PADERBORN UNIVERSITY

Department of Computer Science

Welcome to Paderborn
April 2023

Introduction to the Master Program in Computer Science

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Paderborn University Campus

- Main campus in the southern part of the city
  - Central institutions like
    - International Office (building I, 4th floor)
    - Central Examination Office (building C, 2nd floor)
    - Notebook Cafe (building I, ground floor)
  - Lecture halls, class rooms, work spaces
  - Part of the CS Department (building O)

- Smaller campus at Fürstenallee
  - Part of the CS Department (building F) – and me

Outline

- Semester Start
- Elements of the Master Degree Program
- Structure of the Program
- Scope and Schedule
- Examinations

How to contact us

- Email: study-service-cs@uni-paderborn.de
- Web: https://cs.uni-paderborn.de/en/studies/ advice-and-support/study-service
- Twitter: @Study_CS_UPB
- YouTube: https://www.youtube.com/user/FakultaetEIM

- Office: F2.119 in Fuerstenallee building

Semester start

- Lectures start on April 3rd.

- Courses will be „in real life", not online.

- Updates on the pandemic situation: https://www.uni-paderborn.de/en/university/press-communications-marketing/corona-news-english

- Information from our student's council: https://fsmi.uni-paderborn.de

Getting into the right mindset

- Check your knowledge with our self-assessment.
  - If you experience difficulties in a certain area, try to find a good book to improve your knowledge.

- Get acquainted with the standards of good scientific practice.
  - In particular, make sure you are aware of the problem of plagiarism.

- Be aware of the fact that you will have to organize yourself.
  - From planning your master studies to visiting lectures and tutorials to finding a master's thesis.

- Don't be afraid to talk to us!
  - When something is not clear or there is a problem, talk to your lecturer, us, the examination office – whoever might be able to help. And don't wait too long!

PADERBORN UNIVERSITY

What every lecturer will expect from you
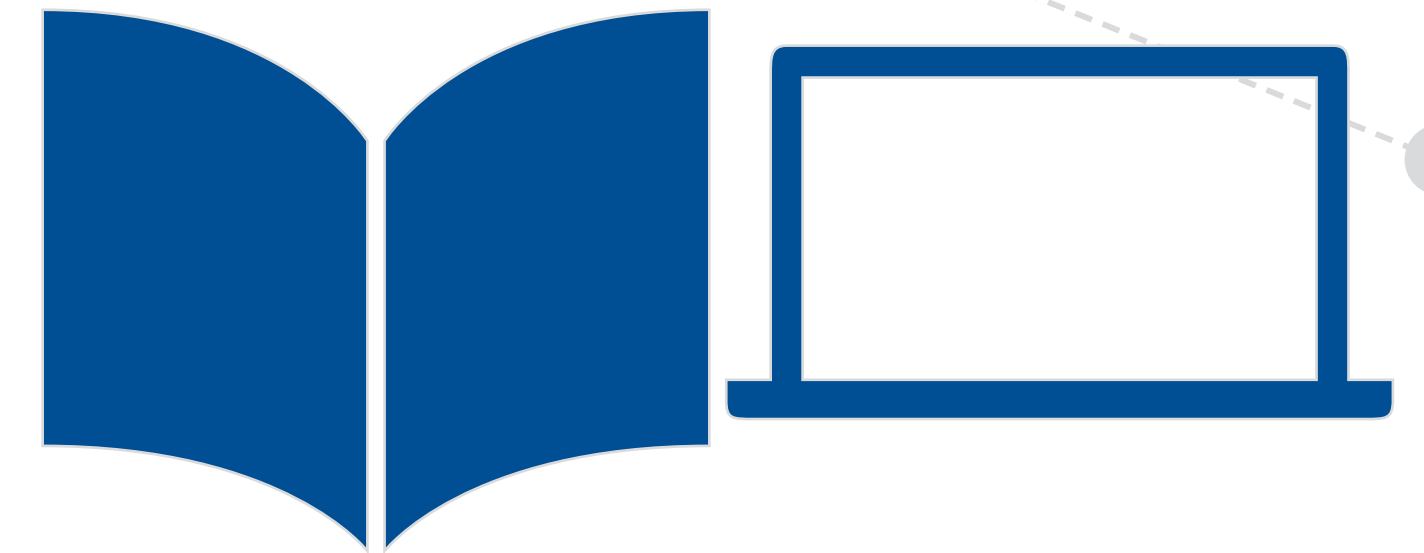
Ability to apply foundations of Computer Science

- usage of formal methods to specify problems, structures, systems, languages, …
- formal methods to analyze algorithms
- formal methods to check solutions
- proving properties of algorithms (correctness, performance, …)

Experience in doing practical work

- application of methods and tools for software design and implementation
- solid background in object-oriented concepts
- substantial experience in at least one programming language
- ability to switch to a new programming language within a short time

There's more to it!

Ability to do scientific work

- searching for and investigating scientific publications

- writing scientific documents
  - adequate structure, clear descriptions and explanations, citations and references, correct English

- developing and giving presentations

- avoid plagiarism https://cs.uni-paderborn.de/en/studies/formalities/notes-on-plagiarism

Planning for your first semester

- Check the course catalog for the upcoming semester at https://paul.uni-paderborn.de
  - "Faculty of Computer Science, Electrical Engineering and Mathematics" – "Computer Science" – "Computer Science Studies" – "Master Studies"

- Browse through the courses from the first seven entries, the focus areas, to identify courses you might wish to take.
  - Check if there is a self-assessment for the course for prior knowledge.

- You can't take a seminar or a project group in your first semester here.

Planning for your first semester

- The recommended workload for each semester is 30 credits, i. e. 5 courses in the first semester of 6 credits each.

- Self-assessment tests are available for many courses: https://cs.uni-paderborn.de/en/studies/getting-started/ information-for-international-students/self-assessment-tests-for-master-lectures

- Keep in mind that this workload may be too high:
  - Language courses (optional)
  - Getting used to living in Germany
  - Getting used to the German university system

- You need to register for the modules as well as the courses – until April 21.

Program structure

AD

Sec   CS

SE   DS

NC   ID
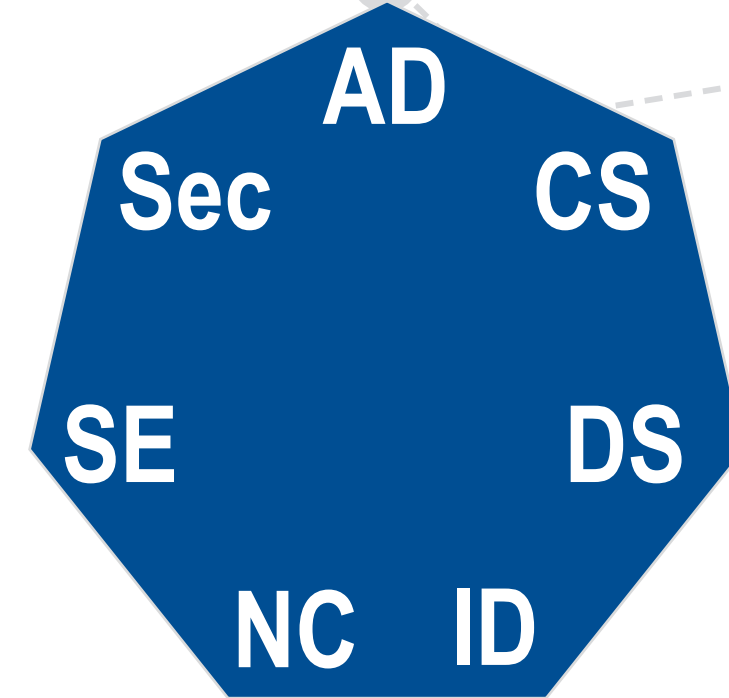
Seven Focus Areas

- Algorithm Design
- Computer Systems
- Data Science
- Intelligence and Data
- Networks and Communication
- Security
- Software Engineering

You have to choose one of these areas as specialization area when applying for a master's thesis.

- No need to decide now, but it's good to have an idea.
- Yet: Plan ahead and ideally try to you have three modules in the focus area you wish to write your Master's thesis in after three semesters.
- You can't start your Master's thesis without meeting this requirement!

Modules

Every student has to

- study three modules in the area of specialization,

- study one module in some other focus area,

- study four more modules in whatever area they like.

- Hence every student has to take 8 modules overall.

Most modules are offered once per year.

Every module has 6 ECTS points

- belongs to one or more focus areas (of the six).

- consists of exactly one class (from that focus area).

- is described in the module handbook (Modulhandbuch).

- If a module belongs to more than one focus area, you can move it later to meet the specialization area requirement.

Master Degree Program in Paderborn (Example I)

1	Advanced Computer Architecture (Computer Systems)	Advanced Algorithms (Algorithm Design)	Information Retrieval (Data Science)	Designing code analyses … (SE)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	Networked Embedded Systems (N&C)	Seminar II	
4	**Master's Thesis**				

Master Degree Program in Paderborn (Example II)

1	Introduction to Quantum Computation (Algorithm Design)	Advanced Algorithms (Algorithm Design)	Real World Crypto Engineering (Algorithm Design)	Advanced Complexity Theory (Algorithm Design)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	Routing and Data Management in Networks (Algorithm Design)	Seminar II	
4	**Master's Thesis**				

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Master Degree Program in Paderborn (Example III)

1	Model-Based Systems Engineering (SE)	Advanced Algorithms (Algorithm Design)	High-Performance Computing (Computer Systems)	Intelligence in Embedded Systems (Computer Systems)	Foundations of Knowledge Graphs (I&D)
2	Project Group	Game Theory (Algorithm Design)		Seminar I	Extracurricular Studies
3		Foundations of Cryptography (Algorithm Design)	VLSI Testing (Computer Systems)	Seminar II	
4	**Master's Thesis**				

Module Handbook

Contains detailed descriptions of all courses

- Content
- Type of exam
- Language of instruction (> 90% are in English)
- When to expect: winter or summer semester

- Also contains lists which module is in which focus areas.

- Updated each semester, see https://cs.uni-paderborn.de/en/studies/advice-and-support/study-service

Logic Programming for Artificial Inte...		
Logic Programming for Artificial Intellig...		
Module number:	**Workload (h):**	
	180	
	Semester numbe...	

1	**Module structure:**	
		Course
	a)	Logic Programming for A... cial Intelligence

2	**Options within the module:**
	none

3	**Admission requirements:**
	Prerequisites of course Logic Pro... **Recommended Proficiencies** Students should have previous kn... mierung" and "Programming Lang... in the course "Database Systems'...

4	**Contents:**
	Contents of the course Logic Prog... This course views various concep... and computational linguistics from... logic. Programming in logic in ge... the ability to describe many conc... and executed by an interpreter at... but also for self-defined or domain... • Introduction into logic progr... • Constraint solvers, puzzles,... • Interpreters for term substit... • Parsing programs, XML, an... • Semantics construction, qu... • Meta interpreters, domain s... • Feature term unification and...

5	**Learning outcomes and competences:**

Students learn
factual knowledge about

- the transformation of knowledge given as facts and rules into an executable programs
- how to program in logic and in self-designed languages

methodological knowledge, including

- the ability to define domain specific languages
- the ability to implement interpreters for domain specific languages
- the ability to develop small question answering systems
- the ability to develop software for theorem provers or constraint solvers solving puzzles

transfer skills

- the ability to transfer the methodolies and skills gained to other data sources, knowledge representation formats, or calculi
- the ability to transfer the parsing and semantics knowledge to domain specific languages

normative evaluation skills including the ability to assess

- the suitability and limitations of different data and knowledgerepresentation formats for different tasks
- the suitability of different programming paradigms for different projects
- the effort and feasibility of projects aiming natural language understanding
- the effort and feasibility of projects aiming at automated translation

Non-cognitive Skills

- Learning competence
- Learning motivation

6	**Assessments:**

☒Final module exam (MAP)   ☐Module exam (MP)   ☐Partial module exams (MTP)

zu	**Type of examination**	**Duration or scope**	**Weighting for the module grade**
a)	Written or oral examination	90-120 min or 40 min	100%

The responsible lecturer announces type and duration of assessment modalities in the first three weeks of the lecture period at latest.

7	**Study Achievement:**

zu	**Type of achievement**	**Duration or Scope**	**SL / QT**
a)	Written exercises		CA

Within the first three weeks of the lecture period each respective lecturer will specify the manner in which the course achievement will be conducted.

Recommendations for the first semester

- Pick five modules that you believe to be the most interesting for you.
- If you already have an idea which focus area you might wish to specialize in, pick at least two in that area.
- If you don't have an idea which focus area you might wish to specialize in, don't worry! Just pick modules according to your interests.
- Check whether there is a self-assessment for the module (https://cs.uni-paderborn.de/en/studies/getting-started/ information-for-international-students/self-assessment-tests-for-master-lectures) and take it.
- Register for the module as well as the course – and mind the deadlines!
- Also register for the course achievement and the exam during the registration phase – again, mind the deadlines!
- If you struggle with a course or your total workload proves to be too high, concentrate on those modules that you are confident to pass.
- Deregister from the course achievement and the exam in those courses that you wish to drop – mind the deadlines!

Modules in Algorithm Design

- Advanced Algorithms
- Advanced Complexity Theory
- Advanced Distributed Algorithms and Data Structures
- **Algorithms for Highly Complex Virtual Scenes**
- Clustering Algorithms
- Combinatorial Optimization
- **Efficiency in Games**
- **Foundations of Cryptography**

- Game Theory
- Introduction to Quantum Computation
- **Post-Quantum Cryptography**
- Quantum Algorithms
- **Quantum Complexity Theory**
- **Quantum Information**
- Real World Crypto Engineering
- Routing and Data Management in Networks

Modules in Computer Systems

- Advanced Computer Architecture
- Approximate Computing
- High-Performance Computing
- **Human Factors in Security and Privacy**
- Reconfigurable Computing
- **Usable Security and Privacy**
- VLSI Testing

Modules in Data Science

- Advanced Algorithms
- Advanced Distributed Algorithms and Data Structures
- Data Science for Physics and Engineering
- Data Science in Industrial Applications
- **Digitale Sprachsignalverarbeitung**
- **Explainable Artificial Intelligence**
- **Foundations of Knowledge Graphs**

- High-Performance Computing
- Information Retrieval
- Machine Learning I
- **Machine Learning II**
- Statistical Natural Language Processing
- Topics in Pattern Recognition and Machine Learning
- Topics in Signal Processing

Modules in Intelligence and Data

- Clustering Algorithms
- Data Science for Physics and Engineering
- **Explainable Artificial Intelligence**
- **Foundations of Knowledge Graphs**
- Information Retrieval
- Logic Programming for Artificial Intelligence

- Machine Learning I
- **Machine Learning II**
- Machine Learning for Biometrics
- Optimization Methods for Machine Learning
- Statistical Natural Language Processing
- Statistical Signal Processing

Modules in Networks and Communication

- Advanced Distributed Algorithms and Data Structures
- Networked Embedded Systems
- Routing and Data Management in Networks
- **Web Security**

Modules in Security

- Advanced Distributed Algorithms and Data Structures
- Designing code analyses for large-scale software systems 1
- **Designing code analyses for large-scale software systems 2**
- **Foundations of Cryptography**
- **Human Factors in Security and Privacy**
- Introduction to Quantum Computation

- Machine Learning for Biometrics
- **Post-Quantum Cryptography**
- Privacy and Technology
- **Quantum Complexity Theory**
- **Quantum Information**
- Real World Crypto Engineering
- **Usable Security and Privacy**
- **Web Security**

Modules in Software Engineering

- Build It, Break It, Fix It
- Data-Driven Innovation and Engineering
- Data Science in Industrial Applications
- Designing code analyses for large-scale software systems 1
- **Designing code analyses for large-scale software systems 2**

- High-Performance Computing
- **Human Factors in Security and Privacy**
- Kontextuelle Informatik (in German)
- Logic Programming for Artificial Intelligence
- **Model-Based Systems Engineering**
- Software Quality Assurance

Seminars are special

- Count for 5 ECTS points
- 2 meeting hours per week or compact on two to three days
- Teacher proposes topics (Seminarthemen)
- Every student selects or is assigned one topic to work on and then
  - prepares a talk with slides (Seminarvortrag)
  - submits a seminar paper (Ausarbeitung)

- You need to work scientifically and be aware of good practices and the problem of plagiarizing in particular!
- Seminars do not belong to specific focus areas. You are free to choose.
- See https://cs.uni-paderborn.de/en/studies/study-elements/seminars-of-computer-science/
  for information on how to apply for a seminar.

Project Groups are even more special

- Workload: 20 ECTS points in one year – including semester breaks

- Presentation of all project groups in a public event (Projektgruppenvorstellung) in the last week of teaching season – you should participate to find a group that suits you.

- Interested students apply for a project group and 8 to 16 students are accepted.
  - Ranking by you as well as by the lecturers.

- Working for two semesters on a project (often: concept and implementation of some software)

Project Groups are even more special

- Highly self-organized
- You have to contribute actively!
- You will be evaluated continuously.
- Usually requires at least two days per week being present in Paderborn.

- All our project groups are in English!
- Project groups do not belong to specific focus areas. You can apply to any one.

- All details at https://cs.uni-paderborn.de/en/studies/study-elements/project-groups/

Master's Thesis (Masterarbeit)

Workload: Full-time for one semester (30 ECTS)

What has to be done?

- Literature review
- Research: develop new results!
- Obey rules of good scientific practice!
- Often: implementation of some software
- Writing a thesis (~ 80-120 pages) on scientific level

All of this: within 6 months (formally checked!)

- First a planning phase (typically 1 month)
- Then the real work (5 months)

Master's Thesis (Masterarbeit)

Finding an advisor (Betreuer)

- talk to professors working in an area that interests you
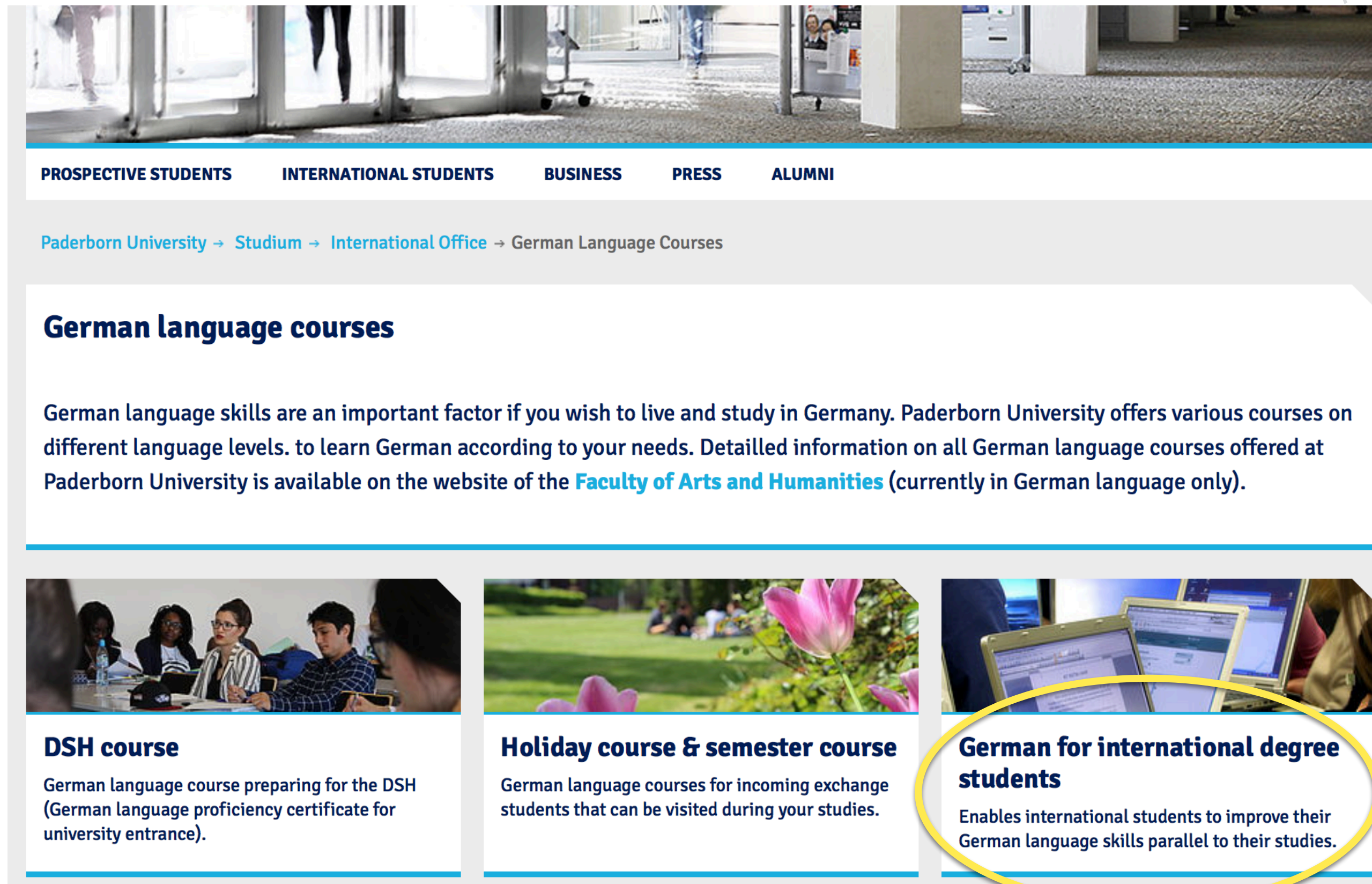- talk to the organizer of your project group
- ask friends

Finding a topic (Thema) is an interactive process between student and advisor

- own ideas?
- project group topic?
- discussion with the (potential) advisor!

The Master's thesis defines your area of specialization –

where you need to have three modules completed before you can register the thesis.

German Language Course (Deutschkurs)

■ Language courses are optional!

■ Language Courses hosted by the International Office

■ You can cover the complete „General Studies" part with language courses (12 ECTS)

■ Check https://www.uni-paderborn.de international-office/deutschkurse/

PROSPECTIVE STUDENTS   INTERNATIONAL STUDENTS   BUSINESS   PRESS   ALUMNI

Paderborn University → Studium → International Office → German Language Courses

German language courses

German language skills are an important factor if you wish to live and study in Germany. Paderborn University offers various courses on different language levels. to learn German according to your needs. Detailed information on all German language courses offered at Paderborn University is available on the website of the **Faculty of Arts and Humanities** (currently in German language only).

DSH course

German language course preparing for the DSH (German language proficiency certificate for university entrance).

Holiday course & semester course

German language courses for incoming exchange students that can be visited during your studies.

German for international degree students

Enables international students to improve their German language skills parallel to their studies.

What you need to do to get your degree

Every student has to…	ECTS credits
… take three modules from the area of specialization	18
… take one module in one other area	6
… take four modules in whatever area	24
… take two seminar modules	10
… take part in a project group	20
… write a Master's thesis (must be from your specialization area)	30
… take minor subject, do general studies or take the German language courses	12
Adding up to	120

It is your own responsibility to meet these criteria!

Examinations: Normal modules

Oral or written exam about the class

- Oral exams: individual date with the lecturer

- Written exams: usually two dates offered in the semester breaks

Class may include written homework or project work as pre-requisite („course achievement").

You need to register for the exams!

- All with PAUL
- Registration for first exam period:
  April 15 to May 15
- Registration for second exam period:
  September 4 to 8

De-register if you don't want to take an exam!
Otherwise you might be stuck with that module.

Examinations: Other types

Seminar: Evaluation of presentation and seminar paper

Project group: Permanent evaluation throughout the project

Master's Thesis: Evaluation by the advisor and a co-advisor

Examinations: Repetition

Module exams can be repeated twice.

Seminars can be repeated twice.

Project group can be repeated twice (you really don't want that!).

Master's Thesis can be repeated once.

Examinations: Compensation

There are (limited) ways

- to shift aside („compensate") exam failures
    - e.g. failure in one module
    - give up on that one and try another one instead

- to improve exam results
    - e.g. you succeeded in a module exam but with an unsatisfactory result, you can try a different module additionally.
    - You can't retake a module that you have passed.

Final failure is possible! If …

… you have no more options to use compensation and you are no more able to fulfill the requirements:

- 3 modules in the specialization area
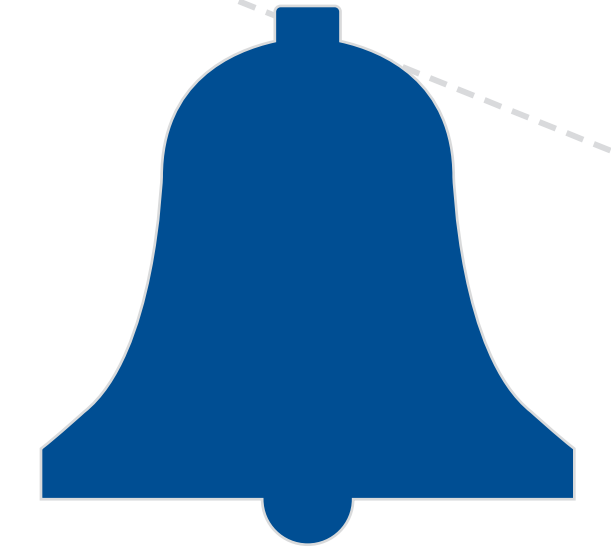- 5 more modules with at least one of them in another area

OR

- three attempts for a project group failed

OR

- one seminar failed three times

OR

- two attempts for a Master's thesis failed

Common pitfalls

- Deadlines are important. Some things can be amended if you miss a deadline, some can't or may result in delays of up to a year!

- You need to register for all sorts of things. Do it – and mind the deadlines!

- If you don't want to finish a course, de-register it and everything associated with it – and mind the deadlines. Otherwise you may be blocked from taking other courses as there is an upper limit of courses you can take.

- Pay your semester fees as early as possible. Otherwise you might not be able to participate in the seminar or project group distribution – which will result in a delay of one semester at least.

- Never miss the first meeting of a course.

- Always – ALWAYS! – visit the first lecture in a semester where all necessary information about the course will be given!

Important deadlines in this semester

Add those dates to your favourite calendar tool with a reminder!

Until April 21

Registration for modules and courses

Between April 15 and May 15

Registration for course achievement

Registration for qualified participation (if applicable)

Registration for exams

June 30

De-registration from course achievement

De-registration from qualified participation

One week before exam

De-registration from exam

Between September 4 and 8

Registration for 2nd exam phase, also late registration for course achievement

If you missed this registration phase, you will most likely have to wait for almost one year to take your exam in that course!

Some more important things

- PAUL is your friend
  - Most important information is sent via the PAUL system or is shown there when you log in.
  - Check your university email address regularly!
  - Check out the PAUL introduction playlist at YouTube

- Many courses use the PANDA system for information and course material.

- Watch out for the project group presentation and attend it!

Stay up to date

- Follow us on Twitter (or at least bookmark us in your browser and check regularly) – we will remind you of important deadlines: @CompScience_UPB, @Study_CS_UPB

- Join in on our monthly live stream on the Faculty's YouTube channel at https://www.youtube.com/user/FakultaetEIM

  - usually third Thursday each month (except March and September) at 6 pm local time
  - Q&A for the Master program
  - next dates always posted at https://cs.uni-paderborn.de/en/studies/advice-and-support/study-service

Welcome to Paderborn!