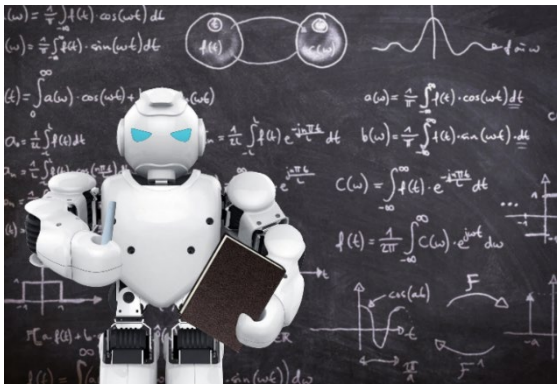
ohm Technische Hochschule Nürnberg

German

Deutsch

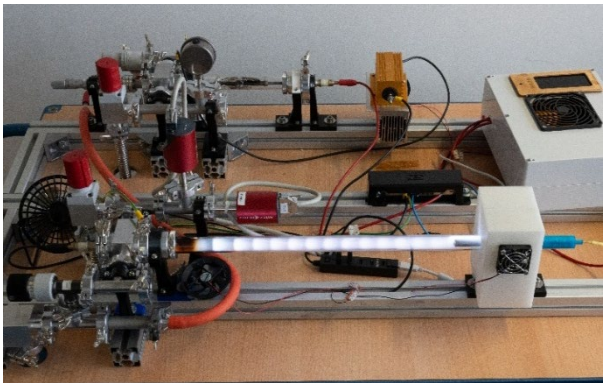


Mathematics

Mathematik

Physics

Physik



Chemistry

Chemie

Pathway programme GerMaN – German Math Natural Sciences

Module Catalogue

Contents

Foreword

The Ohm's pathway programme GerMaN (German Math Natural Sciences) is a two-semester preparatory programme for international participants planning to pursue degree studies at the Ohm. It provides a structured transition into German higher education by combining intensive language training, academic preparation, and comprehensive orientation.

A core objective of the programme is preparation for the **German Language Examination for University Admission (DSH)**, supported by **16 hours of German instruction in class and 4 hours independent online coursework per week**. In addition, participants complete **12 hours in class per week in mathematics, physics, and chemistry**. These subjects are initially taught in English and are gradually transitioned into German as language proficiency increases, ensuring a smooth shift from technical English to technical German.

Alongside subject knowledge, participants develop essential academic skills, including effective note-taking, self-organised learning, and managing the high workload typical of German universities.

The programme further supports participants in settling into life in Germany. With assistance from the university's international support services, participants receive guidance on administrative procedures, accommodation, and everyday matters. Social activities and campus events help participants quickly integrate into the university community.

Furthermore, the lecture-free period between the first and second semester can be used to complete a **pre-study internship**. This allows participants to meet internship requirements ahead of time and to focus fully on their academic studies during their subsequent degree programme.

This module handbook outlines the structure, content, and learning objectives of the pathway programme and serves as a guide throughout the programme.

Structure, Schedule, and Workload

The German language module comprises a total of **16 in class semester hours per week (SWS)**, with one SWS corresponding to **45 minutes** of teaching, while the Mathematics, Physics and Chemistry modules (MPC) comprise a total of **12 in class SWS.** Instruction is delivered in **1.5-hour blocks**, with **4 SWS each in all modules.**

German class takes place **Monday to Thursday from 09:45 to 13:00**. MPC classes are typically held **Monday to Thursday in the afternoon (14:00–15:30)** and, where necessary, **in the morning (08:00–09:30)**. An additional **4 SWS are scheduled on Fridays** for MPC, usually between **09:45 and 13:00**.

In addition to scheduled lectures, **22 SWS of guided self-study time** are allocated per week. This time is intended for preparation and review of both the German language courses and the MPC subjects.

Together with the German courses, the programme includes **28 SWS of weekly instruction**. Including self-study time, this results in a **total workload of approximately 50 SWS**, corresponding to about **38 hours per week** during the lecture period. A comparable workload is expected during the **exam preparation phase**, reflecting the work intensity typical of degree programmes at German universities.

A possible time table is shown in the following:

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
08:00 – 09:30	Study time	Study time	Study time	Study time	Study time
09:45 – 11:15	German (DSH)	German (DSH)	German (DSH)	German (DSH)	Physics (Exercise)
11:30 – 13:00	German (DSH)	German (DSH)	German (DSH)	German (DSH)	Chemistry (Exercise)
13:00 – 14:00	Lunch Break				
14:00 – 15:30	Mathematics (Lecture)	Chemistry (Lecture)	Physics (Lecture)	Mathematics (Exercise)	Study time
15:45 – 17:15	Study time	Study time	Study time	Study time	Study time

The German module follows a **learner-centered teaching approach** aimed at further developing participants' language proficiency **at least up to level B2** of the Common European Framework of Reference for Languages (CEFR). Students are encouraged to work independently and take an active role in their learning through self-directed exercises. A significant focus is placed on developing academic writing skills, as well as on text analysis and interpretation, which are treated as core components of academic language competence.

The MPC lectures follow a **seminar-style teaching approach**. Participants are continuously encouraged to actively contribute through discussion, collaboration, and problem-solving. A substantial portion of the lecture time is dedicated to **exercises**

designed to deepen understanding of the subject matter. **Oral examinations and presentations** may form part of these exercises.

After the end of the lecture period, a **self-study phase of approximately two weeks** is provided before the examination period of MPC each semester. At the end of each semester, students sit **written examinations of 90 minutes each in mathematics, physics, and chemistry**.

Participation in both the German language courses and the MPC lectures is mandatory.

German

German 1

Credits	Type of Assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	-	Lecture	16	Total	495
Module Coordinator	**Lecturer**	Exercise	-	Course Attendance	240
Annette Gebert	Susanne von Lennep Atzl			Self-study incl. preparation for exams	255
Module Duration	**Module offered during**	**Language of Instruction**			
One Semester	Winter term	German			

Pre-requisites

German B1 (CEFR)

Contents

- Practising general language and grammatical structures relevant to studying
- Introduction to text work on topics relevant to studying at university (exercises to improve reading and listening comprehension)
- Introduction to techniques and skills relevant to studying at university (describing simple graphs, oral presentations, taking notes, etc.)
- Process-oriented writing

Learning objectives

-

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

German 2

Credits	Type of Assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam and oral exam (DSH)	Lecture	16	Total	495
Module Coordinator	**Lecturer**	Exercise	-	Course Attendance	240
Annette Gebert	Annette Gebert			Self-study incl. preparation for exams	255
Module Duration	**Module offered during**	**Language of Instruction**			
One Semester	Summer term				

Pre-requisites

Contents

- Practising general language and grammatical structures relevant to studying
- Introduction to text work on topics relevant to studying at university (exercises to improve reading and listening comprehension)
- Introduction to techniques and skills relevant to studying at university (describing simple graphs, oral presentations, taking notes, etc.)
- Process-oriented writing

Learning objectives

-

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

Mathematics

Mathematics 1

Credits	Type of Assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (60 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module Coordinator	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Tim Kröger	Prof. Dr. Tim Kröger, Prof. Dr. Steffen Basting			Self-study incl. preparation for exams	75
Module Duration	**Module offered during**	**Language of Instruction**			
One Semester	Winter term	English			

Pre-requisites

None

Contents

- Numbers
- Basic arithmetic operations
- Rounding and scientific notation
- Sets
- Factions, powers, roots, logarithms
- Equations (linear equations, quadratic equations, fraction equations, equations involving roots/logarithms/exponentials, solving equations by substitution)
- Inequalities

Learning objectives

General objectives:

- Sound knowledge and in-depth understanding of mathematical concepts, laws, ways of thinking and methods
- Apply mathematical methods to Physics 1 and to Chemistry 1 to address physics and chemistry phenomena in a quantitative way
- In combination with Mathematics 2, Physics 1 & 2 and Chemistry 1 & 2: All prerequisites for any technical bachelor programme at the Ohm

Specific Objectives:

- Students apply arithmetic operations, rounding rules, and scientific notation when working with numbers
- Students manipulate algebraic expressions involving fractions, powers, roots, and logarithms
- Students solve linear, quadratic, and other elementary equations using algebraic methods
- Students analyze and solve inequalities and interpret their solution sets

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

Cramer, E., Neslehova, J.: Vorkurs Mathematik, Springer Spektrum
Helping Engineers Learn Mathematics (HELM) Workbooks:
https://www.lboro.ac.uk/departments/mlsc/student-resources/helm-workbooks/

Mathematics 2

Credits	Type of Assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (90 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module Coordinator	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Steffen Basting	Prof. Dr. Steffen Basting, Prof. Dr. Tim Kröger			Self-study incl. preparation for exams	75
Module Duration	**Module offered during**	**Language of Instruction**			
One Semester	Summer term	English / German			

Contents

- Trigonometry
- Basic Geometry
- Vectors
- Differential Calculus
- Integral Calculus

Learning Objectives

General objectives:

- Sound knowledge and in-depth understanding of mathematical concepts and laws, ways of thinking and methods
- Apply mathematical methods to Physics 2 and to Chemistry 2 to address physics and chemistry phenomena in a quantitative way
- In combination with Mathematics 1, Physics 1 & 2 and Chemistry 1 & 2: All prerequisites for any technical bachelor program at the Ohm

Specific:

- Students apply trigonometric and geometric principles to calculate angles, lengths and areas
- Students use vectors and basic operations to represent and solve geometric problems
- Students analyze functions using derivatives, including slopes and extreme values
- Students compute basic integrals and interpret them as areas or accumulated quantities

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

Cramer, E., Neslehova, J.: Vorkurs Mathematik, Springer Spektrum
Helping Engineers Learn Mathematics (HELM) Workbooks:
https://www.lboro.ac.uk/departments/mlsc/student-resources/helm-workbooks/

Physics

Physics 1

Credits	Type of assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (90 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module coordinator	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Norbert Koch	Prof. Dr. Norbert Koch Prof. Dr. Stefan Kasperl Prof. Dr. Th. Lauterbach			Self-study incl. preparation for exams	75
Module duration	**Module offered in**	**Language of Instruction**			
One semester	Winter term	English			

Contents

- Introduction:
  - Physics as Natural Science
  - Basic Physics Quantities and Units
- Mechanics:
  - Kinematics
  - Dynamics
  - Oscillation and waves
- Thermodynamics:
  - Temperature and Thermal Energy
  - Ideal Gas Laws
  - Main Law of Thermodynamics
  - Thermodynamic Cycle

Learning Objectives

General:

- Sound knowledge and in-depth understanding of physics concepts and laws, ways of thinking and methods
- Apply mathematical methods from Mathematics 1 to address physics phenomena in a quantitative way
- Apply lecture contents from Chemistry 1 and link it to physics phenomena
- Introduce students to the language used in Physics in English and German
- In combination with Physics 2, Mathematics 1 & 2 and Chemistry 1 & 2: All prerequisites for any technical bachelor program at the Ohm

Specific:

- Get familiar with quantitative description of physics quantities in terms of SI units
- Describe motions quantitatively and apply Newtons laws and conservation laws in terms of energy and momentum and finally use dynamics to derive oscillation phenomena
- Understand and describe heat and temperature phenomena, the behavior of ideal gases and the underlying microscopic nature and the conversion of thermal to mechanical energy

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

Tipler, P., Mosca, G.: Physics for Engineers and Scientists, ISBN-13: 978-1319496562,
Yevick, D., Yevick, H.: Fundamental Math and Physics for Scientists and Engineers, John Wiley & Sons Incorporated, E-Book ISBN: 9781118979808, Print ISBN: 9780470407844

Physics 2

Credits	Type of assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (90 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module coordinator	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Norbert Koch	Prof. Dr. Norbert Koch, Prof. Dr. St. Kasperl, Prof. Dr. Th. Lauterbach			Self-study incl. preparation for exams	75
Module duration	**Module offered in**	**Language of instruction**			
One semester	Summer term	English / German			

Contents

- Electricity and Magnetism:
  - Electrostatics
  - Magnetostatics
  - Electromagnetism and Electromagnetic Waves
- Classical Atomic Physics
  - Disclosure of the elementary Structure of Matter
  - Atomic Models
  - The Atomic Nucleus

Learning objectives

General:

- Sound knowledge and in-depth understanding of physics concepts and laws, ways of thinking and methods
- Apply mathematical methods from Mathematics 1 & 2 to address physics phenomena in a quantitative way
- Apply lecture contents from Chemistry 1 & 2 and link it to physics phenomena
- Introduce students to the language used in Physics in English and German
- In combination with Physics 1, Mathematics 1 & 2 and Chemistry 1 & 2: All prerequisites for any technical bachelor program at the Ohm

Specific:

- Understand experimental observations and underlaying mechanism of both A/C and D/C electrical currents, electric and magnetic fields and their applications
- Be able to interpret the basic experiments to disclose the microscopic structure of matter

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

Tipler, P., Mosca, G.: Physics for Engineers and Scientists, ISBN-13: 978-1319496562,
Yevick, D., Yevick, H.: Fundamental Math and Physics for Scientists and Engineers, John Wiley & Sons Incorporated, E-Book ISBN: 9781118979808, Print ISBN: 9780470407844

Chemistry

Chemistry 1

Credits	Type of assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (90 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module Leader	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Jens Pesch	Prof. Dr. Jens Pesch			Self-study incl. preparation for exams	75
Module Duration	**Module Timing**	**Class Language**			
One semester	Winter term	English			

Contents

- Introduction to the Basics and Technical Terminology of Chemistry
- Atomic Structure and the Periodic Table of Elements
- Principles of Chemical Bonding and States of Aggregation
- Principles of Chemical Quantities
- Principles of Chemical Reactions
- Reaction Rates and Chemical Equilibrium
- Acids and Bases
- Electrochemistry, Oxidation and Reduction Processes
- Properties of a Selection of Important Chemical Elements

Learning Objectives

General:

- Sound knowledge and in-depth understanding of chemistry concepts, laws and terminology, ways of thinking and methods
- Apply mathematical methods from Mathematics 1 to address chemistry phenomena in a quantitative way
- Link chemistry contents to phenomena discussed in Physics 1
- Introduce students to the language used in chemistry in English and German
- In combination with Chemistry 2, Mathematics 1 & 2 and Physics 1 & 2: All prerequisites for any technical bachelor program at the Ohm

Specific:

- Understand the structure of atoms and how to read and use the periodic table
- Understand the concept of electronegativity and its implication for chemical bonding and the properties of chemical compounds and matter
- Use principles of stoichiometry and understanding of chemical reactions to formulate reaction equations and to calculate the output of a chemical reaction quantitatively
- Understand how reaction rates are calculated and how they are used to calculate chemical equilibria
- Understand the principles of the acid and base theories and their implication on chemical reaction mechanisms and processes in inorganic and biological systems
- Understand and formulate redox reactions and the implication on batteries, fuels cells and corrosion processes

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

K. Timberlake, K.C. Timberlake, B. Timberlake: Basic Chemistry, Global 5th Ed. 2017, Person Education Ltd.,
T.E. Brown, H.E. LeMay, B.E. Bursten, P.Y. Bruice: Basiswissen Chemie, 1. Aufl. 2019, Pearson Studium

Chemistry 2

Credits	Type of assessment	Timing (SWS) and Structure		Workload (hours)	
N/A	Written exam (90 min.) plus oral exams during lecture period	Lecture	2	Total	120
Module Leader	**Lecturer**	Exercise	2	Course Attendance	45
Prof. Dr. Irmtraud Horst	Prof. Dr. Irmtraud Horst Prof. Dr. Jens Pesch			Self-study incl. preparation for exams	75
Module Duration	**Module Timing**	**Class Language**			
One Semester	Summer Term	English / German			

Content

- Introduction to the Basics and Technical Terminology of Organic and Bioorganic Chemistry
- Basics of Organic Chemistry and Polymers
- Basics of Organic Reaction Mechanisms
- Basics of Material Properties derived from molecular properties
  Hazardous properties of chemical compounds as well as health and safety measures
- Basics of Biology and Biochemistry
- Basics of Biotechnology

Learning Objectives

General:

- Sound knowledge and in-depth understanding of chemistry concepts, laws and terminology, ways of thinking and methods
- Apply mathematical methods from Mathematics 1 & 2 to address chemistry phenomena in a quantitative way
- Link chemistry contents to phenomena discussed in Physics 1 & 2
- Introduce students to the language used in chemistry in English and German
- In combination with Chemistry 1, Mathematics 1 & 2 and Physics 1 & 2: All prerequisites for any technical bachelor program at the Ohm

Specific:

- Construct and sketch representations of organic and biochemical molecules and reaction schemes
- Understand the fundamentals of organic reactions mechanisms and how they can be used to design and optimize real reaction processes
- Understand what implication molecular structure has on macroscopic properties of biological and organic matter
- Understand and estimate the hazardous properties of chemicals and how to safely work with them
- Understand the role that modern biology and biotechnology play in industry and beyond

Module Type within GerMaN programme

Module as obligatory part of the GerMaN programme.

Literature

T.E. Brown, H.E. LeMay, B.E. Bursten, P.Y. Bruice: Basiswissen Chemie, 1. Aufl. 2019, Pearson Studium
L.A. Urry, M.L. Cain, S.A. Wasserman, P.V. Minorsky, J.B. Reece, Campbell Biologie Gymnasiale Oberstufe, Pearson Studium