Out of these 80 ECTS credits from the compulsory elective modules:

- at least 4 ECTS credits must come from module group 8;
- at least 10 ECTS credits from module groups 6 and 7;
- at least 50 ECTS credits from module groups 1 to 5, which must be gained as follows:
  - at least 15 ECTS credits from module groups 1 and 2; and
  - at least 15 ECTS credits from module groups 3 to 5.

To pass your master's thesis, you must achieve a mark of 4.0 or better. To be awarded the degree, you must acquire an overall 120 ECTS credits.

Resits

You may resit failed module examinations up to two times. The resit must take place within one year of having failed the module. This resit deadline is not affected by any semesters out/leave of absence or termination of enrolment. You may re-attempt a failed master's thesis once; however, you must do this with a new topic. You may not voluntarily resit examinations for modules you have passed in an attempt to improve your mark.
You may only resit failed examinations within six semesters of starting the programme (maximum duration of study).

If you have not passed all required examinations after the sixth semester, you will fail the degree programme in the first instance; however, you then have one last chance to resit the missing assessments once within the subsequent two semesters. If, by the end of the eighth semester, you have still not passed all required modules, you will fail the programme without the possibility of re-sitting any examinations (‘endgültig nicht bestanden’ / ‘final fail’). This status bars you from enrolling in the same degree programme at other German universities.

The Examinations Office has overall responsibility for all examinations-related matters, including the recognition of assessments completed elsewhere. It also issues your final examination certificate upon request.

For enquiries, please contact:
Ms Gerlinde Lang
Examinations Office 1
Innstrasse 41
94032 Passau
Phone: +49 851 509 1198
gerlinde.lang@uni-passau.de

For information and forms, visit www.uni-passau.de/index.php?id=21061. This page is currently only available in German.

Upon request, the Board of Examiners may permit you to complete assessments in other, non-degree-relevant modules, in addition to those required for the degree programme. You do not, however, need to request permission from the Board of Examiners to complete additional compulsory elective modules. A separate transcript will be issued for the marks attained in these additional modules; however these do not count towards the final grade (average mark) for your degree.

If you are planning to register for a foreign language course and have existing language skills, you are required to take a placement test at the start of the semester. The results will determine at which level you will join the relevant language course. If you have existing language skills for a language for which no placement tests are carried out, please arrange a face-to-face consultation with the relevant language lecturer well in advance of the beginning of the course.

The exact placement test dates are announced on the Language Centre website in the weeks preceding each semester:
www.sprachenzentrum.uni-passau.de/en/placement-tests.

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

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.

Being specially designed for international students, the International Students’ Orientation Weeks include guided tours of Passau, the campus and university facilities in English 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.

More details on the International Students’ Orientation Weeks:
Orientation Week ('O-Woche')

An Orientation Week organised by the student committee of the Faculty of Computer Science and Mathematics ('Fachschaft Info' or 'FS 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 are offered an introduction to the computing facilities, can get help drawing up their timetables and can take part in 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. www.uni-passau.de/en/study/getting-started/orientation-weeks and www.fim.uni-passau.de/studium/fuer-studienanfaenger/o-woche (in German)

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/studip.

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. https://qisserver.uni-passau.de/qisserver/rds?state=user&type=0.

Academic Advice Service

The Academic Advice Service provides information on the degree programme and advises students who are unsure which degree programme to apply for, those who are thinking of transferring programmes or changing subjects as well as students who wish to discontinue their studies.

Academic Advice Service, Innstr. 39, 94032 Passau, Germany
Phone: +49 851 509 ext. 1150, 1151, 1152, 1153, 1154, 1155
Availability for telephone calls:
Mon to Fri 8:30 a.m.–12:00 noon and Mon to Thurs 1:00–3:00 p.m.
If you wish to talk to an adviser in person, please make an appointment or come by during our drop-in hours: Wed 9:00 a.m. to 12:00 noon

E-mail: advice@uni-passau.de
www.uni-passau.de/en/academic-advice

Programme Adviser

Please contact the programme convenor if you have in-depth questions, particularly if you are at an advanced stage of the programme:

Professor Tobias Kaiser
Room IM 228, Innstrasse 33
Phone: +49 851 509 3138
Fax: +49 851 509 2866
E-mail: tobias.kaiser@uni-passau.de

Student committee (FS Info)

The student committee ('Fachschaft') of the Faculty of Computer Science and Mathematics, FS Info, can help you from a student perspective on matters related to student life. Their office is located in room 244 of the IM building, Innstrasse 33; phone +49 851 509 3004; website: https://fsinfo.fim.uni-passau.de
International Student Assistants

International students at the Faculty of Computer Science and Mathematics receive support from the International Coordinator and the International Student Assistants. Ask them if you encounter any problems related to your studies at the University or life in Passau. The International Student Assistants can be reached via master-help@fim.uni-passau.de.

Studying or working abroad

If you need help preparing for your study or work placement abroad, you should get in touch with:

The International Office, Administration building, Innstrasse 41
Phone: +49 851 509 ext. 1160, 1162, 1163, 1165 or 1167
www.uni-passau.de/en/international

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 transferrable 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.

AIESEC

Worldwide internship exchange is at the centre of the activities of AIESEC, the largest international student organisation. If you are interested in joining, get in touch with the Local AIESEC Committee: www.aiesec.de/passau.

Support for business start-ups

Passau is one of the leading regions in Germany in terms of business start-ups. Spin-outs from the University of Passau have already created a large number of jobs in the region. Students who are thinking about becoming entrepreneurs enjoy a number of support services, such as:

- the ‘Gründercafé’ (Start-up Café), a forum for exchange with others willing to start up a business, as well as with experts on the topic
- the ‘5-Euro-Business-Wettbewerb’ (5-Euro-Business Competition), which enables you to set up a company under the guidance of an experienced expert and win exciting prizes
- the ‘Gründersprechstunde’ (Start-up Consultation Hour), where you can gain valuable tips and advice on business formation

Your contact person for start-up support:
Mr Stefan Jelinek
Phone: +49 851 509 1583
stefan.jelinek@uni-passau.de
www.uni-passau.de/index.php?id=1535&L=1

Student Services Association (Studentenwerk)

The Student Services Association (Studentenwerk Niederbayern/Oberpfalz) runs the refectory, cafeterias, halls of residence, BAföG loans/grants and student welfare advice: www.stwno.de/en.

Accommodation

If you are an international student and wish to arrange accommodation for the first semester through the University, get in touch with Ms Alexandra Winterkorn of the International Office (see next page for address):
Accommodation (cont’d)

Administration building
Room 106
Innstrasse 41
94032 Passau
E-mail: alexandra.winterkorn@uni-passau.de
Phone: +49 851 509 1161
Fax: +49 851 509 1164

For information about hotels, B&Bs and guest houses, contact:

Tourist Information Passau
Rathausplatz 3
94032 Passau
Phone: +49 851 955980
E-mail: tourist-info@passau.de
www.passau.de

Further information: www.uni-passau.de/en/accommodation and
www.uni-passau.de/en/study/campuslife/housing.
Programme structure

The degree programme is divided into core modules and compulsory elective modules. The compulsory elective modules are divided into eight module groups.

In order to gain your degree, you must complete:

1) all core modules (see table A)
2) at least 80 ECTS credits' worth of compulsory elective modules (see table B); of these:
   a. at least 4 ECTS credits must come from module group 8;
   b. at least 10 ECTS credits from module groups 6 and 7;
   c. at least 50 ECTS credits from module groups 1 to 5 inclusive; these 50 ECTS credits must, in turn, be sub-divided as follows:
      i. at least 15 ECTS credits from module groups 1 and 2; and
      ii. at least 15 ECTS credits from module groups 3 to 5.

You must obtain at least 60 ECTS credits on the programme before you are allowed to commence writing your master's thesis.

### A) CORE MODULES

<table>
<thead>
<tr>
<th>Module title</th>
<th>ECTS credits</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics seminar module 1</td>
<td>5</td>
<td>A written presentation paper (no more than 10 pages) and the oral presentation itself (45 to 90 minutes in length); the exact form of assessment will be announced on the noticeboards and on the faculty website by the start of the semester.</td>
</tr>
<tr>
<td>Mathematics seminar module 2</td>
<td>5</td>
<td>A written presentation paper (no more than 10 pages) and the oral presentation itself (45 to 90 minutes in length); the exact form of assessment will be announced on the noticeboards and on the faculty website by the start of the semester.</td>
</tr>
<tr>
<td>Presentation of your thesis</td>
<td>3</td>
<td>Presentation (45 to 90 minutes in length); the examiner will announce the exact duration beforehand.</td>
</tr>
</tbody>
</table>

### B) COMPULSORY ELECTIVE MODULE GROUPS

<table>
<thead>
<tr>
<th>Module group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Algebra, Geometry and Cryptography</td>
<td>This module group imparts advanced results in the areas of algebra and geometry, which constitute the fundament for algorithmic calculations, particularly in cryptography but also in many other mathematical areas.</td>
</tr>
<tr>
<td>Module group</td>
<td>Description</td>
</tr>
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<td>--------------------------------------------------</td>
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</tr>
<tr>
<td>2) Mathematical Logic and Discrete Mathematics</td>
<td>The theoretical possibilities and limitations of algorithm-based solutions are treated in this module group.</td>
</tr>
<tr>
<td>3) Analysis, Numerics and Approximation Theory</td>
<td>Methods from the fields of mathematical analysis, applied harmonic analysis and approximation theory for modelling and approximating continuous and discrete data and systems as well as efficient numerical implementation and evaluation of these methods are the scope of this module group.</td>
</tr>
<tr>
<td>4) Dynamical Systems and Optimisation</td>
<td>Dynamical systems theory deals with the description of change over time. This module group is concerned with methods used for the modelling, analysis, optimisation and design of dynamical systems, as well as the numerical implementation of such techniques.</td>
</tr>
<tr>
<td>5) Stochastics, Statistics</td>
<td>This module group deals with methods for modelling and analysing complex random phenomena as well as the construction, analysis and optimisation of stochastic algorithms and techniques used in statistical data analysis.</td>
</tr>
<tr>
<td>6) Data Analysis and Data Management and Programming</td>
<td>This module group examines the core methods used in computer science for the analysis of data of heterogeneous modalities (e.g. multimedia data, social networks and sensor data) and for the realisation of data analysis systems.</td>
</tr>
<tr>
<td>7) Applications</td>
<td>In this module group, students practise applying the mathematical methods learned in module groups 1 to 6 to real-world applications such as Marketing, Predictive Analytics and Computational Finance.</td>
</tr>
<tr>
<td>8) Key Competencies and Language Training</td>
<td>In this module group, students choose seminars that develop their non-subject-specific skills, such as public speaking, academic writing and other soft skills; they may also undertake internships. This serves to complement their technical expertise gained during their degree studies and helps to prepare them for their professional life after university.</td>
</tr>
</tbody>
</table>