Georg-August-Universität
Göttingen

Directory of Modules

zu der Prüfungs- und Studienordnung für den konsekutiven Master-Studiengang "Angewandte Informatik" (Amtliche Mitteilungen I 41/2012 S. 2127, zuletzt geaendert durch Amtliche Mitteilungen I Nr. 31/2025 S. 771)

Modules

Index by areas of study

I. Master's Degree Programme "Applied Computer Science (M.Sc.)“

A total of 120 C have to be successfully completed according to the following regulations.

1. Core Curriculum

Modules of at least 24 C must be successfully completed in accordance with the following regulations.

a. Compulsory Elective Modules

At least three of the following modules totalling at least 15 C must be successfully completed:

b. Elective Modules

Furthermore, the following modules may be completed; only one of the modules M.Inf.1101 and M.Inf.1102 is allowed to be completed:

2. Area of Professionalisation

Modules totalling at least 66 C must be successfully completed in accordance with the following regulations.

a. Specialisation

One of the following specialisations totalling at least 48 C must be successfully completed in accordance with the regulations listed in II. to XII.

- Bioinformatics
- Digital Humanities
- Geoinformatics
- Ecological Informatics
- Medical Informatics
- Computational Neuroscience
- Information Technology Law
- Business Information Systems

- Scientific Computing
- Data Science
- Applied System Engineering with Minor Subject in one of the applied computer sciences
- Applied System Engineering

b. Key Competencies

Modules totalling at least 12 C must be successfully completed in accordance with the following regulations.

aa. Profession-specific Key Competencies (Compulsory Elective Modules)

At least one of the following modules totalling at least 6 C must be successfully completed.

bb. Interdisciplinary Key Competencies (Optional Modules)

Modules from the university-wide module list of key competencies or the examination regulations for study programmes of the Central Institute for Languages and Transferable Skills (ZESS) can be taken.

c. Elective Area

Further modules from the core curriculum according to letters a. and b. and from the area of professionalisation according to letters a. and b. must be successfully completed until a total of at least 66 C has been acquired in the area of professionalisation.

3. Master's Thesis

The successful completion of the Master's thesis will earn 30 C.

II. Specialisation "Bioinformatics"

1. Compulsory Elective Modules

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

a. Subject Area "Bioinformatics" (at least 24 C)

Modules of at least 24 C must be successfully completed in accordance with the following regulations.

aa. Group 1

The following module of 12 C must be successfully completed:

bb. Group 2

Modules totalling at least 12 C must be successfully completed from the following area:

cc. Group 3

Furthermore, the following modules may be completed:

b. Subject Area "Biology" (at least 18 C)

Modules of at least 18 C must be successfully completed in accordance with the following regulations.

aa. Group 1

The following module of 8 C must be successfully completed:

bb. Group 2

Furthermore, the following modules in this subject area may be completed:

III. Specialisation "Digital Humanities"

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations.

1. Fundamentals

The following two modules must be successfully completed if their competencies have not already been acquired elsewhere.

2. Strategies and Methods

At least one of the following modules totalling at least 6 C must be successfully completed.

3. Theories and Research Questions

At least one of the following modules totalling at least 9 C must be successfully completed:

4. Project

At least one of the following modules totalling at least 9 C must be successfully completed:

IV. Specialisation "Ecological Informatics"

1. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Ecological Informatics" and at least 15 C in the subject area "Forest Sciences/Forest Ecology".

2. Compulsory Elective Modules

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

a. Subject Area "Ecological Informatics" (at least 18 C)

aa. Group 1

One of the following modules totalling at least 6 C must be successfully completed:

bb. Group 2

At least one of the following modules totalling at least 6 C must be successfully completed:

cc. Group 3

Furthermore, the following modules may be completed:

b. Subject Area "Forest Sciences/Forest Ecology" (at least 12 C)

aa. Group 1

The following module of 9 C must be successfully completed:

bb. Group 2

At least one of the following modules totalling at least 3 C must be successfully completed:

V. Specialisation "Medical Informatics"

1. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Medical Informatics" and at least 15 C in the subject area "Health Care System".

2. Compulsory Elective Modules

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

a. Subject Area "Medical Informatics" (at least 24 C)

aa. Group 1

The following modules totalling 18 C must be successfully completed:

bb. Group 2

At least one of the following modules totalling at least 6 C must be successfully completed:

b. Subject Area "Health Care System" (at least 24 C)

The following modules totalling 24 C must be successfully completed:

VI. Specialisation "Computational Neuroscience"

1. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Computational Neuroscience" and at least 15 C in the subject area of "Mathematics/Natural Sciences".

2. Compulsory Elective Modules

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

a. Subject Area "Computational Neuroscience" (at least 18 C)

Modules totalling at least 18 C must be successfully completed in accordance with the following regulations.

aa. Fundamentals

The following module of 3 C must be successfully completed:

bb. Seminar

One of the following two modules of at least 4 C must be successfully completed:

cc. Elective Modules

Furthermore, the following modules may be completed. Only one of the modules M.Inf.1203 and M.Inf.1209 is allowed to be completed.

At least two of the following modules totalling at least 12 C must be successfully completed.

c. Optional Modules

Furthermore, the following modules may be completed.

2. Subject Area "Jurisprudential Foundations" (at least 10 C)

Modules totalling at least 10 C must be successfully completed in accordance with the following regulations.

a. Compulsory Elective Modules I

At least one of the following modules totalling at least 4 C must be successfully completed:

b. Compulsory Elective Modules II

At least one of the following modules totalling at least 6 C must be successfully completed:

c. Optional Modules

Furthermore, the following modules may be completed:

VIII. Specialisation "Business Information Systems"

1. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Business Information Systems" and at least 15 C in the subject area "Business Administration".

2. Compulsory Elective Modules

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

a. Subject Area "Business Information Systems" (at least 24 C)

aa. Group 1

At least one of the following modules totalling at least 12 C must be successfully completed:

bb. Group 2

At least two of the following modules totalling at least 12 C must be successfully completed:

b. Subject Area "Mathematics/Natural Sciences" (at least 21 C)

At least three of the following modules totalling at least 21 C must be successfully completed:

X. Specialisation "Data Science"

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations.

1. Compulsory Elective Modules

At least three of the following modules totalling at least 15 C must be successfully completed:

2. Seminar

At least one of the following modules totalling at least 5 C must be successfully completed:

3. Research Project

Exactly one of the following modules with a minimum of 6 C and a maximum of 12 C must be successfully completed:

4. Optional Modules

Furthermore, further modules according to no. 1 & 2 as well as the following modules may be completed:

XI. Specialisation "Applied System Engineering with Minor Subject"

Modules totalling at least 48 C must be successfully completed in accordance with the following regulations.

1. Minor Subjects

One minor subject totalling at least 30 C must be successfully completed in accordance with the following regulations.

a. Bioinformatics

aa. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Bioinformatics" (at least 18 C)

At least two of the following modules totalling at least 18 C must be successfully completed:

ii. Subject Area "Biology" (at least 12 C)

A total of at least 12 C must be successfully completed in accordance with the following regulations.

A. Group 1

The following module of 8 C must be successfully completed:

B. Group 2

Furthermore, the following modules may be completed:

b. Digital Humanities

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Fundamental Modules

It is recommended to take the modules B.DH.02 and B.Inf.1904 if their competencies have not already been acquired elsewhere.

bb. Advanced Modules

At least two of the following modules totalling at least 12 C must be successfully completed.

c. Geoinformatics

aa. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Geoinformatics" and at least 15 C in the subject area "Geography".

bb. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Geoinformatics" (at least 19 C)

The following modules totalling 19 C must be successfully completed:

ii. Subject Area "Geography" (at least 11 C)

At least two of the following modules totalling at least 11 C must be successfully completed:

d. Ecological Informatics

aa. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Ecological Informatics" and at least 15 C in the subject area "Forest Sciences/Forest Ecology".

bb. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Ecological Informatics" (at least 18 C)

Modules totalling at least 18 C must be successfully completed in accordance with the following regulations.

A. Group 1

One of the following modules of 6 C must be successfully completed:

B. Group 2

At least two of the following modules totalling at least 12 C must be successfully completed:

ii. Subject Area "Forest Sciences/Forest Ecology" (at least 12 C)

Modules totalling at least 12 C must be successfully completed in accordance with the following regulations.

A. Group 1

The following module of 9 C must be successfully completed:

B. Group 2

At least one of the following modules totalling at least 3 C must be successfully completed:

e. Medical Informatics

aa. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Medical Informatics" and at least 15 C in the subject area "Health Care System".

bb. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Medical Informatics" (at least 18 C)

At least three of the following modules totalling at least 18 C must be successfully completed:

ii. Subject Area "Health Care System" (at least 9 C)

At least one of the following modules totalling at least 9 C must be successfully completed:

f. Computational Neuroscience

aa. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Computational Neuroscience" and at least 15 C in the subject area "Mathematics/Natural sciences".

bb. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Computational Neuroscience" (at least 11 C)

Modules totalling at least 11 C must be successfully completed in accordance with the following regulations.

A. Fundamentals

The following module of 3 C must be successfully completed:

B. Seminar

One of the following two modules of at least 4 C must be successfully completed:

C. Elective Modules

Furthermore, the following modules may be completed.

ii. Subject Area "Mathematics and Natural Sciences" (at least 9 C)

Modules totalling at least 9 C must be successfully completed in accordance with the following regulations.

A. Group 1

Modules totalling at least 6 C must be successfully completed:

B. Group 2

Furthermore, the following modules may be completed:

g. Information Technology Law

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

aa. Subject Area "Information Technology Law" (at least 12 C)

Modules totalling at least 12 C must be successfully completed in accordance with the following regulations.

i. Compulsory Elective Modules

At least two of the following modules totalling at least 12 C must be successfully completed.

ii. Optional Modules

Furthermore, the following modules may be completed:

bb. Subject Area "Jurisprudential Foundations" (at least 10 C)

Modules totalling at least 10 C must be successfully completed in accordance with the following regulations.

i. Compulsory Elective Modules I

At least one of the following modules totalling at least 4 C must be successfully completed

ii. Compulsory Elective Modules II

At least one of the following modules totalling at least 6 C must be successfully completed.

h. Business Information Systems

aa. Prerequisites

Relevant previous knowledge of at least 30 C, of which at least 15 C in the subject area "Business Information Systems" and at least 15 C in the subject area "Business Administration".

bb. Compulsory Elective Modules

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations. The following two subject areas must be successfully completed.

i. Subject Area "Business Information Systems" (at least 18 C)

Modules totalling at least 18 C must be successfully completed in accordance with the following regulations.

A. Group 1

At least one of the following modules totalling at least 12 C must be successfully completed:

B. Group 2

ii. Subject Area "Mathematics and Natural Sciences" (at least 15 C)

At least two of the following modules totalling at least 15 C must be successfully completed:

2. Subject Area "System-oriented Informatics" (at least 15 C)

At least two of the following modules totalling at least 15C must be successfully completed.

One of the following five module packages of at least 30C must be successfully completed. For the module package "Basics of Ecological Informatics", the following prerequisites have to be met: achievements of at least 6 C in in the field of nature conservation and spatial information systems.

a. Module Package "Specific Application Systems" (at least 30 C)

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Lecture

At least one of the following modules totalling at least 5 C must be successfully completed.

bb. Seminar

At least one of the following modules totalling at least 5 C must be successfully completed.

cc. Practical Course

At least one of the following modules totalling at least 5 C must be successfully completed. Only one of the modules M.Inf.1101 and M.Inf.1102 is allowed to be completed.

b. Module Package "Fundamentals of Bioinformatics" (at least 30 C)

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Group 1

Modules totalling at least 12 C must be successfully completed.

bb. Group 2

At least one of the following modules totalling at least 6 C must be successfully completed.

cc. Group 3

Furthermore, the following modules may be completed:

c. Module Package "Fundamentals of Business Information Systems" (at least 30 C)

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Group 1

At least two of the following modules totalling at least 12 C must be successfully completed.

bb. Group 2

At least two of the following modules totalling at least 12 C must be successfully completed.

d. Module Package "Fundamentals of Computational Neuroscience" (at least 30 C)

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Fundamentals

The following modules totalling 6 C must be successfully completed.

bb. Seminar

One of the following two modules of at least 4 C must be successfully completed:

cc. Elective Modules

Furthermore, the following modules may be completed:

e. Module Package "Fundamentals of Ecological Informatics" (at least 30 C)

Modules totalling at least 30 C must be successfully completed in accordance with the following regulations.

aa. Group 1

The following module of 6 C must be successfully completed.

bb. Group 2

At least three of the following modules totalling at least 18 C must be successfully completed:

cc. Group 3

Furthermore, the following modules may be completed:

2. System-oriented Informatics (at least 15 C)

At least two of the following modules totalling at least 15 C must be successfully completed.

XIII. Module Packages "Computer Science" of 36 C or 18 C

(only available in another suitable Master's programme)

1. Prerequisites

For the module packages „Computer Science“ of 36 C or 18 C, the following prerequisites apply:

Proof of achievements in fundamentals of computer science totalling at least 30 C. Proof of achievements in fundamentals of mathematics totalling at least 18 C. Proof of programming knowledge totalling at least 5 C. Proof of further achievements in computer science totalling at least 10 C.

2. Module Package "Computer Science" of 36 C

a. Study Objectives

Basic objective is to develop the ability to carry out independent scientific work in the field of system-oriented informatics. Furthermore, the knowledge in one of the fields of theoretical computer science, software engineering, databases or computer networks should be deepened, as well as competences in dealing with current scientific literature in this field should be acquired.

b. Overview of Modules

From the following offer, modules totalling at least 36 C must be successfully completed.

aa. Compulsory Elective Modules A

The following modules are recommended:

bb. Compulsory Elective Modules B

Furthermore, all modules according to section I point 1 ("Core Subject Studies") of the M.Sc. programme "Applied Computer Science" may be chosen.

3. Module Package "Computer Science" of 18 C

a. Study Objectives

The basic objective is to develop the ability to carry out independent scientific work in the field of system-oriented informatics. For this purpose advanced competences in system-oriented informatics, e.g. dealing with current scientific literature, should be acquired.

b. Overview of Modules

From the following offer, modules totalling at least 18 C must be successfully completed.

aa. Compulsory Elective Modules A

The following modules are recommended:

bb. Compulsory Elective Modules B

Furthermore, all modules according to section I point 1 ("Core Subject Studies") of the M.Sc. programme "Applied Computer Science" may be chosen.

XIV. Forms of Examination

As far as module descriptions are published in English in this module directory, the following classification applies to the forms of examination used:

- Oral exam = mündliche Prüfung [§ 15 Abs. 8 APO]
- Written exam = Klausur [§ 15 Abs. 9 APO]
- Term paper = Hausarbeit [§ 15 Abs. 11 APO]
- Presentation = Präsentation [§ 15 Abs. 12 APO]
- Presentation with written elaboration/report = Präsentation mit schriftlicher Ausarbeitung [§ 15 Abs. 12 APO]
- Practical examination = praktische Prüfung [§ 15 Abs. 13 APO]

APO = Allgemeinen Prüfungsordnung für Bachelor- und Master-Studiengänge sowie sonstige Studienangebote an der Universität Göttingen (English: "General examination regulations for Bachelor's and Master's programmes and other programmes offered at the University of Göttingen")

Georg-August-Universität Göttingen **Module B.Bio-NF.112: Biochemistry**	6 C 4 WLH

Learning outcome, core skills: Students acquire basic knowledge of biochemical substances and an overview over elementary principles of biochemical reactions and learn the application of biochemical methods. They get insight into the basics of protein chemistry and genetics: DNA, RNA, enzymes, carbohydrates, lipids and cell membranes; basics of metabolism and signal transduction.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Grundlagen der Biochemie (Lecture)	4 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Basic knowledge of biochemical reactions and its components as well as biochemical methods. Anabolism and catabolism of amino acids, carbohydrates, lipids and nucleic acids; synthesis and function of macromolecules; generation and accumulation of metabolic energy.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Dr. rer. nat. Ellen Hornung
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 20	

Additional notes and regulations: The combination of this module with module B.Bio.112 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.116: General developmental and cell biology**	6 C 4 WLH

Learning outcome, core skills: The students learn about developmental aspects in cell biology; fundamental topics in developmental biology of animals and plants; classic and molecular-biological methods in developmental biology and model organisms.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Allgemeine Entwicklungs- und Zellbiologie (Lecture)	4 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Students should be able to assess validity of statements, answer random control questions and describe and compare fundamental aspects from the fields: structure and compartments of cells, cytoskeleton, mitochondria, membrane structure and transport, contact and communication between cells, cell cycle, cell division, apoptosis, control of gene expression in eukaryotes, mechanisms in development, germ cells and fertilization, cleavage, principles in pattern formation, morphogenesis, gastrulation, neurulation, genesis of organs, cellular movement and shaping, methods from experimental embryology and developmental genetics, model organisms, formation of axis, genes for segmentation, homeotic selection genes, evolutionary developmental biology, neuronal development, stem cells and regeneration, homeostasis, origination of cancer, embryogenesis of plants, dormancy and germination, light dependent development, phytohormones, evolution and genetics during flower formation.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Ernst Anton Wimmer
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 25	

Additional notes and regulations: The combination of this module with module B.Bio.116 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.117: Genome analysis - lecture and seminar**	6 C 4 WLH
Learning outcome, core skills: The students will learn basic methods of genome analysis. After successful participation at this module, they have a basic knowledge in the field of genome sequencing, function and structure of genomes and algorithms for bioinformatical genome analysis.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Grundlagen der Bioinformatik (Lecture,Exercise) nach Absprache als Online-Veranstaltung oder in Präsenz	4 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Basic methods of genome analysis, in particular genome assembly, sequence alignment and basic algorithms for phylogenetic tree reconstruction based on genome sequences.	6 C

Admission requirements: BSc Biology: at least 40 C from the first study period	**Recommended previous knowledge:** For the module we assume basic programming skills (e.g. from the LINUX/PERL course, SK.Bio.114-1) or other programming courses.
Language: German	**Person responsible for module:** Prof. Dr. Jan de Vries
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 6
Maximum number of students: 14	

Additional notes and regulations:
The combination of this module with module B.Bio.117 or SK.Bio.117 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.118: Microbiology**	6 C 4 WLH

Learning outcome, core skills: Students acquire fundamental knowledge in systematics, cell biology, growth and reproduction, variety of metabolisms and the ecological, medical and biotechnological relevance of microorganisms. After passing the module, the students have the ability to differentiate microorganisms and know important biotechnological processes and mechanisms pathogens use to attack their hosts.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Allgemeine Mikrobiologie (Lecture)	4 WLH
Examination: Written examination (120 minutes) **Examination requirements:** In the examination, basics in microbiology are addressed concerning the systematic classification, various metabolic pathways, cell biology, the relevance of microorganisms to the industry, the environment and medicine and their application in these fields. The students should be able to assess current events related to microbiology.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Jörg Stülke
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 15	

Additional notes and regulations: The combination of this module with module B.Bio.118 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.123: Animal physiology**	6 C 4 WLH
Learning outcome, core skills: The students acquire comprehension for structure and function of nerve cells, glia cells, sensory cells and sensory organs; also comprehension for the principles of central processing of sensory information. They gain insight into the function of hormone systems and different vegetative functions like respiration, energy balance, digestion and excretion. The students gain insight into the complex interaction of physiological performances of the nervous, sensory and vegetative systems and thereby learn to appraise physiological reactions of animals. They learn to assess the relevance of single physiological performances for the whole organism and to better understand its adaptability to existing environmental conditions.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Tierphysiologie (Lecture)	4 WLH
Examination: Written examination (120 minutes) **Examination requirements:** The students should be able to validate statements on animal physiological facts and relationships in the fields neuro-, sensory and vegetative physiology; they should be able to answer random questions on function of sensory cells, neurons and organs regarding physiological aspects; they should have the ability to correctly describe and compare basics and the activity of physiological processes.	6 C

Admission requirements: 2-F-BA: at least 20 C from the orientation modules	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Ralf Heinrich
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 25	

Additional notes and regulations:
The combination of this module with module B.Bio.123 is not possible.

Georg-August-Universität Göttingen Module B.Bio-NF.125: Cell and molecular biology of plants	6 C 4 WLH
Learning outcome, core skills: The students gain insight into the characteristics of plant cells, learn to know the relation between structure and function of organelles and the cell wall and get an overview of transport processes and intracellular signal transduction. They learn to know the model plant Arabidopsis thaliana and acquire knowledge in biosynthesis, signal transduction, effects of phytohormones and the molecular methods for adaption of plants to different abiotic and biotic stress factors. The students get an overview of current facts of phylogeny and biotechnology of algae.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Zell- und Molekularbiologie der Pflanze (Lecture)	4 WLH
Examination: Written examination (75 minutes) **Examination requirements:** Arabidopsis thaliana as model organism for research on cell- and molecular processes; methods for research on cell- and molecular processes; mechanisms of protein transport in different cell organelles and into the cell wall; mechanisms of signal transduction in plants; mechanisms of plant immunity.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Christiane Gatz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 15	

Additional notes and regulations: The combination of this module with module B.Bio.125 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.126: Ecology of animals and plants**	6 C 3 WLH
Learning outcome, core skills: After passing the module the students have knowledge in the following fields and have the ability to interrelate these to each other: Basics in plant and animal ecology; ecophysiology of higher and lower plants; aut- and synecology; ecosystem research and ecology of soil systems.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Ökologie (Lecture)	3 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Abiotic environmental conditions; biotic interactions; coevolution; the relevance of the factor “resource”; ecological niche; population models; regulation of populations; relation of populations; competitors; predation; herbivory; mutualism; symbiosis; ecosystems; succession; diversity and disruption; nutrition networks; definition of an individual; Genet- Ramet concept; r-K-concept; case study “Global Change”.	6 C

Admission requirements: 2-F-BA: at least 20 C from the orientation modules	**Recommended previous knowledge:** Basic kowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Stefan Scheu
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 15	

Additional notes and regulations: The combination of this module with module B.Bio.126 is not possible.

Georg-August-Universität Göttingen Module B.Bio-NF.127: Evolution and systematics of plants	6 C 4 WLH
Learning outcome, core skills: The students acquire basic knowledge in evolution, phylogenetic history, systematics and ecology of terrestrial plants (focus on flowering plants). They learn about the spectrum of methods for the reconstruction of the evolution of land plants in time and location and methods for the systematical classification and denotation.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Evolution und Systematik der Pflanzen (Lecture)	4 WLH
Examination: Written examination (60 minutes) **Examination requirements:** In the written examination, the students should be able to validate statements on the evolution and systematics of terrestrial plants and the spectrum of methods for reconstruction of evolution. They should have the ability to answer questions on these topics and also on basics in taxonomy and nomenclature.	6 C

Admission requirements: 2-F-BA: at least 20 C from the orientation modules	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Elvira Hörandl
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 15	

Additional notes and regulations:
The combination of this module with module B.Bio.127 is not possible.

Georg-August-Universität Göttingen **Module B.Bio-NF.128: Evolution and systematics of animals**	6 C 5 WLH
Learning outcome, core skills: The students acquire the ability to comprehend basic concepts and the way of thinking of the ecological, evolution biological and systematic research. The students learn to know the abundance of structures and phylogenetic relations in selected groups of animals.	**Workload:** Attendance time: 70 h Self-study time: 110 h
Course: Phylogenetisches System und Evolution der Tiere (Lecture)	5 WLH
Examination: Written examination (60 minutes) **Examination requirements:** Phylogeny and evolution of animals; basics in biological systematics (morphological and molecular methods); abundance of structures and phylogenetic relations of selected groups of animals; knowledge in systematics and biology of animal taxa; skills in systematic classification of animals in particular from indigenous biocoenoses.	6 C

Admission requirements: 2-F-BA: at least 20 C from the orientation modules	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Christoph Bleidorn
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 15	

Additional notes and regulations:
The combination of this module with module B.Bio.128 is not possible.

Georg-August-Universität Göttingen Module B.Bio-NF.129: Genetics and microbial cell biology	6 C 4 WLH
Learning outcome, core skills: The students gain basic knowledge of classic and molecular genetics and cell biology as well as an overview of genetic, molecular and cellular biological methods and model organisms. They get an insight into inheritance of genetic information and the complex regulation of gene expression, After passing the module they should have the ability to understand how the development and morphology of single and multicellular organisms are regulated by genes and how genes influence the structure and function of cells.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Genetik und mikrobielle Zellbiologie (Lecture)	4 WLH
Examination: Written examination (90 minutes) **Examination requirements:** The students should be able to answer random questions from the fields of genetic and cell biology and to validate statements on genetic and cellular biological facts and relations. The basis for these abilities is the content of the lecture and the answering of a catalog of questions with the help of the accompanying tutorials. For the genetics prat, the lecture is based on the book Watson, 6th Edition, Molecular Biology of the Gene (Pearson) and for the cell biology part on selected chapters from the book Alberts et al., 5th Edition, Molecular Biology of the Cell (Garland Science).	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: German	**Person responsible for module:** Prof. Dr. Gerhard Braus
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 15	

Additional notes and regulations: The combination of this module with module B.Bio.129 is not possible.

Georg-August-Universität Göttingen Module B.Bio.102: Lecture series biology II	8 C 6 WLH
Learning outcome, core skills: The students get an insight into the fields of Biology to assure a common basic level of knowledge for constitutive modules. They acquire basic knowledge of biochemistry, immunology, genetics, bioinformatics, developmental biology, microbiology and plant physiology.	**Workload:** Attendance time: 84 h Self-study time: 156 h
Course: Biological lecture series II (Biochemistry, Genetics, Bioinformatics)	3 WLH
Examination: Written examination (60 minutes) **Examination requirements:** Basic knowledge in the fields biochemistry (chemical structures of carbohydrates, proteins, fats, as well as basic knowledge in the central metabolic pathways like glycolysis, citric acid cycle and redox reactions, respiratory chain, degradation of proteins, the urea cycle, digestive enzymes), genetics (the structure of DNA and RNA, transcription and translation, principles in inheritance and gene regulation for pro- and eucaryotes) and bioinformatics (basics in Bioinformatics regarding algorithms for alignments and reconstruction of phylogenetic trees)	4 C
Course: Biological lecture series II (Immunology, Developmental biology, Microbiology, Plant physiology)	3 WLH
Examination: Written examination (60 minutes) **Examination requirements:** Basic knowledge and skills in the disciplines of immunology (natural and adaptive immune system, variability of antibodies, immunological reactions, infections and vaccination), developmental biology (knowledge of the concepts of developmental biology and its model organisms), microbiology (diversity, importance and organization of microorganisms, growth and reproduction, microbial metabolic types) and plant physiology (basic knowledge of plant physiology such as photosynthesis, water transport, plant hormones and plant reproduction).	4 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Stefanie Pöggeler
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 2
Maximum number of students: 240	

Additional notes and regulations: The exams are conducted as e-exams

Georg-August-Universität Göttingen **Module B.DH.02: Introduction to Computational Image and Artefact Analysis**	6 C 4 WLH
Learning outcome, core skills: Die Studierenden • haben einen Überblick über wesentliche Gegenstände und Problemstellungen der Digitalen Bild- und Objektwissenschaft; • können wissenschaftliche, gesellschaftliche und ethische Folgen und Perspektiven der Digitalen Bild- und Objektanalyse einschätzen; • kennen zentrale Fragen der Digitalen Bild- und Objektwissenschaft, relevante Case Studies und die wichtigsten Werkzeuge zum Erstellen, Verwalten und Verarbeiten digitaler Daten (z.B. Korpusbildung, Bildverarbeitung, 3D Erfassung, Bild- und Objektdatenbanken, quantifizierende Methoden, Virtual Heritage).	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Einführung in die Digitale Bild- und Objektwissenschaft (Lecture)	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** regelmäßige Teilnahme am Tutorium sowie Ausarbeitung einer praktischen Anwendung im Umfang von max. 5 Seiten. **Examination requirements:** Die Studierenden weisen im Bereich der Bild- und Objektwissenschaften Kenntnisse spezifisch geisteswissenschaftlicher Fragestellungen, Vorgehensweisen und Forschungsergebnisse auf Grundlage digitaler Datenverarbeitung nach sowie die Fähigkeit, Methoden und Theoriebildungen in den Digital Humanities nachzuvollziehen und in Ansätzen zu reflektieren.	6 C
Course: Tutorium (Tutorial)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.33: Information Retrieval and Corpus Formation for Text and Language Data**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der automatisierten Erfassung und Pflege von Text- und Sprachdaten; • sind in der Lage, gängige Such- und Retrievalverfahren theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität textueller und sprachlicher Datenstrukturen • können an ausgewählten Beispielen etablierte Verfahren der Massendigitalisierung, Korpusabfrage, Big Data Analyse und Visualisierung sprachlicher Phänomene evaluieren und diskutieren.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden des Information Retrieval und der Korpusbildung, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Seminar zu erbringen.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Dr. Anna Dorofeeva
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.34: Computational Analysis of Linguistic Heterogeneity**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • verstehen in Ansätzen die Komplexität und Heterogenität von Sprache (u.a. linguistische Varietäten, unterschiedliche Sprachfamilien und Schriftsysteme, ressourcenarme Sprachen); • sind in der Lage die damit einhergehenden Herausforderungen für die digitale Analyse theoretisch zu durchdringen; • können an ausgewählten Beispielen etablierte Lösungsstrategien evaluieren und diskutieren.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH

Course: Vertiefungsseminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme am Seminar und Vertiefungsseminar sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden der Korpus- und Computerlinguistik sowie der Sprachtechnologie, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Vertiefungsseminar zu erbringen	9 C

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Marco Coniglio
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module B.DH.35: Multimodal Analysis of Humanities Data**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • lernen an einer spezifischen Problemstellung gemeinsame Probleme der Digitalen Text- und Bildwissenschaften in der Erfassung, Analyse und Präsentation geisteswissenschaftlicher Daten (z.B. im Bereich der Klassifikation, Sentimentanalyse, Narratologie, Intermedialität, Populärkultur) kennen; • sind vertraut mit den medialen Eigenschaften von Texten und Bildern und den digitalen Methoden ihrer Erforschung; • verstehen in Ansätzen die Komplexität und Heterogenität von multimodalen Datenstrukturen; • können an ausgewählten Beispielen etablierte Verfahren der multimodalen Analyse von Daten vergleichen und evaluieren; • besitzen die Fähigkeit, geisteswissenschaftliche Fragestellungen aus den Querschnittsbereichen Sprache, Text, Bild, Objekt und Informationswissenschaft mit computergestu¨tzten Methoden zu modellieren; • wissen, welche digitalen Hilfsmittel für die Beschreibung und Interpretation von sozio-kulturellen Mustern und Prozessen am besten geeignet sind.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden weisen vertiefte Kenntnisse spezifisch bildwissenschaftlicher Fragestellungen, Vorgehensweisen und Forschungsergebnisse und deren Umsetzung mit digitalen Methoden nach und können verschiedene Vorgehensweisen und Forschungsergebnisse nachvollziehen und reflektieren. Die Prüfungsleistung im Seminar zu erbringen.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6

Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.41: Strategies and Methods of Computational Image Analysis**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der digitalen Bildwissenschaften; • sind in der Lage, bildwissenschaftlicher Forschungsfragen (z.B. aus den Bereichen Content Based Image Retrieval, Digitale Bildanalyse und Bildmustererkennung, Kulturelle Netzwerke, Rezeptionsforschung und Wahrnehmungsanalyse, Virtualisierung und mediale Vermittlung) theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität von bildwissenschaftlichen Datenstrukturen; • können an ausgewählten Beispielen etablierte Verfahren der Digitalisierung, Analyse und Präsentation von Bilddaten evaluieren und diskutieren; • wissen, welche digitalen Hilfsmittel für die Beschreibung und Interpretation von Mustern und Prozessen historischer Gesellschaften und Bilderwelten am besten geeignet sind.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden der digitalen Bildwissenschaften, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Seminar zu erbringen. Vorlesung und/oder Seminar können nach Angebot auch durch e-learning Komponenten, die erfolgreiche Teilnahme an einem Workshop oder einer Summer School ersetzt werden.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.42: Strategies and Methods of Computational Artefact Analysis**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der digitalen Objektwissenschaften; • sind in der Lage, objektwissenschaftlicher Forschungsfragen (z.B. aus den Bereichen 3D Modellierung, CAD und FEM basierte digitale Rekonstruktionen, Shape Analysis, Object Mining, Form-Funktionsanalysen, Kulturelle Netzwerke, Rezeptionsforschung und Wahrnehmungsanalyse, Virtualisierung und mediale Vermittlung, naturwissenschaftliche Verfahren zur Analyse von Objekten) theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität von objektwissenschaftlichen Datenstrukturen; • können an ausgewählten Beispielen etablierte Verfahren der Digitalisierung, Analyse und Präsentation von Objektdaten evaluieren und diskutieren; • wissen, welche digitalen Hilfsmittel für die Beschreibung und Interpretation von Mustern und Prozessen historischer Gesellschaften und ihrer materiellen Kultur am besten geeignet sind.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben **Examination requirements:** Die Studierenden weisen vertiefte Kenntnisse spezifisch objektwissenschaftlicher Fragestellungen, Vorgehensweisen und Forschungsergebnisse und deren Umsetzung mit digitalen Methoden nach und können verschiedene Vorgehensweisen und Forschungsergebnisse nachvollziehen und reflektieren. Die Prüfungsleistung im Seminar zu erbringen. Seminar und/oder Übung können nach Angebot auch durch e-learning Komponenten, die erfolgreiche Teilnahme an einem Workshop oder einer Summer School ersetzt werden.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner

Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.43: Strategies and Methods of Computational Spatial Analysis**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der digitalen Bildwissenschaften; • sind in der Lage, bildwissenschaftlicher Forschungsfragen (z.B. aus den Bereichen Content Based Image Retrieval, Digitale Bildanalyse und Bildmustererkennung, Kulturelle Netzwerke, Rezeptionsforschung und Wahrnehmungsanalyse, Virtualisierung und mediale Vermittlung) theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität von bildwissenschaftlichen Datenstrukturen; • können an ausgewählten Beispielen etablierte Verfahren der Digitalisierung, Analyse und Präsentation von Bilddaten evaluieren und diskutieren; • wissen, welche digitalen Hilfsmittel für die Beschreibung und Interpretation von Mustern und Prozessen historischer Gesellschaften und Bilderwelten am besten geeignet sind.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) oder Projektbericht (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden der digitalen Geowissenschaften, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Seminar zu erbringen. Seminar und/oder Übung können nach Angebot auch durch e-learning Komponenten, die erfolgreiche Teilnahme an einem Workshop oder einer Summer School ersetzt werden.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen Module B.DH.44: Image Retrieval and Corpus Formation	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der automatisierten Erfassung von Bildern und Objekten; • sind in der Lage, Verfahren der massenhaften Analyse von Bilddaten theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität von visuellen Datenstrukturen; • können an ausgewählten Beispielen etablierte Verfahren der Massendigitalisierung, Big Data Analyse und Visualisierung von visuellen Phänomenen evaluieren und diskutieren.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden des Image Retrieval und der Korpusbildung, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Seminar zu erbringen. Seminar und/oder Übung können nach Angebot auch durch e-learning Komponenten, die erfolgreiche Teilnahme an einem Workshop oder einer Summer School ersetzt werden.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module B.DH.45: Digital Analysis of Contexts and Networks**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • vertiefen ihre Kenntnisse der Grundlagen- und Methodenforschung im Bereich der visuellen Netzwerke und digitalen Kontextanalyse; • sind in der Lage, kontextuelle Forschungsfragen mit Hilfe der Netzwerkanalyse theoretisch zu durchdringen; • verstehen in Ansätzen die Komplexität und Heterogenität von kontextabhängigen Datensets und ihren Abhängigkeiten; • können an ausgewählten Beispielen etablierte Verfahren der Netzwerkanalyse evaluieren und diskutieren; • wissen, welche digitalen Hilfsmittel für die Beschreibung und Interpretation von Mustern und Prozessen historischer Gesellschaften und ihrer materiellen Kultur am besten geeignet sind.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Seminar (Seminar)	2 WLH
Examination: Referat (max. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme an Seminar und Übung sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben **Examination requirements:** Die Studierenden beherrschen verschiedene Methoden der digitalen Netzwerkanalyse, die sie in praktischer Anwendung und zum Teil in experimenteller Weise auf gegebene Forschungsprobleme anwenden können. Die Prüfungsleistung ist im Seminar zu erbringen. Seminar und/oder Übung können nach Angebot auch durch e-learning Komponenten, die erfolgreiche Teilnahme an einem Workshop oder einer Summer School ersetzt werden.	9 C

Course: Übung (Exercise)	2 WLH

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 25	

Georg-August-Universität Göttingen Module B.Forst.1101: Elements of Forest Botany	6 C 4 WLH
Learning outcome, core skills: Das Modul gibt einen Überblick über Zellbiologie und funktionelle Anatomie von Gehölzen. Die Veranstaltungen umfassen die Einführung in den molekularen Bau der Zelle, die Bedeutung von Speicherstoffen, den Bau der Wurzel, des Stamm mit Schwerpunkt auf dem Transportsystem, der Anatomie von Blättern mit Besonderheiten der Anpassung an unterschiedliche Standorte sowie Aufbau und Funktion des Phloems und von Abschlussgeweben. Wichtige organismische Interaktionen, z.B. mit Mykorrhizapilzen werden eingeführt. In den Übungen wird der Inhalt der Vorlesungen anhand von Beispielen mittels mikroskopischer und histochemischer Techniken veranschaulicht. Die Studierenden erlernen ihre Beobachtungen objektiv zu beschreiben (Protokollführung). In dem Modul werden Kenntnisse über die Biologie einzelner Zellen bis hin zum ganzen Organismus an Hand von Bäumen und deren Besonderheiten vermittelt	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Grundlagen der Forstbotanik (Lecture)	2 WLH
Course: Übungen zur Forstbotanik (Exercise)	2 WLH
Examination: Written examination (120 minutes)	6 C
Examination requirements: Die Studierenden erbringen den Nachweis, dass sie Kenntnisse über die funktionelle Anatomie des Pflanzenkörpers und wichtige biologische Prozesse in Bäumen erworben haben und dieses Wissen wiedergeben können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Dr. Ines Teichert
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Forst.1104: Forest Zoology, Wildlife Biology and Hunting Science**	6 C 5 WLH
Learning outcome, core skills: Die Studierenden erwerben grundlegende Kenntnisse zu Systematik, Ökologie und Verhalten einheimischer Insekten und Wirbeltiere, über ihre Rolle in Waldökosystemen, ihre Nutzung, (jagdliche) Steuerung und Erhaltung, Habitatgestaltung, Jagdrecht, sowie Jagdmethodik.	**Workload:** Attendance time: 70 h Self-study time: 110 h
Course: Forstzoologie (Lecture,Exercise)	2 WLH
Course: Wildbiologie und Jagdkunde (Lecture)	2 WLH
Course: Jagdrecht (Lecture)	1 WLH
Examination: Written examination (100 minutes)	6 C
Examination requirements: Die Studierenden weisen grundlegende Kenntnisse über Systematik, Physiologie, Ökologie und Verhalten von Insekten im Kontext mit dem Ökosystem Wald nach.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Niko Balkenhol
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 1
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module B.Forst.1106: Bioclimatology	6 C 4 WLH
Learning outcome, core skills: Verständnis der grundlegenden atmosphärischen Faktoren wie Wind, Strahlung, Lufttemperatur und -feuchte und ihres Einflusses auf den Wald, des Kohlenstoff- und Wasserkreislaufes auf lokaler bis globaler Skala sowie des Klimawandels.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Bioklimatologie (Lecture)	4 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** Bioklimatologie - Vorleistung Selbstlernmodule	6 C
Examination requirements: Bioklimatologie - Klausur Nachweis, die wichtigsten Prozesse in der Atmosphäre und ihrer Wechselwirkung mit Vegetation verstanden zu haben; quantitative Analysen mit Hilfe von grundlegenden Gleichungen; Erstellen und Interpretation von Grafiken, die funktionale Zusammenhänge abbilden. Bioklimatologie - Vorleistung Selbstlernmodule Nach Abschluss eines Kapitels (je ca. 1 Woche lang) bearbeiten die Studierenden ein Selbstlernmodul mit 5-10 Fragen (Dauer ca. 30 min). Sie haben dafür maximal eine Woche Zeit. Es müssen 50% der Selbstlernmodule bestanden werden.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Alexander Nils Knohl
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Forst.1108: Soil Science**	6 C 4 WLH

Learning outcome, core skills: Einführung in die Bodenbildung und -entwicklung: Kentnisse der Bodenbildungsprozesse, Bodenentwicklung auf unterschiedlichen Ausgangssubstraten, Boden- und Standortseigenschaften, ökologische Bewertung von Böden. Grundlagen der Bodenbiogeochemie: Kentnisse der wichtigsten chemischen, biologischen und physikalischen Prozesse in Böden, Wechselwirkungen zwischen festen, flüssigen, gasförmigen und lebenden Phasen in Böden, Vertiefung der Kenntnisse über die Prozesse der Bodengenese.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Einführung in die Bodenbildung und -entwicklung (Lecture,Excursion,Exercise)	2 WLH
Course: Grundlagen der Bodenbiogeochemie (Lecture,Excursion,Exercise)	2 WLH
Examination: Written examination (120 minutes)	6 C

Examination requirements: Qualitative und quantitative Zusammenhänge der Bodenbildungsprozesse und Bodenbiogeochemie.	

Admission requirements: none	**Recommended previous knowledge:** Naturwissenschaftliche Grundlagen (B.Forst.1103)
Language: German	**Person responsible for module:** N. N.
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Forst.1110: Silviculture**	9 C 6 WLH
Learning outcome, core skills: Die Studierenden kennen die Grundzüge des Wachstums von Bäumen und Beständen sowie der natürlichen Dynamik von Wäldern, können die Wirkungsweise von waldbaulichen Eingriffen erklären und kennen verschiedene Optionen zum naturnahen Management von Waldbeständen im Hinblick auf unterschiedliche Ziele.	**Workload:** Attendance time: 84 h Self-study time: 186 h
Course: Waldbau (Lecture)	6 WLH
Examination: Written examination (120 minutes)	9 C
Examination requirements: Kenntnisse waldökologischer Zusammenhänge und ihrer Bedeutung für die Bewirtschaftung von Wäldern. Vertiefte Kenntnisse zu waldbaulicher Verfahren, insbesondere zu Möglichkeiten der Bestandesbegründung, -pflege und –verjüngung, Fähigkeit die Wirkungsweise waldbaulicher Maßnahmen auf der Grundlage eines gesicherten ökologischen Wissens zu erklären.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Christian Ammer
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module B.Forst.1114: Forest Genetics	6 C 4 WLH
Learning outcome, core skills: Grundkenntnisse in klassischer und molekularer Genetik. Kenntnisse in moderner forstgenetischer Forschung auf der Basis genetischer Marker. Verständnis der Bedeutung genetischer Information für das Wachstum von Bäumen sowie der zeitlichen und räumlichen Dynamik genetischer Strukturen von Waldbaumpopulationen. Grundkenntnisse über die Erhaltung und Nutzung forstgenetischer Ressourcen.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Forstgenetik (Lecture,Exercise)	4 WLH
Examination: Written examination (120 minutes)	6 C
Examination requirements: Nachweis von Kenntnissen in klassischer und molekularer Genetik, Populationsgenetik, Evolution sowie in Anwendungen genetischer Forschung in den Forstwissenschaften.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Oliver Gailing
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Forst.1115: Silviculture Practice**	3 C 4 WLH
Learning outcome, core skills: Die Studierenden sollen in die Lage versetzt werden, Boden, Vegetation und Bestand im Gelände umfassend anzusprechen und im Hinblick auf die Entwicklung waldbaulicher Handlungsalterativen zu bewerten. Sie sollen darüber hinaus die Fähigkeit erwerben selbstständig praxisnahe Empfehlungen zur Behandlung von Waldbeständen zu entwickeln.	**Workload:** Attendance time: 56 h Self-study time: 34 h
Course: Waldbau - Übungen (Exercise)	4 WLH
Examination: Written examination (120 minutes)	3 C
Examination requirements: Fähigkeit im Gelände die Standortsverhältnisse im Hinblick auf die Baumartenwahl einschätzen zu können, sowie auf der Grundlage einer ausführlichen Bestandesbeschreibung geeignete waldbauliche Maßnahmen für einen konkreten Waldbestand abzuleiten.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Christian Ammer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module B.Forst.1117: Forest Business Administration	6 C 5 WLH
Learning outcome, core skills: Neben der Vermittlung des erforderlichen fachbezogenen Basiswissens (Grundlagen der forstlichen Kosten u. Leistungsrechnung, Betriebsstatistik, Planungs- u. Investitionsrechnung) sollen die Studierenden mit den Instrumenten der entscheidungsorientierten forstlichen Betriebswirtschaftslehre vertraut gemacht werden; das betrifft insbesondere die Methoden der Waldbewertung und Entscheidungsfindung zu verschiedenen forstbetrieblichen Funktionsbereichen (wie Beschaffung, Produktion, Absatz, Finanzierung, forstlicher Steuerlehre) . Dabei soll durch praktische Übungen die Fähigkeiten zum problembezogenen Denken und zur eigenständigen Problemlösung gestärkt werden.	**Workload:** Attendance time: 70 h Self-study time: 110 h
Course: Forstliche Betriebswirtschaftslehre (Lecture,Exercise)	5 WLH
Examination: Written examination (90 minutes)	6 C
Examination requirements: Die Studierenden weisen in der Modulprüfung nach, dass sie • das fachbezogene Basiswissen der Vorlesung vollständig wiedergeben können, • die kennengelernten Ansätze auf vergleichbare Problemstellungen übertragen und diese lösen können, • Konzepte und Instrumente der entscheidungsorientierten forstlichen Betriebswirtschaftslehre erklären und anwenden können, • die eigenen Lösungen kritisch reflektieren und Altennativen aufzeigen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Carola Paul
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module B.Forst.1118: Forest Monitoring I	6 C 5 WLH

Learning outcome, core skills: Die Studierenden sollen die Themenbereiche „Waldmesslehre“, „Waldinventur“, „Vermessungslehre“ und „Fernerkundung“ in ihrer Bedeutung für die Daten- und Informationsbeschaffung für Entscheidungsprozesse und Forschungsaufgaben in praktisch aller anderen forstlichen Disziplinen kennen und einordnen können. Sie sollen die grundlegenden Techniken und Methoden beherrschen, um deren Einsatz in konkreten Projekten der Forschung und der Anwendung optimieren zu können. Die Übungen vermitteln Kenntnisse im Umgang mit Messgeräten für grundlegende Anwendungen in der Waldinventur. Die Studierenden sollen die wissenschaftlichen Grundlagen der Waldinventur beherrschen lernen (Prinzipien und Techniken der Erfassung von Einzelbaum- und Wald-bezogenen Attributen), um forstliche, waldökologische oder landschaftsökologische Projekte in Forschung und Anwendung hinsichtlich Datenerfassung und –auswertung effizient planen, durchführen und berichten zu können. Grundlage hierfür ist auch das Beherrschen von Messgeräten und Auswertungsalgorithmen. Ein wichtiger Fokus liegt hier auf "Datenqualität" und der Reduktion von Zufallsfehlern, die es in allen empirischen Datenerhebungen gibt. Zu den Lernzielen gehört die Fähigkeit zur eigenständigen effizienten Planung, Durchführung, Auswertung und Analyse von Datenerfassungen in Forstwirtschaft, Forstwissenschaft und Ökologie. Dazu gehören auch die Lösung grundlegender Vermessungsaufgaben, der Einsatz von GNSS Empfängern und digitaler Kartographie, sowie der Einsatz von Fernerkundungsmethoden, sowie ein grundlegendes Verständnis über die Anwendung unterschiedlicher Fernerkundungsdaten wie z.B. Luft- oder Satellitenbildern oder auch TLS/ALS LiDAR Punktwolken.	**Workload:** Attendance time: 70 h Self-study time: 110 h

Course: Waldinventur (Lecture,Exercise)	5 WLH
Examination: Klausur (90 Minuten, Gewichtung: 75%) und praktische Prüfung (ca. 30 Minuten, Gewichtung: 25%)	6 C

Examination requirements: Die Studierenden sollen nachweisen, dass sie Kenntnisse und Fertigkeiten bezüglich grundlegender Methoden der Messung und Schätzung von Attributen von Bäumen und Waldbeständen besitzen. Die Studierenden sollen Kenntnisse der wissenschaftlichen Grundlagen der Waldinventurmethoden nachweisen und auch grundlegende Aufgaben zu Planung, Implementation und Auswertung von Waldinventurdaten lösen können. Im praktischen Teil der Prüfung soll die Sicherheit im korrekten Umgang mit relevanten Messgeräten nachgewiesen werden. Die Gewichtung der Einzelprüfungsergebnisse zur Ermittlung der Gesamtnote erfolgt nach erreichter Anzahl Punkte.	

Admission requirements: none	**Recommended previous knowledge:** Grundlagen der beschreibenden Statistik, Geometrie und Trigonometrie aus der Schulmathematik
Language: German	**Person responsible for module:** Prof. Dr. Christoph Kleinn
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 4
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Forst.1122: Tree Growth and Forest Management Planning**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Erwerb von Grundkenntnissen über die Wachstumsprozesse von Einzelbäumen und Beständen in ihrer Abhängigkeit von Zeit, Standortbedingungen, waldbaulichen Maßnahmen und biotischen oder abiotischen Störfaktoren. Aufbau und Anwendung von Waldwachstumsmodellen als Entscheidungshilfe für den Forstbetrieb und die Forstplanung. Vermittlung von Grundkenntnissen und Methoden der Forstplanung (Forsteinrichtung). Die Waldzustandserfassung und -beschreibung, die Zuwachsprognose mithilfe von Wuchsmodellen und die Planung der nachhaltigen Waldentwicklung bilden thematische Schwerpunkte. Teilnehmer/-innen dieser Veranstaltung lernen, alternative forstliche Nutzungs- und Pflegemaßnahmen auf der Grundlage der rechtlichen Vorgaben, der betrieblichen Ziele, der standörtlichen Voraussetzungen sowie der waldwachstumskundlichen Gesetzmäßigkeiten zu beurteilen und zu planen. Die Veranstaltung fördert selbständiges Denken, das Verständnis für Zusammenhänge und die Fähigkeit zur Planung und Berwertung nachhaltiger forstlicher Nutzungskonzepte.	Attendance time: 56 h Self-study time: 124 h

Course: Einführung in die Waldwachstumskunde (Lecture,Excursion,Exercise)	2 WLH
Course: Einführung in die Forsteinrichtung (Lecture,Excursion,Exercise)	2 WLH
Examination: Written examination (120 minutes)	6 C

Examination requirements:	
Grundkenntnisse zu Wachstumsprozessen von Einzelbäumen und Beständen und zu Aufbau und Anwendung von Waldwachstumsmodellen. Grundkenntnisse in den Methoden der Forstplanung. Hierzu zählen die Waldzustandserfassung und -beschreibung, die Anwendung von Wuchsmodellen zu Prognose- und Simulationszwecken und die Analyse und Planung forstlicher Nutzungs- und Pflegemaßnahmen.	

Admission requirements: none	**Recommended previous knowledge:** Waldinventur, Waldbau, Standortskunde
Language: German	**Person responsible for module:** Prof. Dr. Carola Paul
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** 5
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Inf.1214: Types and Programming Languages**	8 C 6 WLH

Learning outcome, core skills: A type system is a syntactic method for enforcing levels of abstraction in programs. The study of type systems—and of programming languages from a type-theoretic perspective—has important applications in software engineering, language design, high-performance compilers, and security. In this lecture, we will discuss the following topics: • Lambda calculus • Static and dynamic semantics of programming languages • Functional programming • Curry-Howard correspondence • Computational logic • Proof assistants • Typed intermediate languages Expertise: • Get acquainted with the aims of the module Methodological competence: • Students will get familiar with the jargon used in scientific publications about programming languages Personal competence: • Learn how to read scientific publications about programming languages • Teamwork skills	**Workload:** Attendance time: 84 h Self-study time: 156 h

Course: Types and Programming Languages (TaPL) (Lecture) *Types and Programming Languages*. February 2002. Benjamin C. Pierce. The MIT Press. ISBN: 978-0-262-16209-8	4 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** >=50% points in homework assignments in groups of 2-3 students **Examination requirements:** Lambda calculus; Static and dynamic semantics of programming languages; Functional programming; Curry-Howard correspondence; Computational logic; Proof assistants; Typed intermediate languages	8 C

Course: Types and Programming Languages (TaPL) - Exercise (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Roland Leißa
Course frequency: each summer semester	**Duration:** 1 semester[s]

Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 60	

Georg-August-Universität Göttingen Module B.Inf.1215: Compiler Construction	6 C 4 WLH
Learning outcome, core skills: Basic concepts of compiler design & implementation • Lexing, Parsing • Semantic Analysis, Type Checking • Program Analysis & Optimizations • SSA • LLVM	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Compiler Construction (Lecture) • Aho, Alfred Vaino; Lam, Monica Sin-Ling; Sethi, Ravi; Ullman, Jeffrey David (2006). Compilers: Principles, Techniques, and Tools. ISBN 0-321-48681-1. • Helmut Seidl, Reinhard Wilhelm, Sebastian Hack: Compiler Design - Analysis and Transformation. Springer 2012, ISBN 978-3-642-17547-3. • Helmut Seidl, Reinhard Wilhelm, Sebastian Hack: Compiler Design - Syntactic and Semantic Analysis. Springer 2013, ISBN 978-3-642-17539-8. • Andrew W. Appel, Jens Palsberg: Modern Compiler Implementation in Java, 2nd edition. Cambridge University Press 2002, ISBN 0-521-82060-X.	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** >=50% points in homework assignments in groups of 2-3 students **Examination requirements:** Basic concepts of compiler design and implementation: Lexing, Parsing; Semantic Analysis, Type Checking; Program Analysis and Optimizations; SSA; LLVM	6 C
Course: Compiler Construction - Exercise (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Roland Leißa
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 60	

Georg-August-Universität Göttingen Module B.Inf.1216: Compiler Lab	6 C 2 WLH
Learning outcome, core skills: Expertise: • Know basic concepts of compiler design & implementation. Methodological competence: • Students will be able to design and implement a compiler from scratch. Personal competence: • Learn how to read software documentation and a language specification. • Learn how to cope with a huge software stack. • Teamwork skills.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Compiler Lab (Lecture)	2 WLH
Examination: Project work (6 weeks in groups of 2 – 3 students) and oral project presentation (approx. 30 minutes per group) **Examination requirements:** Implementation of a compiler that translates a subset of C into executable code via LLVM. Automatic testing & project presentation.	6 C

Admission requirements: Compiler Construction (B.Inf.1215 or equivalent). Taking B.Inf.1215 and B.Inf.1216 concurrently is recommended.	**Recommended previous knowledge:** Basic skills in C/C++ are advantageous but the course will include a crash course in C++.
Language: English	**Person responsible for module:** Prof. Dr. Roland Leißa
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 60	

Georg-August-Universität Göttingen Module B.Inf.1231: Infrastructures of Data Science	6 C 4 WLH

Learning outcome, core skills: Upon completion the course, students • understand the basic functions of data science infrastructures and their significance. • understand basic data types and their specifics. • understand the most important technical infrastructures for storing and processing data locally and in the cloud as well as their advantages and disadvantages in relation to data science applications. • can apply the concept of the data lake to basic data science problems. • are able to apply the different steps of data pre-processing to selected data sets. • can identify the characteristics of time series and graph data and are able to recall the functions of DBMSs designed for their processing. • can present the basic tasks of data analysis platforms and can describe them using examples. • can apply methods and tools for the presentation and visualisation of data. • can model basic data science workflows and are able to transfer their knowledge to basic data science projects.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Infrastructures of Data Science (Lecture,Exercise) *Contents*: • Data types and their characteristics • Common functions of data science infrastructures • Storage, compute, and cloud infrastructures for data science • Concept of a data lake • Data pre-processing methods and selected tools • Time series and graph data, the respective DBMS, and query languages • Data analytics platforms • Data presentation and visualization • Data science workflows and selected infrastructure components	4 WLH
Examination: In-class, written exam (90 min) or oral exam (approx. 30 min.) **Examination prerequisites:** Students complete 50% of the homework exercises. **Examination requirements:** Through the examination students demonstrate that they are able to describe basic functions of (cloud-based) data science infrastructures as well as to specify and identify basic data types. Students can also prove their understanding of data lakes and can apply their knowledge of MapReduce and Hadoop in that particular context. They can analyse basic data pre-processing problems and sketch common solutions. Student can show that they understand time series and graph data as well as the corresponding DBMS and that they can present common tasks of data analysis platforms. Through the examination, students also demonstrate their ability to select appropriate methods for visualising data and show that they are able to create basic data science workflows.	6 C

Admission requirements: none	**Recommended previous knowledge:** Python and basic database knowledge (recommended, not mandatory)
Language: English	**Person responsible for module:** Hon.-Prof. Dr. Philipp Wieder
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 3 - 6; Master: 1 - 2
Maximum number of students: 50	

Georg-August-Universität Göttingen Module B.Inf.1236: Machine Learning	6 C 4 WLH
Learning outcome, core skills: Students • learn concepts and techniques of machine learning and understand their advantages and disadvantages compared with alternative approaches • learn techniques of supervised learning for classification and regression • learn techniques of unsupervised learning for density estimation, dimensionality reduction and clustering • implement machine learning algorithms like linear regression, logistic regression, kernel methods, tree-based methods, neural networks, principal component analysis, k-means and Gaussian mixture models • solve practical data science problems using machine learning methods	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Machine Learning (Lecture) Bishop: Pattern recognition and machine learning. https://cs.ugoe.de/prml	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** B.Inf.1236.Ex: At least 50% of homework exercises solved and N-1 attempts presented to tutors **Examination requirements:** Knowledge of the working principles, advantages and disadvantages of the machine learning methods covered in the lecture	6 C

Course: Machine Learning - Exercise (Exercise) *Contents*: Students present their solutions of the homework exercises to tutors and discuss them with their tutors.	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Knowledge of basic linear algebra and probability English language proficiency at level B2 (CEFR)
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4
Maximum number of students: 100	

Georg-August-Universität Göttingen Module B.Inf.1237: Deep Learning for Computer Vision	6 C 4 WLH
Learning outcome, core skills: Students • learn concepts and techniques of deep learning and understand their advantages and disadvantages compared to alternative approaches • learn to solve practical data science problems using deep learning • implement deep learning techniques like multi-layer perceptrons, convolutional neural networks and other modern deep learning architectures • learn techniques for optimization and regularization of deep neural networks • learn applications of deep neural networks for computer vision tasks such as segmentation and object detection	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Deep Learning for Computer Vision (Lecture) Goodfellow, Bengio, Courville: Deep Learning. https://www.deeplearningbook.org Bishop: Pattern Recognition and Machine Learning. https://cs.ugoe.de/prml	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** B.Inf.1237.Ex: At least 50% of homework exercises solved and N-1 attempts presented to tutors **Examination requirements:** Knowledge of basic deep learning techniques, their advantages and disadvantages and approaches to optimization and regularization. Ability to implement these techniques.	6 C
Course: Deep Learning for Computer Vision - Exercise (Exercise) *Contents*: Students present their solutions of the homework exercises to tutors and discuss them with their tutors.	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of linear algebra and probability Completion of B.Inf.1236 Machine Learning or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Constantin Pape Prof. Dr. Alexander Ecker
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 5
Maximum number of students: 100	

Georg-August-Universität Göttingen **Module B.Inf.1240: Visualization**	6 C 4 WLH
Learning outcome, core skills: Knowledge of • the potentials and limitations of data visualization • the fundamentals of visual perception and cognition and their implications for data visualization. Students can apply these to the design of visualizations and detect manipulative design choices • a broad variety of techniques for visual representation of data, including abstract and high-dimensional data. Students can select appropriate methods on new problems • integration of visualization into the data analysis process, algorithmic generation and interactive methods	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Visualization (Lecture,Exercise)	4 WLH
Examination: Practical project (2-3 weeks) with presentation and questions during oral exam in groups (approx. 20 minutes per examinee). **Examination prerequisites:** At least 50% of homework exercises solved. **Examination requirements:** Knowledge of potentials and limitations of data visualization, fundamentals of visual perception and their implications for good design choices, techniques for visual representation and how to use them.	6 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of linear algebra and analysis (e.g. B.Mat.0801 and B.Mat.0802) and programming skills (e.g. B.Inf.1842).
Language: English	**Person responsible for module:** Prof. Dr. Bernhard Schmitzer
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 6
Maximum number of students: 50	

Georg-August-Universität Göttingen Module B.Inf.1241: Computational Optimal Transport	6 C 4 WLH
Learning outcome, core skills: Knowledge of • the fundamental notions of optimal transport, and its strengths and limitations as a data analysis tool • the discrete Kantorovich formulation, its convex duality, and Wasserstein distances • classical numerical algorithms, entropic regularization, and their scopes of applicability • examples for data analysis applications. Students can transfer these to new potential applications	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Computational Optimal Transport (Lecture,Exercise)	4 WLH
Examination: Written exam (90 minutes) or oral exam (approx. 20 minutes) **Examination prerequisites:** At least 50% of homework exercises solved. **Examination requirements:** Knowledge of Kantorovich duality, Wasserstein distances, standard algorithms and implications for data analysis applications.	6 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of linear algebra and analysis (e.g. B.Mat.0801 and B.Mat.0802) and programming skills (e.g. B.Inf.1842).
Language: English	**Person responsible for module:** Prof. Dr. Bernhard Schmitzer
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module B.Inf.1244: Data Management for Data Science**	5 C 4 WLH

Learning outcome, core skills: The module provides the fundamental conceptual, systemic and application-related aspects of the sustainable utilization of data from its creation and publication to its sustainable storage. Organized handling of data includes the processes of archiving and re-using data. This covers the strategic planning of research projects (research data management), the management of the technical foundations and the recording, organization, and linking of metadata. The participants will learn approaches to handle big data, including all facets of heterogenous or fast streaming data. We will also work on the concepts of (web) APIs in order to empower the participants to collect and combine their own data sets. The latter requires an understanding of standard processes such as Extract-Transform-Load (ETL). Data integration and interoperability of different data sources is the central challenge. The learned concepts will be tested and applied using advanced solutions. We will investigate the current market of data management tools, warehouse solutions or data processing platforms. The students develop the ability to think in systems and processes. The students are able to transfer their acquired knowledge and skills for problem solving to new areas of responsibility, to work together in groups and to work on new issues together.	**Workload:** Attendance time: 56 h Self-study time: 94 h

Course: Data Management for Data Science (Lecture,Exercise) *Contents*: • Data management processes in the context of the data life cycle • Tools for data management • Provision of data for data science processes • Data quality and data security • Data handling in the context of IoT • ETL/ELT processes • Stream & batch processing • Read-only-data structures • Data Lakes vs Data Warehouse • Event-driven data architectures *Course frequency:* each winter semester	4 WLH
Examination: Written examination (120 minutes) **Examination requirements:** • Describing the data lifecycle • Understanding different approaches for data archiving • Explaining the structure, functionality and use of practice-relevant data management, storage and archiving systems • Understanding the ETL/ELT processes for data handling • Describing the concepts of data warehousing and data lakes • Describing the concepts and challenges for Big Data and data at scale	5 C

• Understanding the read only data store architecture	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Sven Bingert
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module B.Inf.1248: Language as Data**	6 C 4 WLH
Learning outcome, core skills: After completion of this module, students can • make appropriate use of terminology and explain theoretical concepts to describe characteristics of language data • describe foundational knowledge of representation learning for language data • apply language technology software to text datasets and interpret the output • discuss limitations of language models and their ethical implications	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Language as Data (Lecture)	2 WLH
Examination: Written exam (90 minutes) or oral exam (20 minutes) **Examination prerequisites:** successful completion of exercise projects **Examination requirements:** Students need to achieve the learning goals	6 C
Course: Language as Data - Exercise (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Python programming skills Foundations of machine learning
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module B.Inf.1249: Introduction to Robotics**	6 C 4 WLH
Learning outcome, core skills: After successful completion of this course, students: • Explain the basics of serial kinematic chains, their mathematical representations, and perform computations of forward and backward kinematics. • Apply these mathematical models to transfer them to parallel kinematics. • Describe the basic principles of motion planning along trajectories, including obstacle avoidance and dynamics. • Discuss the challenges of operating robots in the real world and apply solutions in application scenarios, including calibration, localization, and robot control.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Introduction to Robotics (Lecture) *Contents*: Robot types, serial kinematic chains, mathematical models of kinematic chains, forward kinematics, backward kinematics, kinematics of parallel robotics, mobile robotics, trajectory planning, control strategies, calibration *Literature*: M. Spong et al.: Robot Modeling and Control - Wiley & Sons, 2005 S. Niku: Introduction to Robotics: Analysis, Control, Applications - Wiley & Sons, 2010	2 WLH
Examination: Written Exam (90 Min.) or Oral Exam (ca. 20 Min.) **Examination prerequisites:** At least 50% of homework exercises solved and N-1 attempts presented to tutors. **Examination requirements:** The students must be able to: • repeat and explain lecture material • perform kinematic calculations • apply and adopt algorithms discussed in the lecture to specific application scenarios	6 C
Course: Introduction to Robotics - Exercise (Exercise) *Contents*: Students present their solutions of the homework exercises to tutors and discuss them with their tutors.	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of linear algebra and analysis
Language: English	**Person responsible for module:** Prof. Dr. Jannis Hagenah
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 3

Maximum number of students: 100	

Georg-August-Universität Göttingen **Module B.Inf.1250: Deep Learning for Natural Language Processing**	9 C 4 WLH

Learning outcome, core skills: The course seeks to enable students to solve a wide range of applied problems in Natural Language Processing. After successfully completing the course, the participants should be able to: • Explain state-of-the-art methods to tackle NLP sub-problems, such as text representation, information extraction, text mining, language modeling, and similarity detection • Determine the conceptual requirements of specific NLP tasks • Assess the strengths and limitations of state-of-the-art NLP approaches • Devise solutions for complex, interdisciplinary NLP problems by implementing and adapting suitable algorithms and data structures • Evaluate NLP methods and systems quantitatively and qualitatively	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Lecture Deep Learning for Natural Language Processing (Lecture) *Contents*: The lecture will cover the following topics: Foundational NLP • Text representation (words, sentences, paragraphs, documents) • Text processing, stopwords, regular expressions, tokenization, stemming, lemmatization • Bag-of-Words, weighting schemes (e.g., tf-idf), information retrieval • Minimum edit distance • Language models, N-grams, perplexity, smoothing • Word sense, lexical databases, distance measures • Word embeddings (sparse and dense vector representation) • Vector representation • Evaluation and metrics Deep Learning • Neural Networks • Feed-Forward Networks • Activation functions, cost function, gradient descent, regularization • Backpropagation • Neural Language Models, RNN (and improvements) • Vanishing Gradients • Seq2Seq • Attention • Transformers, self-attention • Pre-training and post-training (e.g., supervised fine-tuning, reinforcement learning with human feedback, direct preference optimization) • Large language models and related topics (e.g., adaptation, prompting, reasoning) Applications	2 WLH

• Lexical databases, lexical semantics • Word sense disambiguation, semantic similarity • Part-of-speech tagging, parsing • Word similarity, word dissimilarity, distance measures • Text classification • Sentiment analysis/evaluation • Named entity recognition, information extraction, relation extraction • Questioning and answering, chatbots • Text generation and summarization • Machine translation Please visit www.gipplab.org/teaching for details on this course.	
Course: Practical Course Deep Learning for Natural Language Processing (Practical course) *Contents*: In the practical course, students work on applied research projects (teamwork is possible) that address complex NLP downstream tasks and subtasks, such as: • Word sense disambiguation and similarity • Document and sentence classification • Named entity recognition • Question and answering systems • Text generation and summarization • Paraphrase generation and detection • Sentiment analysis • Part-of-speech tagging • Machine translation Applications that participants can address in their projects include but are not limited to: • Plagiarism and paraphrase detection • Social media analysis • Fake news identification and classification • Detection of political opinions • Identification of opinion polarity • Online harassment and bias identification systems • Sentiment analysis in social media • Question and answering systems • Semantic evaluation Invited speakers may present selected advanced topics in NLP during the lecture and/or tutorial sessions. Using the programming language Python is mandatory. Please visit www.gipplab.org/teaching for details on this course.	2 WLH
Examination: Written test (90 min.) and Project submission; in case of 15 or fewer participants: oral exam (approx. 20 min.) and project presentation (approx. 20 min.) **Examination requirements:**	9 C

Examination for the lecture (40% of the final grade)

- Knowledge of major NLP tasks, sub-tasks, and applications
- Ability to explain state-of-the-art methods to address NLP tasks, such as text representation, information extraction, text mining, language modeling, and similarity detection
- Ability to analyze the conceptual requirements of specific NLP tasks
- Ability to compare the suitability of state-of-the-art NLP approaches for specific tasks
- Ability to evaluate NLP methods and systems quantitatively and qualitatively

Examination for the practical course (60% of the final grade)

- Ability to analyze the conceptual requirements of specific NLP problems
- Ability to determine the conceptual requirements of specific IR and NLP problems
- Ability to compare the suitability of algorithms and data structures for specific NLP problems
- Ability to devise solutions for complex, interdisciplinary NLP tasks by implementing and adapting suitable algorithms and data structures.
- Ability to evaluate NLP methods and systems quantitatively and qualitatively

The examination for the lecture and the practical course must be completed successfully in the same semester. A repeated examination always encompasses both components.

Admission requirements:	**Recommended previous knowledge:**
none	This is an advanced course primarily intended for master’s students. Advanced bachelor's students can participate in the course if they possess the following recommended previous knowledge: Advanced knowledge of Python is required to complete the course. Experience with numpy, sckit-learn, pandas, and other libraries in the SciPy ecosystem is beneficial. At the University of Göttingen's computer science department, the courses B.Inf.1101: Grundlagen der Informatik und Programmierung and B.Inf.1842: Programmieren für Data Scientists: Python provide a good foundation for this course. Knowledge of neural networks is strongly recommended to participate in this course. Participants should be familiar with basic neural network architectures, hidden layers, activation functions, derivatives, classification, training and test strategies, precision, recall, backpropagation, gradients, and other foundational topics in machine learning and artificial neural networks. We strongly recommend completing at least two of the following

	courses prior or concurrently to this course to obtain the knowledge required for this course: • B.Inf.1236 Machine Learning or equivalent • B.Inf.1237: Deep Learning for Computer Vision or equivalent • B.Inf.1248: Language as Data or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Béla Gipp PD Dr. Terry Lima Ruas
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 4 - 6; Master: 1 - 3
Maximum number of students: 50	

Additional notes and regulations:

The course provides a good foundation for a bachelor's or master's thesis in our group. Visit https://gipplab.org/students-corner/graduation-projects for our current theses proposals.

The module B.Inf.1250 may not be taken if the module M.Inf.2202 has already been completed.

Georg-August-Universität Göttingen Module B.Inf.1251: Deep Learning for Computer Vision Advanced	4 C 1 WLH
Learning outcome, core skills: This course expands and deepens the competences acquired in B.Inf.1237 Deep Learning for Computer Vision. After successful completion of this module, students • explain concepts and techniques of deep learning and discuss their advantages and disadvantages compared to alternative approaches • solve practical data science problems using deep learning • explain and apply techniques for optimization and regularization of deep neural networks • apply deep neural networks on computer vision tasks such as segmentation and object detection • develop and implement solutions that address common computer vision tasks at a fundamental level. • discuss and compare existing implementations for computer vision tasks.	**Workload:** Attendance time: 14 h Self-study time: 106 h
Course: Deep Learning for Computer Vision Advanced (Lecture)	0,5 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** (1) Participation and submission of results in all exercise sessions. Presentation of at least one task. (2) Successful completion of the examination prerequisite of B.Inf.1237 Deep Learning for Computer Vision. **Examination requirements:** Knowledge of basic deep learning techniques, their advantages and disadvantages and approaches to optimization and regularization. Ability to implement these techniques.	4 C
Course: Deep Learning for Computer Vision Advanced - Exercise (Exercise) *Contents*: Students present their solutions of the homework exercises to tutors and discuss them with their tutors.	0,5 WLH

Admission requirements: parallel participation in B.Inf 1237	**Recommended previous knowledge:** Basic knowledge of linear algebra and probability Completion of B.Inf.1236 Machine Learning or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Constantin Pape Prof. Dr. Alexander Ecker
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 3
Maximum number of students:	

20	

Georg-August-Universität Göttingen Module B.Inf.1701: Advanced Theoretical Computer Science	5 C 3 WLH
Learning outcome, core skills: Dieses Modul baut die Kompetenzen aus dem Modul B.Inf.1201 aus. Es geht um den Erwerb fortgeschrittener Kompetenz im Umgang mit theoretischen Konzepten der Informatik und den damit verbundenen mathematischen Techniken und Modellierungstechniken.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Vorlesungen zur Codierungstheorie, Informationstheorie oder Komplexitätstheorie (Lecture,Exercise) *Contents*: Vertiefung in einem der folgenden Gebiete: Komplexitätstheorie (Erkundung der Grenzen effizienter Algorithmen), Datenstrukturen für boolesche Funktionen, Kryptographie, Informationstheorie, Codierungstheorie, Signalverarbeitung.	
Examination: Klausur (90 Minuten) oder mündliche Prüfung (ca. 20 Min.)	5 C
Examination requirements: Nachweis über den Erwerb vertiefter weiterführender Kompetenzen aus dem Kompetenzbereich der Module *B.Inf.1201 Theoretische Informatik* oder *B.Inf.1202 Formale Systeme*.	

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1201, B.Inf.1202
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module B.Inf.1704: Advanced Computer Engineering	5 C 3 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet der technischen Informatik erworben, z.B. auf dem Gebiet Sensorik und Aktorik.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Sensorik und Aktorik (Lecture,Exercise) *Contents*: Die Studierenden • kennen die Grundlagen der Mess- und Regelungstechnik für die Sensorik und Aktorik • können die Begriffe Sensor und Aktor definieren • kennen Verfahren, Prinzipien und Methoden für die Messung mit Sensoren und Steuerung mit Aktoren • kennen Eigenschaften realer Sensoren und Aktoren • kennen Sensor- und Aktor-Systeme • kennen speicherprogrammierbare Steuerung (programmable logic controller, PLC) • kennen ein Feldbus (fieldbus) und ein Industrial-Ethernet-System, sowie die zugehörigen Protokolle • können Informations- und Echtzeitsysteme unterscheiden *Course frequency:* once a year	
Examination: Written examination (90 minutes) **Examination requirements:** Grundlagen der Mess- und Regelungstechnik; Definition von Sensor und Aktor; Mess-/Steuerungsverfahren; Mess-/Steuerungsprinzipien; Mess-/Stuerungsmethoden; Eigenschaften realer Sensoren und Aktoren; Sensor- und Aktorik-Systeme; speicherprogrammierbare Steuerung; Feldbus; Industrial-Ethernet; Informationssystem; Echtzeitsysteme	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1212
Language: German, English	**Person responsible for module:** Dr. Henrik Brosenne
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module B.Inf.1705: Advanced Software Engineering**	5 C 3 WLH

Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen aus einem Gebiet der Softwaretechnik erworben. Beispiele für Gebiete der Softwaretechnik in denen vertiefte Kenntnisse und Kompetenzen erworben werden können sind Requirements Engineering, Qualitätssicherung oder Softwareevolution.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Software Testing (Lecture,Exercise) *Contents*: The students • can define the term software quality and acquire knowledge on the principles of software quality assurance. • become acquainted with the general test process and know how the general test process can be embedded into the overall software development process. • gain knowledge about manual static analysis and about methods for applying manual static analysis. • gain knowledge about computer-based static analysis and about methods for applying computer-based static analysis. • gain knowlege about black-box testing and about the most important methods for deriving test cases for black-box testing. • gain knowlege about glass-box testing and about the most important methods for deriving test cases for glass-box testing. • acquire knowledge about the specialities of testing of object oriented software. • acquire knowledge about tools that support software testing. • gain knowledge about the principles of test managment.	3 WLH
Examination: Klausur (90 Minuten) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Develop and present the solution of at least one exercise (presentation and report) and active participation in the exercises. **Examination requirements:** Software quality, principles of software quality assurance, general test process, static analysis, dynamic analysis, black-box testing, glass-box testing, testing of object-oriented systems, testing tools, test management	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101, B.Inf.1209
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Maximum number of students: 30	

Georg-August-Universität Göttingen **Module B.Inf.1706: Advanced Databases**	6 C 4 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen aus einem Gebiet der Datenbanken erworben. Beispiele für Gebiete der Datenbanktechnik in denen vertiefte Kenntnisse und Kompetenzen erworben werden können sind Semistrukturierte Daten und XML, Semantic Web, sowie Deduktive Datenbanken.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Semistrukturierte Daten und XML (Lecture,Exercise)	4 WLH
Course: Semantic Web (Lecture,Exercise)	4 WLH
Course: Deduktive Datenbanken (Lecture,Exercise)	4 WLH
Examination: Klausur (90 Minuten) oder mündliche Prüfung (ca. 25 Min.) **Examination requirements:** Semistrukturierte Daten und XML • Konzepte semistrukturierter Datenmodelle und die Parallelen sowie Unterschiede zum "klassischen" strukturierten, relationalen Datenmodell;. Fähigkeit zur Beurteilung, welche Technologien in einer konkreten Anwendung zu wählen und zu kombinieren sind; praktische Grundkenntnisse in den üblichen Sprachen dieses Bereiches; Überblick über die historische Entwicklung von Modellen und Sprachen im Datenbankbereich; Fähigkeit zum Nachvollziehen wissenschaftlicher Fragestellungen und Vorgehensweisen. Semantic Web • Kenntnisse der theoretischen Grundlagen und technischen Konzepte des Semantic Web; Fähigkeit zum Abschätzen des Nutzens und der Grenzen der verwendeten Technologien; Fähigkeit zur Abwägung realer Szenarien; Fähigkeit zum Nachvollziehen wissenschaftlicher Fragestellungen und Vorgehensweisen. Deduktive Datenbanken • Vertiefte Kenntnisse der im Datenbankbereich zugrundeliegenden Theorie. Praktische Anwendung logikbasierter Programmiersprachen.	6 C

Admission requirements: *Semistrukturierte Daten und XML*: B.Inf.1206 *Semantic Web:* B.Inf.1202 und B.Inf.1206 *Deduktive Datenbanken:* B.Inf.1202 und B.Inf.1206	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students:	

30	

Georg-August-Universität Göttingen **Module B.Inf.1707: Advanced Computernetworks**	5 C 3 WLH

Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen aus einem Gebiet der Computernetzwerke erworben. Beispiele für Gebiete der Computernetzwerke in denen vertiefte Kenntnisse und Kompetenzen erworben werden können sind z.B. Mobilkommunikation, Sensornetzwerke, Computer- und Netzwerksicherheit.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Mobile Communication (Lecture,Exercise) *Contents*: On completion of the module students should be able to: • explain the fundamentals of mobile communication including the use of frequencies, modulation, antennas and how mobility is managed • distinguish different multiple access schemes such as SDMA (Space Division Multiple Access), FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access) and their variations as used in cellular networks • describe the history of cellular network generations from the first generation (1G) up to now (4G), recall their different ways of functioning and compare them to complementary systems such as TETRA • explain the fundamental idea and functioning of satellite systems • classify different types of wireless networks including WLAN (IEEE 802.11), WPAN (IEEE 802.15) such as Bluetooth and ZigBee, WMAN (IEEE 802.16) such as WiMAX and recall their functioning • explain the challenges of routing in mobile ad hoc and wireless sensor networks • compare the transport layer of static systems to the transport layer in mobile systems and explain the approaches to improve the mobile transport layer performance • differentiate between the security concepts used in GSM and 802.11 security as well as describe the way tunnelling works	3 WLH
Examination: Klausur (90 Minuten) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Erarbeiten und Vorstellen der Lösung mindestens einer Übungsaufgabe (Präsentation und schriftliche Ausarbeitung), sowie die aktive Teilnahme an den Übungen. **Examination requirements:** Fundamentals of mobile communication (frequencies, modulation, antennas, mobility management); multiple access schemes (SDMA, FDMA, TDMA, CDMA) and their variations; history of cellular network generations (first (1G) up to current generation (4G) and outlook to future generations); complementary systems (e.g. TETRA); fundamentals of satellite systems; wireless networks (WLAN (IEEE 802.11), WPAN (IEEE 802.15) such as Bluetooth and ZigBee, WMAN (IEEE 802.16) such as WiMAX); routing in MANETs and WSNs; transport layer for mobile systems; security challenges in mobile networks such as GSM and 802.11 and tunneling	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101, B.Inf.1204
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module B.Inf.1709: Advanced Algorithms and Data Structures**	5 C 4 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet aus dem Bereich Algorithmen und Datenstrukturen erworben. Beispiele für solche Gebiete sind Algorithms on Sequences und Advanced Topics on Algorithms.	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Algorithms on Sequences (Lecture,Exercise) *Contents*: This course is an introduction into the theory of stringology, or algorithms on sequences of symbols (also called words or strings). Our main intention is to present a series of basic algorithmic and combinatorial results, which can be used to develop efficient word-processing tools. While the emphasis of the course is on the theoretical side of stringology, we also present a series of applications of the presented concepts in areas like data-compression or computational biology. We expect that the participants to this course will gain an understanding of classical string-processing tools. They are supposed to understand and be able to use in various situations: classical text algorithms (e.g., pattern matching algorithms, edit distance), classical text indexing data structures (e.g., suffix arrays / trees), and classical combinatorial results that are useful in this context (e.g., periodicity lemmas). The main topics our course will cover are: basic combinatorics on words, pattern matching algorithms, data structures for text indexing (suffix arrays, suffix trees), text compression (Huffman encoding, Lempel-Ziv method), detection of regularities in words, algorithms for words with don't care symbols (partial words), word distance algorithms, longest common subsequence algorithms, approximate pattern matching. The presentation of each theoretical topic from the above will be accompanied by a brief discussion on its possible applications. Literature • T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: Introduction to Algorithms (3rd Edition), MIT Press, 2009. • M. Crochemore, C. Hancart, T. Lecroq: Algorithms on Strings, Cambridge University Press, 2007. • M. Crochemore, W. Rytter: Jewels of Stringology, World Scientific, 2002. • D. Gusfield. Algorithms on strings, trees, and sequences: computer science and computational biology. Cambridge University Press, 1997. *Course frequency:* irregular	4 WLH
Course: Advanced Topics on Algorithms (Lecture,Exercise) *Contents*: In this course we present a series of selected results on data structures and efficient algorithms, and discuss a series of areas in which they can be applied successfully. The emphasis of the course is on the theory, we also approach the problem of a practical implementation of the presented algorithms.	4 WLH

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We expect that the students that will participate in this lecture will become familiar with efficient sorting and searching methods, advanced data structures, dynamic data structures, as well as other efficient algorithmic methods, they will be able to estimate the complexity of those algorithms, and they will be able to apply those algorithms to particular programming problems (from practical or theoretical settings).

The main topics our course will cover are: efficient sorting and searching (non-comparison based methods, van Emde Boas trees, Radix Sort), advanced tree-structures (Fibonacci heaps, B-Trees, structures for working with disjoint sets), dynamic data structures (range minimum queries, lowest common ancestor, applications to string algorithms: suffix arrays, suffix trees), Hashing and Dictionaries, Young tableaux, geometric algorithms (convex hull), number theoretic algorithms. The presentation of each theoretical topic from the above will be accompanied by a brief discussion on its possible applications.

Literature

T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: Introduction to Algorithms (3rd Edition), MIT Press, 2009.
E. Demaine: Advanced Data Structures, MIT Course nr. 6.851, 2012.
Pawel Gawrychowski and Mayank Goswami and Patrick Nicholson: Efficient Data Structures, MPI Course, Summer 2014.

Course frequency: irregular
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Examination: Oral examination (approx. 20 minutes)
Examination requirements:
Algorithms on Sequences

basic combinatorics on words
pattern matching algorithms
data structures for text indexing (suffix arrays, suffix trees)
text compression (Huffman encoding, Lempel-Ziv method)
detection of regularities in words
algorithms for words with don't care symbols (partial words)
word distance algorithms
longest common subsequence algorithms
approximate pattern matching

Advanced Topics on Algorithms

efficient sorting and searching (non-comparison based methods, van Emde Boas trees, Radix Sort)
advanced tree-structures (Fibonacci heaps, B-Trees, structures for working with disjoint sets)
dynamic data structures (range minimum queries, lowest common ancestor, applications to string algorithms: suffix arrays, suffix trees)
Hashing and Dictionaries
Young tableaux
geometric algorithms (convex hull)
number theoretic algorithms

</td><td>5 C</td></tr>
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Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101, B.Inf.1103
Language: English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen Module B.Inf.1710: Advanced Computer Security and Privacy	5 C 4 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet aus dem Bereich Computersicherheit und Privatheit erworben. Beispiele für solche Gebiete sind "Usable Security and Privacy" und "Privacy in Ubiquitous Computing".	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Usable Security and Privacy (Lecture,Exercise) On completion of the lecture, students should be able to: • Understand the needs for usability in secure and privacy-preserving solutions and the associated challenges, • Present and discuss selected themes addressed in the research area of usable security and privacy, • Define and understand the principles and guidelines to apply when designing new solutions, • Describe and compare different methodologies to conduct user studies, • Plan user studies from their design to the processing and presentation of the results. *Course frequency:* irregular	4 WLH
Course: Privacy in Ubiquitous Computing (Lecture,Exercise) *Contents*: After successful completion of the lecture, students are able to: • Define and understand the key concepts of privacy and ubiquitous computing, • Identify and classify threats to privacy in ubiquitous computing, • Describe, compare, and choose fundamental techniques to protect privacy, • Understand and analyze cutting-edge solutions. *Course frequency:* irregular	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination requirements:** Usable Security and Privacy • Introduction to usable security and privacy, selected topics in the research field of usable security and privacy, human-computer interaction principles and guidelines, methods to design and evaluate usable solutions in the area of security and privacy. Privacy in Ubiquitous Computing • Introduction to privacy and ubiquitous computing, privacy threats, privacy-enhancing technologies, wireless sensor networks, smart meters, participatory sensing, RFIDs, Internet-of-Things.	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101, B.Inf.1210

Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module B.Inf.1711: Advanced Sensor Data Processing**	5 C 4 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet aus dem Bereich Sensordatenverarbeitung erworben. Beispiele für solche Gebiete sind "Sensor Data Fusion" und "Mobile Robotics".	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Sensor Data Fusion (Lecture,Exercise) *Contents*: This lecture is concerned with fundamental principles and algorithms for the processing and fusion of noisy (sensor) data. Applications in the context of navigation, object tracking, sensor networks, robotics, Internet-of-Things, and data science are discussed. After completion, students are able to • define the notion of data fusion and distinguish different data fusion levels • formalize data fusion problems as state estimation problems • develop distributed and decentralized data fusion architectures • describe the basic concepts of linear estimation theory • explain the fundamental formulas for the fusion of noisy data • deal with unknown correlations in data fusion • understand the Bayesian approach to data fusion and estimation • formulate dynamic models for time-varying phenomena • describe the concept of a recursive Bayesian state estimator • explain and apply the Kalman filter for state estimation in dynamic systems • explain and apply basic nonlinear estimation techniques such as the Extended Kalman filter (EKF) and Unscented Kalman filter (UKF) • assess the properties, advantages, and disadvantages of the discussed (nonlinear) estimators • explain different approaches to deal with uncertainty such as probability theory, fuzzy theory, and Dempster–Shafer theory • identify data fusion applications and assess the benefits of data fusion *Course frequency:* irregular	4 WLH
Course: Mobile Robotics (Lecture,Exercise) *Contents*: This lecture is concerned with fundamental principles and algorithms for mobile robot navigation and perception. After completion, the students are able to • model the locomotion of wheeled mobile robots • understand the concept of dead reckoning • describe the most common sensors for mobile robots, e.g., inertial sensors and beam-based sensors • employ probabilistic state estimation methods such as Kalman filters and sequential Monte Carlo methods (particle filters) for robot navigation and perception	4 WLH

• describe and distinguish different concepts for localization such as trilateration and triangulation • implement and evaluate basic algorithms for localization • understand the robot mapping problem and explain different map representations such as occupancy grids • describe the problem of Simultaneous Localization and Mapping (SLAM) • implement and evaluate basic algorithms for SLAM such as graph-based approaches and Rao-Blackwellized particle filters • implement and evaluate basic feature extraction methods such as Random Sample Consensus (RANSAC) • design basic planning algorithms for mobile robots using, e.g., a Markov Decision Process (MDP) *Course frequency:* irregular	
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination requirements:** Sensor Data Fusion • Definition of data fusion; data fusion levels; formalization of data fusion problems; distributed and decentralized fusion architectures; linear estimation theory; fundamental fusion formulas; dynamic state estimation; Kalman filter; Extended Kalman filter (EKF); Unscented Kalman filter (UKF), algorithms for dealing with unknown correlations; fuzzy theory; Dempster-Shafer theory Mobile Robotics • Motion models for wheeled robots; dead reckoning; mobile robot sensors; Kalman filter; particle filter; localization concepts and algorithms; robot mapping; Simultaneous Localization and Mapping (SLAM); feature extraction methods; planning algorithms	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101, B.Inf.1211
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module B.Inf.1712: Advanced High Performance Computing**	6 C 4 WLH
Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet aus dem Bereich Hochleistungsrechnen erworben. Beispiele für solche Gebiete sind High-Performance Data Analytics.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: High-Performance Data Analytics (Lecture,Exercise) *Contents*: Data-driven science requires the handling of large volumes of data in a quick period of time. Executing efficient workflows is challenging for users but also for systems. This module introduces concepts, principles, tools, system architectures, techniques, and algorithms toward large-scale data analytics using distributed and parallel computing. We will investigate the state-of-the-art of processing data of workloads using solutions in High-Performance Computing and Big Data Analytics. Topics cover: • Challenges in high-performance data analytics • Use-cases for large-scale data analytics • Performance models for parallel systems and workload execution • Data models to organize data and (No)SQL solutions for data management • Industry relevant processing models with tools like Hadoop, Spark, and Paraview • System architectures for processing large data volumes • Relevant algorithms and data structures • Visual Analytics • Parallel and distributed file systems Guest talks from academia and industry will be incorporated in teaching that demonstrates the applicability of this topic. Weekly laboratory practicals and tutorials will guide students to learn the concepts and tools. In the process of learning, students will form a learning community and integrate peer learning into the practicals. Students will have opportunities to present their solutions to the challenging tasks in the class. Students will develop presentation skills and gain confidence in the topics.	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 30 Min.) **Examination requirements:** High-Performance Data Analytics • Challenges in high-performance data analytics • Use-cases for large-scale data analytics • Performance models for parallel systems and workload execution • Data models to organize data and (No)SQL solutions for data management • Industry relevant processing models with tools like Hadoop, Spark, and Paraview • System architectures for processing large data volumes	6 C

• Relevant algorithms and data structures • Visual Analytics • Parallel and distributed file systems	

Admission requirements: none	**Recommended previous knowledge:** Basic programming skills, Basic knowledge of Linux operating systems, Python
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module B.Inf.1713: Advanced Data Science**	5 C 3 WLH

Learning outcome, core skills: Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet der Data Science erworben, z.B. auf dem Gebiet Mensch-Maschine-Interaktion.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Mensch-Maschine-Interaktion (Lecture,Exercise) *Contents*: In diesem Kurs werden unterschiedliche Bereiche der Mensch-Maschine-Interaktion (Human-Computer-Interaction) beleuchtet. Ein Schwerpunkt wird auf Usability Engineering und den darin verwendeten Methoden liegen. Dazu zählt die Unterscheidung von expertenorientierten und nutzerorientierten Methoden für die Evaluation von Nutzerschnittstellen und entsprechenden Methodenbeispielen. Es werden zudem Themen wie Design Pattern für Nutzerschnittstellen und Besonderheiten der Wahrnehmung von Nutzer_Innen angesprochen. Zudem werden unterschiedlichen Arten von aktuellen Nutzerschnittstellen, wie Voice User Interfaces, Augmented Reality und Virtual Reality beleuchtet und voneinander abgegrenzt. Ziel des Kurses ist es den Studierenden einen breiten Überblick über die richtige Herangehensweise beim Design und der Entwicklung von Nutzerschnittstellen zu vermitteln. Das Wissen kann später für alle Arten von Nutzerschnittstellen eingesetzt werden. *Course frequency:* irregular	
Examination: Written examination (90 minutes) **Examination prerequisites:** Teilnahme am Übungsbetrieb und die Präsentation mindestens einer Übungslösung **Examination requirements:** Usability Engineering und die darin verwendeten Methoden, expertenorientierten und nutzerorientierten Methoden für die Evaluation von Nutzerschnittstellen, Design Pattern für Nutzerschnittstellen, aktuelle Nutzerschnittstellen (z.B. Voice User Interfaces, Augmented Reality und Virtual Reality), Design und der Entwicklung von Nutzerschnittstellen	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module B.Inf.1714: Advanced Practical Computer Science	5 C 3 WLH

Learning outcome, core skills:	**Workload:**
Die Studierenden haben vertiefte Kenntnisse und Kompetenzen auf einem Gebiet der Praktischen Informarik erworben, z.B. auf folgenden Gebieten. • Softwaretechnik • Betriebssysteme • Compilerbau und Programmiersprachen • Embedded Systems • Mobile Edge Computing • Pervasive Computing	Attendance time: 42 h Self-study time: 108 h

Course: Praktische Informatik (Lecture,Exercise) *Course frequency:* irregular	
Examination: Written examination (90 minutes)	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Studiendekan Informatik
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module B.Inf.1802: Training in Programming**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Die Studierenden erlernen eine objektorientierte Programmiersprache, sie • kennen die gängigen Programmierwerkzeuge (Compiler, Build-Management-Tools) und können diese benutzen. • kennen die Grundsätze und Techniken des objektorientierten Programmentwurfs (z.B. Klassen, Objekte, Kapselung, Vererbung, Polymorphismus) und können diese anwenden. • kennen eine Auswahl der zur Verfügung stehenden Application Programming Interfaces (APIs) (z.B. Collections-, Grafik-, Thread-API). • können Dokumentationskommentare benutzen und kennen die Werkzeuge zur Generierung von API-Dokumentation. • kennen Techniken und Werkzeuge zur Versionskontrolle und können diese anwenden. • können Programme erstellen, die konkrete Anforderungen erfüllen, und deren Korrektheit durch geeignete Testläufe überprüfen. • kennen die Prinzipien und Methoden der projektbasierten Teamarbeit und können diese umsetzen.	Attendance time: 56 h Self-study time: 124 h

Course: Programmierpraktikum (Internship,Lecture)	
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** Alle Übungsblätter müssen jeweils mit mindestens 40% der erreichbaren Punkte bestanden werden. Bei fünf oder weniger Übungsblättern mit Ausnahme von maximal einem Übungsblatt, sonst mit Ausnahme von maximal zwei Übungsblättern. **Examination requirements:** Klassen, Objekte, Schnittstellen, Vererbung, Packete, Exceptions, Collections, Typisierung, Grafik, Threads, Thread-Synchronisation, Prozess-Kommunikation, Dokumentation, Archive, Versionskontrolle Die Prüfung umfasst eine **Projektarbeit** (4-6 Wochen) und einen **mündliche online Prüfung** (ca. 20 Minuten je zu prüfender Person) als **Gruppenprüfung**.	6 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1801
Language: German	**Person responsible for module:** Dr. Henrik Brosenne
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 80	

Georg-August-Universität Göttingen **Module B.Inf.1903: Applied Language and Text Processing**	6 C 4 WLH
Learning outcome, core skills: Nach dem Bestehen des Moduls ist der/die Teilnehmer:in befähigt zum: • Analysieren der Anforderungen einer spezifischen Anwendung • Auswählen und Anwenden gängiger Verfahren für eine Verarbeitungsaufgabe • Entwerfen komplexer Verarbeitungspipelines • Planen eines kleineren Projektes im Team • Auswerten und Einordnen der Ergebnisse	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Sprach- und Textanalyse in der Praxis (Exercise,Seminar) *Contents*: Die Studierenden lernen in Kleingruppen, Verfahren der computationellen oder manuellen Sprach- und Textanalyse zu entwickeln und an einem Fallbeispiel anzuwenden und zu evaluieren. Sie lernen geeignete Daten zu finden, auszuwählen und aufzubereiten. Sie erwerben ein Verständnis für die Schwierigkeiten, die bei der Arbeit mit authentischen Daten entstehen können und entwickeln Lösungsstrategien. Die Studierenden üben die Anwendung von algorithmischen Verfahren und die Erarbeitung und kritische Evaluation komplexer Anwendungspipelines. Sie lernen ebenso die Zusammenarbeit in einer Gruppe.	4 WLH
Examination: Präsentation (max. 20 Minuten) und Bericht (max. 10 Seiten) **Examination prerequisites:** Teilnahme an Seminar und Übung **Examination requirements:** Die Studierenden weisen nach, dass Sie die Anforderungen einer spezifischen Text-/Sprachverarbeitungsaufgabe analysieren und geeignete Verfahren auswählen und anwenden können. Sie können zudem ein Projekt im Team planen und komplexe Verarbeitungspipelines entwerfen sowie die Ergebnisse auswerten und einordnen. **Bei Gruppenarbeit** wird die Prüfungsleistung als **Gruppenprüfung** erbracht: Präsentation (max. 20 Minuten pro zu prüfender Person) und Bericht (max. 10 Seiten pro zu prüfender Person).	6 C

Admission requirements: none	**Recommended previous knowledge:** Wissen über grundlegende Sprachverarbeitungsaufgaben und -algorithmen (Tokenisierung, Wortartenerkennung, syntaktische Analyse) ist sinnvoll und kann z.B. durch den Besuch einer entsprechenden Einführungsveranstaltung oder die Arbeit mit einem einschlägigen Lehrbuch erworben werden. Elementare Programmierkenntnisse (in irgendeiner Programmiersprache) können hilfreich sein, sind aber nicht zwingend erforderlich.

Language: German, English	**Person responsible for module:** Prof. Dr. Caroline Sporleder
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module B.Inf.1904: Introduction to Computational Linguistics and Natural Language Processing**	6 C 4 WLH
Learning outcome, core skills: A successful completion of the module enables the participants to: • describe typical language analysis tasks • illustrate suitable methods for different language analysis tasks • apply elementary language analysis algorithms • compare the advantages and disadvantages of different methods • sketch methods for measuring the quality of data annotation performed by humans and algorithms • construct complex problem solving pipelines (data selection, annotation, analysis and evaluation of the results) • select suitable algorithms for specific application scenarios	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Introduction to Computational Linguistics and Natural Language Processing (Lecture,Exercise) *Contents*: The course provides an overview of the main tasks and challenges in computational linguistics and natural language processing. Students are introduced to standard algorithms for analysing natural language, covering the areas lexicon, syntax, semantics and discourse. The course highlights the underlying assumptions and strategies of different methods as well as their advantages and disadvantages in different application scenarios. The students learn to develop approaches for solving text and language processing tasks, taking into account data selection, annotation, analysis and evaluation of the results.	4 WLH
Examination: Written exam (90 minutes) or oral exam (20 minutes) **Examination prerequisites:** Participation in the exercise **Examination requirements:** The students demonstrate knowledge of specific computational linguistic tasks, methods and research results and are able to understand and reflect to some extent on methods and theories in computational linguistics. They are able to: • describe typical language analysis tasks • illustrate suitable methods for different analysis tasks • apply elementary language analysis algorithms • compare the advantages and disadvantages of different methods • select suitable algorithms for specific application scenarios	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Caroline Sporleder

Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module B.Mat.3030: Numerical linear algebra for data science**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: After successfully completing the module, students will be familiar with analysing numerical methods of linear algebra, in particular with regard to stability, efficiency and applicability to data science problems. The module builds on the courses "Numerics and optimisation I/II", whose first part already covers linear systems of equations and direct solution methods. The focus of this module is on advanced topics and their applications in data science. Following the course students • will have a better understanding of the importance of eigenvalues and singular values of linear mappings, especially in the context of data science; • know efficient numerical methods for the numerical calculation of these and can apply and analyse them; • know how to solve large linear least squares problems efficiently. **Core skills:** Students will develop fundamental skills in numerical linear algebra and its application in data science. They • are able to identify problems from data science as problems of (numerical) linear algebra and apply tools of numerical analysis to them; • are able to apply numerical methods to solve linear systems of equations, fitting problems or eigenvalue problems; • analyse their computational complexity, stability and suitability for large data sets.	Attendance time: 84 h Self-study time: 186 h

Course: Numerical linear algebra for data science (Lecture)	4 WLH
Examination: Written examination (120 minutes) **Examination prerequisites:** B.Mat.3030.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Numerical linear algebra for data science - exercises (Exercise)	2 WLH

Examination requirements: Proof of advanced knowledge in numerical linear algebra for data science	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1023
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency:	**Duration:**

each winter semester	1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3031: Scientific computing	6 C 4 WLH

Learning outcome, core skills: **Lernziele:** Nach erfolgreichem Absolvieren des Moduls haben die Studierenden • Grundwissen zu numerischen Verfahren in einem ausgewählten aktuellen Gebiet des wissenschaftlichen Rechnens erworben; • beispielbezogene Erfahrungen zur Anwendung dieser numerischen Verfahren in dem ausgewählten aktuellen Gebiet des wissenschaftlichen Rechnens und ihren theoretischen Hintergründen gesammelt. **Kompetenzen:** Nach erfolgreichem Absolvieren des Moduls haben die Studierenden weitergehende Kompetenzen im Schwerpunkt "Numerische und Angewandte Mathematik" erworben. Sie sind in der Lage, • numerische Verfahren des ausgewählten aktuellen Gebietes des wissenschaftlichen Rechnens einzusetzen; • diese numerischen Algorithmen in einem Anwendersystem oder in einer geeigneten Programmiersprache zu implementieren; • elementare Aussagen zu Konvergenz und Komplexität der ausgewählten numerischen Algorithmen herzuleiten; • die ausgewählten numerischen Verfahren des Gebietes exemplarisch anzuwenden.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Weiterführende Vorlesung zu einem aktuellen Gebiet im Bereich der Verfahren des wissenschaftlichen Rechnens mit Übungen und/oder Praktikum	
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3031.Ue: Teilnahme an Übungen/Praktikum und mündlicher Vortrag	6 C

Examination requirements: Die Beherrschung der in der Veranstaltung behandelten Verfahren des wissenschaftlichen Rechnens, ihre Anwendbarkeit und Eigenschaften	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1023
Language: German	**Person responsible for module:** Studiendekan*in Mathematik
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 4 - 6
Maximum number of students:	

not limited	

Additional notes and regulations: Dozent*in: Lehrpersonen des Instituts für Numerische und Angewandte Mathematik

Georg-August-Universität Göttingen **Module B.Mat.3032: Numerics of ordinary differential equations**	6 C 4 WLH

Learning outcome, core skills: **Learning outcome:** After successfully completing the module, students are familiar with analysing ordinary differential equations, in particular with regard to the existence, uniqueness and stability of solutions and basic numerical methods for solving them. They • learn the basics of the theory of initial value problems;become familiar with numerical methods for the numerical solution of initial value problems and deal with the error analysis of the methods; • know the concept of stiffness as well as the necessity and examples of implicit integrators; • analyse geometric integrators and their properties; • discuss the theory of boundary value problems in one space dimension and analyse their solution with finite differences. **Core skills:** Students develop basic competences in the numerics of differential equations. They: • analyse the well-posedness of differential equations and systems of differential equations; • analyse errors in numerical integrators; in particular, they can analyse the consistency and stability of these; • are able to apply numerical differential equation solvers to differential equations and systems of differential equations; • analyse numerical methods in terms of their complexity and suitability for different types of differential equations; • implement and analyse numerical algorithms for selected problems.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Numerics of ordinary differential equations (Lecture)	3 WLH
Examination: Written examination (120 minutes) **Examination prerequisites:** B.Mat.3032.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	6 C

Course: Numerics of ordinary differential equations - exercises (Exercise)	1 WLH

Examination requirements: Proof of knowledge of numerics of ordinary differential equations	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1023
Language:	**Person responsible for module:**

English	Dean of studies mathematics
Course frequency: every 4th semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3033: Numerical and applied mathematics	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: After successfully completing the module, students are familiar with advanced concepts of numerical and applied mathematics. They • acquire sound knowledge of mathematical modelling of real problems, the development of numerical algorithms and their theoretical and practical analysis, in particular they • learn methods for modelling complex systems and their numerical solution techniques; • analyse the efficiency, stability and convergence of numerical methods; • know modern algorithms and analyse their application to current problems in science and technology **Core skills:** Students develop essential skills in numerical and applied mathematics. They: • master advanced techniques of mathematical modelling and their implementation in numerical methods; • analyse numerical algorithms with regard to their accuracy, stability and computational complexity; • evaluate and optimise numerical methods for real applications; • implement numerical algorithms and test their performance on practical problems.	Attendance time: 56 h Self-study time: 124 h

Course: Numerical and applied mathematics (Lecture)	3 WLH
Examination: Written examination (120 minutes) **Examination prerequisites:** B.Mat.3033.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	6 C

Course: Numerical and applied mathematics - exercises (Exercise)	1 WLH

Examination requirements: Proof of knowledge of numerical and applied mathematics	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1023
Language: English	**Person responsible for module:** Dead of studies mathematics
Course frequency: every 4th semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

three times	Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3111: Introduction to analytic number theory**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Analytic number theory" enables students to learn methods, concepts, theories and applications in the area of "Analytic number theory". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • solve arithmetical problems with basic, complex-analytical, and Fourier-analytical methods; • know characteristics of the Riemann zeta function and more general L-functions, and apply them to problems of number theory; • are familiar with results and methods of prime number theory; • acquire knowledge in arithmetical and analytical theory of automorphic forms, and its application in number theory; • know basic sieving methods and apply them to the problems of number theory; • know techniques used to estimate the sum of the sum of characters and of exponentials; • analyse the distribution of rational points on suitable algebraic varieties using analytical techniques; • master computation with asymptotic formulas, asymptotic analysis, and asymptotic equipartition in number theory. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Analytical number theory"; • explain basic ideas of proof in the area "Analytical number theory"; • illustrate typical applications in the area "Analytical number theory".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3111.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Analytic number theory"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3112: Introduction to analysis of partial differential equations**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Analysis of partial differential equations" enables students to learn methods, concepts, theories and applications in the area "Analysis of partial differential equations". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the most important types of partial differential equations and know their solutions; • master the Fourier transform and other techniques of the harmonic analysis to analyse partial differential equations; • are familiar with the theory of generalized functions and the theory of function spaces and use these for solving differential partial equations; • apply the basic principles of functional analysis to the solution of partial different equations; • use different theorems of function theory for solving partial different equations; • master different asymptotic techniques to study characteristics of the solutions of partial different equations; • are paradigmatically familiar with broader application areas of linear theory of partial different equations; • are paradigmatically familiar with broader application areas of non-linear theory of partial different equations; • know the importance of partial different equations in the modelling in natural and engineering sciences; • master some advanced application areas like parts of microlocal analysis or parts of algebraic analysis. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Analysis of partial different equations"; • explain basic ideas of proof in the area "Analysis of partial different equations"; • illustrate typical applications in the area "Analysis of partial different equations".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3112.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Analysis of partial differential equations"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3113: Introduction to differential geometry**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Differential geometry" enables students to learn methods, concepts, theories and applications in the area "Differential geometry". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master the basic concepts of differential geometry; • develop a spatial sense using the examples of curves, areas and hypersurfaces; • develop an understanding of the basic concepts of differential geometry like "space" and "manifolds", "symmetry" and "Lie group", "local structures" and "curvature", "global structure" and "invariants" as well as "integrability"; • master (variably weighted and sorted depending on the current courses offered) the theory of transformation groups and symmetries as well as the analysis on manifolds, the theory of manifolds with geometric structures, complex differential geometry, gauge field theory and their applications as well as the elliptical differential equations of geometry and gauge field theory; • develop an understanding for geometrical constructs, spatial patterns and the interaction of algebraic, geometrical, analytical and topological methods; • acquire the skill to apply methods of analysis, algebra and topology for the treatment of geometrical problems; • are able to import geometrical problems to a broader mathematical and physical context. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Differential geometry"; • explain basic ideas of proof in the area "Differential geometry"; • illustrate typical applications in the area "Differential geometry".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3113.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements:	

Proof of knowledge and mastery of basic competencies in the area "Differential geometry"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3114: Introduction to algebraic topology	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Algebraic topology" students get to know the most important classes of topological spaces as well as algebraic and analytical tools for studying these spaces and the mappings between them. The students use these tools in geometry, mathematical physics, algebra and group theory. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic topology uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic topology and supplement one another complementarily. The following content-related competencies are pursued. Students • know the basic concepts of set-theoretic topology and continuous mappings; • construct new topologies from given topologies; • know special classes of topological spaces and their special characteristics like CW complexes, simplicial complexes and manifolds; • apply basic concepts of category theory to topological spaces; • use concepts of functors to obtain algebraic invariants of topological spaces and mappings; • know the fundamental group and the covering theory as well as the basic methods for the computation of fundamental groups and mappings between them; • know homology and cohomology, calculate those for important examples and with the aid of these deduce non-existence of mappings as well as fixed-point theorems; • calculate homology and cohomology with the aid of chain complexes; • deduce algebraic characteristics of homology and cohomology with the aid of homological algebra; • become acquainted with connections between analysis and topology; • apply algebraic structures to deduce special global characteristics of the cohomology of a local structure of manifolds. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Algebraic topology"; • explain basic ideas of proof in the area "Algebraic topology"; • illustrate typical applications in the area "Algebraic topology".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH

Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3114.Ue: AchieveAchievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Algebraic topology"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3121: Introduction to algebraic geometry	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Algebraic geometry" students get to know the most important classes of algebraic varieties and schemes as well as the tools for studying these objects and the mappings between them. The students apply these skills to problems of arithmetic or complex analysis. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic geometry uses and connects concepts of algebra and geometry and can be used versatilely. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic geometry and supplement one another complementarily. The following content-related competencies are pursued. Students • are familiar with commutative algebra, also in greater detail; • know the concepts of algebraic geometry, especially varieties, schemes, sheafs, bundles; • examine important examples like elliptic curves, Abelian varieties or algebraic groups; • use divisors for classification questions; • study algebraic curves; • prove the Riemann-Roch theorem and apply it; • use cohomological concepts and know the basics of Hodge theory; • apply methods of algebraic geometry to arithmetical questions and obtain e. g. finiteness principles for rational points; • classify singularities and know the significant aspects of the dimension theory of commutative algebra and algebraic geometry; • get to know connections to complex analysis and to complex geometry. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Algebraic geometry"; • explain basic ideas of proof in the area "Algebraic geometry"; • illustrate typical applications in the area "Algebraic geometry".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3121.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Algebraic geometry"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3122: Introduction to algebraic number theory	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Algebraic number theory" enables students to learn methods, concepts, theories and applications in the areas "Algebraic number theory" and "Algorithmic number theory". During the course of the cycle students will be successively introduced to current theoretical and/or applied research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued in relation to algebra. Students

- know Noetherian and Dedekind rings and the class groups;
- are familiar with discriminants, differents and bifurcation theory of Hilbert;
- know geometrical number theory with applications to the unit theorem and the finiteness of class groups as well as the algorithmic aspects of lattice theory (LLL);
- are familiar with L-series and zeta functions and discuss the algebraic meaning of their residues;
- know densities, the Tchebotarew theorem and applications;
- work with orders, S-integers and S-units;
- know the class field theory of Hilbert, Takagi and Idele theoretical field theory;
- are familiar with Zp-extensions and their Iwasawa theory;
- discuss the most important hypotheses of Iwasawa theory and their consequences.

Concerning algorithmic aspects of number theory, the following competencies are pursued. Students

- work with algorithms for the identification of short lattice bases, nearest points in lattices and the shortest vectors;
- are familiar with basic algorithms of number theory in long arithmetic like GCD, fast number and polynomial arithmetic, interpolation and evaluation and prime number tests;
- use the sieving method for factorisation and calculation of discrete logarithms in finite fields of great characteristics;
- discuss algorithms for the calculation of the zeta function of elliptic curves and Abelian varieties of finite fields;
- calculate class groups and fundamental units;
- calculate Galois groups of absolute number fields.

Core skills:

After having successfully completed the module, students will be able to

- discuss basic concepts of the area "Algebraic number theory";
- explain basic ideas of proof in the area "Algebraic number theory";
- illustrate typical applications in the area "Algebraic number theory".

Workload:

Attendance time:
84 h

Self-study time:
186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3122.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Algebraic number theory"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3123: Introduction to algebraic structures**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: In the modules of the cycle "Algebraic structures" students get to know different algebraic structures, amongst others Lie algebras, Lie groups, analytical groups, associative algebras as well as the tools from algebra, geometry and category theory that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic structures use concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic structures and supplement one another complementarily. The following content-related competencies are pursued. Students • know basic concepts like rings, modules, algebras and Lie algebras; • know important examples of Lie algebras and algebras; • know special classes of Lie groups and their special characteristics; • know classification theorems for finite-dimensional algebras; • apply basic concepts of category theory to algebras and modules; • know group actions and their basic classifications; • apply the enveloping algebra of Lie algebras; • apply ring and module theory to basic constructs of algebraic geometry; • use combinatorial tools for the study of associative algebras and Lie algebras; • acquire solid knowledge of the representation theory of Lie algebras, finite groups and compact Lie groups as well as the representation theory of semisimple Lie groups; • know Hopf algebras as well as their deformation and representation theory. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Algebraic structures"; • explain basic ideas of proof in the area "Algebraic structures"; • illustrate typical applications in the area "Algebraic structures".	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3123.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH
Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Algebraic structures"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3124: Introduction to groups, geometry and dynamical systems**	9 C 6 WLH
Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Groups, geometry and dynamical systems" students get to know the most important classes of groups as well as the algebraic, geometrical and analytical tools that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Group theory uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of the area "Groups, geometry and dynamical systems" that supplement one another complementarily. The following content-related competencies are pursued. Students • know basic concepts of groups and group homomorphisms; • know important examples of groups; • know special classes of groups and their special characteristics; • apply basic concepts of category theory to groups and define spaces via universal properties; • apply the concepts of functors to obtain algebraic invariants; • know group actions and their basic classification results; • know the basics of group cohomology and compute these for important examples; • know the basics of geometrical group theory like growth characteristics; • know self-similar groups, their basic constructs as well as examples with interesting characteristics; • use geometrical and combinatorial tools for the study of groups; • know the basics of the representation theory of compact Lie groups. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Groups, geometry and dynamical systems"; • explain basic ideas of proof in the area "Groups, geometry and dynamical systems"; • illustrate typical applications in the area "Groups, geometry and dynamical systems".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes)	9 C

Examination prerequisites: B.Mat.3124.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Groups, geometry and dynamical systems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1100, B.Mat.1200
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3131: Introduction to inverse problems**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Inverse problems" enables students to learn methods, concepts, theories and applications in the area of "Inverse problems". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the phenomenon of illposedness and identify the degree of illposedness of typical inverse problems; • evaluate different regularisation methods for ill posed inverse problems under algorithmic aspects and with regard to various a priori information and distinguish concepts of convergence for such methods with deterministic and stochastic data errors; • analyse the convergence of regularisation methods with the help of spectral theory of bounded self-adjoint operators; • analyse the convergence of regularisation methods with the help of complex analysis; • analyse regularisation methods from stochastic error models; • apply fully data-driven models for the choice of regularisation parameters and evaluate these for concrete problems; • model identification problems in natural sciences and technology as inverse problems of partial differential equations where the unknown is e. g. a coefficient, an initial or a boundary condition or the shape of a region; • analyse the uniqueness and conditional stability of inverse problems of partial differential equations; • deduce sampling and testing methods for the solution of inverse problems of partial differential equations and analyse the convergence of such methods; • formulate mathematical models of medical imaging like computed tomography (CT) or magnetic resonance tomography (MRT) and know the basic characteristics of corresponding operators. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Inverse problems"; • explain basic ideas of proof in the area "Inverse problems"; • illustrate typical applications in the area "Inverse problems".	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: written examination (120 minutes) or oral examination (appr. 20 minutes)	9 C

Examination prerequisites: B.Mat.3131.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Inverse problems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3132: Introduction to approximation methods**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Approximation methods" enables students to learn methods, concepts, theories and applications in the area of "Approximation methods", so the approximation of one- and multidimensional functions as well as for the analysis and approximation of discrete signals and images. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the modelling of approximation problems in suitable finite- and infinite-dimensional vector spaces; • can confidently handle models for the approximation of one- and multidimensional functions in Banach and Hilbert spaces; • know and use parts of classical approximation theory, e. g. Jackson and Bernstein theorems for the approximation quality for trigonometrical polynomials, approximation in translationally invariant spaces; polynomial reductions and Strang-Fix conditions; • acquire knowledge of continuous and discrete approximation problems and their corresponding solution strategies both in the one- and multidimensional case; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods for the efficient solution of the approximation problems on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge about linear and non-linear approximation methods for multidimensional data; • are informed about current developments of efficient data approximation and data analysis; • adapt solution strategies for the data approximation using special structural characteristics of the approximation problem that should be solved. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Approximation methods"; • explain basic ideas of proof in the area "Approximation methods" for one- and multidimensional data; • illustrate typical applications in the area of data approximation and data analysis.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH

Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3132.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Approximation methods"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3133: Introduction to numerics of partial differential equations**	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Numerics of partial differential equations" enables students to learn methods, concepts, theories and applications in the area of "Numerics of partial differential equations". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students

- are familiar with the theory of linear partial differential equations, e. g. questions of classification as well as existence, uniqueness and regularity of the solution;
- know the basics of the theory of linear integral equations;
- are familiar with basic methods for the numerical solution of linear partial differential equations with finite difference methods (FDM), finite element methods (FEM) as well as boundary element methods (BEM);
- analyse stability, consistence and convergence of FDM, FEM and BEM for linear problems;
- apply methods for adaptive lattice refinement on the basis of a posteriori error approximations;
- know methods for the solution of larger systems of linear equations and their preconditioners and parallelisation;
- apply methods for the solution of larger systems of linear and stiff ordinary differential equations and are familiar with the problem of differential algebraic problems;
- apply available software for the solution of partial differential equations and evaluate the results sceptically;
- evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time;
- acquire advanced knowledge in the theory as well as development and application of numerical solution strategies in a special area of partial differential equations, e. g. in variation problems with constraints, singularly perturbed problems or of integral equations;
- know propositions about the theory of non-linear partial differential equations of monotone and maximally monotone type as well as suitable iterative solution methods.

Core skills:

After having successfully completed the module, students will be able to

- discuss basic concepts of the area "Numerics of partial differential equations";
- explain basic ideas of proof in the area "Numerics of partial differential equations";
- illustrate typical applications in the area "Numerics of partial differential equations".

Workload:
Attendance time:
84 h
Self-study time:
186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3133.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Numerics of partial differential equations"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3134: Introduction to optimisation	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Optimisation" enables students to learn methods, concepts, theories and applications in the area of "Optimisation", so the discrete and continuous optimisation. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • identify optimisation problems in application-oriented problems and formulate these as mathematical programmes; • evaluate the existence and uniqueness of the solution of an optimisation problem; • identify structural characteristics of an optimisation problem, amongst others the existence of a finite candidate set, the structure of the underlying level set; • know which special characteristics of the target function and the constraints (like (virtual) convexity, dc functions) for the development of solution strategies can be utilised; • analyse the complexity of an optimisation problem; • classify a mathematical programme in a class of optimisation problems and know current solution strategies for it; • develop optimisation methods and adapt general methods to special problems; • deduce upper and lower bounds for optimisation problems and understand their meaning; • understand the geometrical structure of an optimisation problem and apply it for solution strategies; • distinguish between proper solution methods, approximation methods with quality guarantee and heuristics and evaluate different methods on the basis of the quality of the found solutions and their computing times; • acquire advanced knowledge in the development of solution strategies on the basis of a special area of optimisation, e. g. integer optimisation, optimisation of networks or convex optimisation; • acquire advanced knowledge for the solution of special optimisation problems of an application-oriented area, e. g. traffic planning or location planning; • handle advanced optimisation problems, like e. g. optimisation problems with uncertainty or multi-criteria optimisation problems. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Optimisation"; • explain basic ideas of proof in the area "Optimisation"; • illustrate typical applications in the area "Optimisation".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3134.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Optimisation"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3138: Introduction to image and geometry processing	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Image and geometry processing" enables students to learn and apply methods, concepts, theories and applications in the area of "Image and geometry processing", so the digital image and geometry processing. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the modelling of problems of image and geometry processing in suitable finite- and infinite-dimensional vector spaces; • learn basic methods for the analysis of one- and multidimensional functions in Banach and Hilbert spaces; • learn basic mathematical concepts and methods that are used in image processing, like Fourier and Wavelet transform; • learn basic mathematical concepts and methods that play a central role in geometry processing, like curvature of curves and surfaces; • acquire knowledge about continuous and discrete problems of image data analysis and their corresponding solution strategies; • know basic concepts and methods of topology; • are familiar with visualisation software; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • know which special characteristics of an image or of a geometry can be extracted and worked on with which methods; • evaluate different numerical methods for the efficient analysis of multidimensional data on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge about linear and non-linear methods for the geometrical and topological analysis of multidimensional data; • are informed about current developments of efficient geometrical and topological data analysis; • adapt solution strategies for the data analysis using special structural characteristics of the given multidimensional data. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Image and geometry processing"; • explain basic ideas of proof in the area "Image and geometry processing"; • illustrate typical applications in the area "Image and geometry processing".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3138.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Image and geometry processing"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3139: Introduction to scientific computing / applied mathematics	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Scientific computing / applied mathematics" enables students to learn and apply methods, concepts, theories and applications in the area of "Scientific computing / Applied mathematics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of basic mathematical models of the corresponding subject area, especially about the existence and uniqueness of solutions; • know basic methods for the numerical solution of these models; • analyse stability, convergence and efficiency of numerical solution strategies; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • are informed about current developments of scientific computing, like e. g. GPU computing and use available soft- and hardware; • use methods of scientific computing for solving application problems, like e. g. of natural and business sciences. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Scientific computing / applied mathematics"; • explain basic ideas of proof in the area "Scientific computing / applied mathematics"; • illustrate typical applications in the area "Scientific computing / applied mathematics".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: written examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3139.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements:	

Proof of knowledge and mastery of basic competencies in the area "Scientific computing / applied mathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1300
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3141: Introduction to applied and mathematical stochastics**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Applied and mathematical stochastics" enables students to understand and apply a broad range of problems, theories, modelling and proof techniques of stochastics. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued: Students • are familiar with advanced concepts of probability theory established on measure theory and apply them independently; • are familiar with substantial concepts and approaches of probability modelling and inferential statistics; • know basic characteristics of stochastic processes as well as conditions for their existence and uniqueness; • have a pool of different stochastic processes in time and space at their disposal and characterise those, differentiate them and quote examples; • understand and identify basic characteristics of invariance of stochastic processes like stationary processes and isotropy; • analyse the convergence characteristic of stochastic processes; • analyse regularity characteristics of the paths of stochastic processes; • adequately model temporal and spatial phenomena in natural and economic sciences as stochastic processes, if necessary with unknown parameters; • analyse probabilistic and statistic models regarding their typical characteristics, estimate unknown parameters and make predictions for their paths on areas not observed / at times not observed; • discuss and compare different modelling approaches and evaluate the reliability of parameter estimates and predictions sceptically. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Applied and mathematical stochastics"; • explain basic ideas of proof in the area "Applied and mathematical stochastics"; • illustrate typical applications in the area "Applied and mathematical stochastics".	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3141.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Applied and mathematical stochastics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1400
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen Module B.Mat.3142: Introduction to stochastic processes	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Stochastic processes" enables students to learn and apply methods, concepts, theories and proof techniques in the area of "Stochastic processes" and use these for the modelling of stochastic systems. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students

- are familiar with advanced concepts of probability theory established on measure theory and apply them independently;
- know basic characteristics as well as existence and uniqueness results for stochastic processes and formulate suitable probability spaces;
- understand the relevance of the concepts of filtration, conditional expectation and stopping time for the theory of stochastic processes;
- know fundamental classes of stochastic processes (like e. g. Poisson processes, Brownian motions, Levy processes, stationary processes, multivariate and spatial processes as well as branching processes) and construct and characterise these processes;
- analyse regularity characteristics of the paths of stochastic processes;
- construct Markov chains with discrete and general state spaces in discrete and continuous time, classify their states and analyse their characteristics;
- are familiar with the theory of general Markov processes and characterise and analyse these with the use of generators, semigroups, martingale problems and Dirichlet forms;
- analyse martingales in discrete and continuous time using the corresponding martingale theory, especially using martingale equations, martingale convergence theorems, martingale stopping theorems and martingale representation theorems;
- formulate stochastic integrals as well as stochastic differential equations with the use of the Ito calculus and analyse their characteristics;
- are familiar with stochastic concepts in general state spaces as well as with the topologies, metrics and convergence theorems relevant for stochastic processes;
- know fundamental convergence theorems for stochastic processes and generalise these;
- model stochastic systems from different application areas in natural sciences and technology with the aid of suitable stochastic processes;
- analyse models in mathematical economics and finance and understand evaluation methods for financial products.

Core skills:

After having successfully completed the module, students will be able to

- discuss basic concepts of the area "Stochastic processes";

Workload:

Attendance time:

84 h

Self-study time:

186 h

• explain basic ideas of proof in the area "Stochastic processes"; • illustrate typical applications in the area "Stochastic processes".	

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3142.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Stochastic processes"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1400
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3143: Introduction to stochastic methods of economathematics**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Stochastic methods of economathematics" enables students to learn methods, concepts, theories and applications in this area. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master problems, basic concepts and stochastic methods of economathematics; • understand stochastic connections; • understand references to other mathematical areas; • get to know possible applications in theory and practice; • gain insight into the connection of mathematics and economic sciences. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Stochastic methods of economathematics"; • explain basic ideas of proof in the area "Stochastic methods of economathematics"; • illustrate typical applications in the area "Stochastic methods of economathematics".	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3143.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Stochastic methods of economathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1400
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency:	**Duration:**

not specified	1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3144: Introduction to mathematical statistics**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Mathematical statistics" enables students to learn methods, concepts, theories and applications in the area of "Mathematical statistics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the most important methods of mathematical statistics like estimates, testing, confidence propositions and classification and use them in simple models of mathematical statistics; • evaluate statistical methods mathematically precisely via suitable risk and loss concepts; • analyse optimality characteristics of statistical estimate methods via lower and upper bounds; • analyse the error rates of statistical testing and classification methods based on the Neyman Pearson theory; • are familiar with basic statistical distribution models that base on the theory of exponential indexed families; • know different techniques to obtain lower and upper risk bounds in these models; • are confident in modelling typical data structures of regression; • analyse practical statistical problems in a mathematically accurate way with the techniques learned on the one hand and via computer simulations on the other hand; • are able to mathematically analyse resampling methods and apply them purposively; • are familiar with advanced tools of non-parametric statistics and empirical process theory; • independently become acquainted with a current topic of mathematical statistics; • evaluate complex statistical methods and enhance them in a problem-oriented way. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Mathematical statistics"; • explain basic ideas of proof in the area "Mathematical statistics"; • illustrate typical applications in the area "Mathematical statistics".	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Written or oral examwritten examination (120 minutes) or oral examination (appr. 20 minutes)	9 C

Examination prerequisites: B.Mat.3144.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Mathematical statistics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1400
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3147: Introduction to statistical foundations of data science**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Statistical foundations of data science" enables students to learn methods, concepts, theories and applications in the area of "Statistical foundations of data science". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the most important methods of statistical foundations of data science like estimation, testing, confidence statements, prediction, resampling, pattern recognition and classification, and use them in modeling real world applications; • evaluate statistical methods mathematically precisely via suitable statistical risk and loss concepts; • analyse characteristics of statistical estimation methods via lower and upper information bounds; • are familiar with basic statistical distribution models that base on the theory of exponential families; • are confident in modelling real world data structures such as categorial data, multidimensional and high dimensional data, data in imaging, data with serial dependencies • analyse practical statistical problems in a mathematically accurate way with the techniques and models learned on the one hand and via computer simulations on the other hand; • are able to mathematically analyse resampling methods and apply them purposively; • are familiar with concepts of large scale computational statistical techniques; • are familiar with advanced tools of non-parametric statistics and empirical process theory; • independently become acquainted with a current topic of statistical data science; • evaluate complex statistical methods and enhance them in a problem-oriented way. **Core skills:** After having successfully completed the module, students will be able to • discuss basic concepts of the area "Statistical foundations of data science"; • explain basic ideas of proof in the area "Statistical foundations of data science"; • illustrate typical applications in the area "Statistical foundations of data science".	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: written examination (120 minutes) or oral examination (appr. 20 minutes) **Examination prerequisites:** B.Mat.3147.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of knowledge and mastery of basic competencies in the area "Statistical foundations of data science"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.1400
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3311: Advances in analytic number theory**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Analytic number theory" enables students to learn methods, concepts, theories and applications in the area of "Analytic number theory". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • solve arithmetical problems with basic, complex-analytical, and Fourier-analytical methods; • know characteristics of the Riemann zeta function and more general L-functions, and apply them to problems of number theory; • are familiar with results and methods of prime number theory; • acquire knowledge in arithmetical and analytical theory of automorphic forms, and its application in number theory; • know basic sieving methods and apply them to the problems of number theory; • know techniques used to estimate the sum of the sum of characters and of exponentials; • analyse the distribution of rational points on suitable algebraic varieties using analytical techniques; • master computation with asymptotic formulas, asymptotic analysis, and asymptotic equipartition in number theory. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Analytic number theory" confidently; • explain complex issues of the area "Analytic number theory"; • apply methods of the area "Analytic number theory" to new problems in this area.	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3311.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements:	
Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Analytic number theory"	

Admission requirements:	**Recommended previous knowledge:**

none	B.Mat.3111
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3111 "Introduction to analytic number theory"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3312: Advances in analysis of partial differential equations**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Analysis of partial differential equations" enables students to learn methods, concepts, theories and applications in the area "Analysis of partial differential equations". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the most important types of partial differential equations and know their solutions; • master the Fourier transform and other techniques of the harmonic analysis to analyse partial differential equations; • are familiar with the theory of generalised functions and the theory of function spaces and use these for solving differential partial equations; • apply the basic principles of functional analysis to the solution of partial different equations; • use different theorems of function theory for solving partial different equations; • master different asymptotic techniques to study characteristics of the solutions of partial different equations; • are paradigmatically familiar with broader application areas of linear theory of partial different equations; • are paradigmatically familiar with broader application areas of non-linear theory of partial different equations; • know the importance of partial different equations in the modelling in natural and engineering sciences; • master some advanced application areas like parts of microlocal analysis or parts of algebraic analysis. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Analysis of partial differential equations" confidently; • explain complex issues of the area "Analysis of partial differential equations"; • apply methods of the area "Analysis of partial differential equations" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3312.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Analysis of partial differential equations"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3112
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3112 "Introduction to analysis of partial differential equations"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3313: Advances in differential geometry**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Differential geometry" enables students to learn methods, concepts, theories and applications in the area "Differential geometry". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master the basic concepts of differential geometry; • develop a spatial sense using the examples of curves, surfaces and hypersurfaces; • develop an understanding of the basic concepts of differential geometry like "space" and "manifolds", "symmetry" and "Lie group", "local structures" and "curvature", "global structure" and "invariants" as well as "integrability"; • master (variably weighted and sorted depending on the current courses offered) the theory of transformation groups and symmetries as well as the analysis on manifolds, the theory of manifolds with geometric structures, complex differential geometry, gauge field theory and their applications as well as the elliptical differential equations of geometry and gauge field theory; • develop an understanding for geometrical constructs, spatial patterns and the interaction of algebraic, geometrical, analytical and topological methods; • acquire the skill to apply methods of analysis, algebra and topology for the treatment of geometrical problems; • are able to import geometrical problems to a broader mathematical and physical context. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Differential geometry" confidently; • explain complex issues of the area "Differential geometry"; • apply methods of the area "Differential geometry" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3313.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements:	

Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Differential geometry"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3113
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3113 "Introduction to differential geometry"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3314: Advances in algebraic topology	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: In the modules of the cycle "Algebraic topology" students get to know the most important classes of topological spaces as well as algebraic and analytical tools for studying these spaces and the mappings between them. The students use these tools in geometry, mathematical physics, algebra and group theory. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic topology uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic topology and supplement one another complementarily. The following content-related competencies are pursued. Students • know the basic concepts of set-theoretic topology and continuous mappings; • construct new topologies from given topologies; • know special classes of topological spaces and their special characteristics like CW complexes, simplicial complexes and manifolds; • apply basic concepts of category theory to topological spaces; • use concepts of functors to obtain algebraic invariants of topological spaces and mappings; • know the fundamental group and the covering theory as well as the basic methods for the computation of fundamental groups and mappings between them; • know homology and cohomology, calculate those for important examples and with the aid of these deduce non-existence of mappings as well as fixed-point theorems; • calculate homology and cohomology with the aid of chain complexes; • deduce algebraic characteristics of homology and cohomology with the aid of homological algebra; • become acquainted with connections between analysis and topology; • apply algebraic structures to deduce special global characteristics of the cohomology of a local structure of manifolds. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Algebraic topology" confidently; • explain complex issues of the area "Algebraic topology"; • apply methods of the area "Algebraic topology" to new problems in this area.	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes)	9 C

Examination prerequisites: B.Mat.3314.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Algebraic topology"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3114
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3114 "Introduction to algebraic topology"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3315: Advances in mathematical methods in physics**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: In the modules of the cycle "Mathematical methods of physics" students get to know different mathematical methods and techniques that play a role in modern physics. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. The topics of the cycle can be divided into four blocks, a cycle normally contains parts of different blocks, that topically supplement each other, but can also be read within one block. The introducing parts of the cycle form the basis for the advanced specialisation area. The topic blocks are • harmonic analysis, algebraic structures and representation theory, (group) effects; • operator algebra, C* algebra and von-Neumann algebra; • operator theory, perturbation and scattering theory, special PDE, microlocal analysis, distributions; • (semi) Riemannian geometry, symplectic and Poisson geometry, quantization. One of the aims is that a connection to physical problems is visible, at least in the motivation of the covered topics. Preferably, in the advanced part of the cycle, the students should know and be able to carry out practical applications themselves. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Mathematical methods in physics" confidently; • explain complex issues of the area "Mathematical methods in physics"; • apply methods of the area "Mathematical methods in physics" to new problems in this area.	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3315.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements:	
Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Mathematical methods in physics"	

Admission requirements:	**Recommended previous knowledge:**
none	B.Mat.3115

Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: on an irregular basis	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3321: Advances in algebraic geometry	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Algebraic geometry" students get to know the most important classes of algebraic varieties and schemes as well as the tools for studying these objects and the mappings between them. The students apply these skills to problems of arithmetic or complex analysis. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic geometry uses and connects concepts of algebra and geometry and can be used versatilely. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic geometry and supplement one another complementarily. The following content-related competencies are pursued. Students • are familiar with commutative algebra, also in greater detail; • know the concepts of algebraic geometry, especially varieties, schemes, sheafs, bundles; • examine important examples like elliptic curves, Abelian varieties or algebraic groups; • use divisors for classification questions; • study algebraic curves; • prove the Riemann-Roch theorem and apply it; • use cohomological concepts and know the basics of Hodge theory; • apply methods of algebraic geometry to arithmetical questions and obtain e. g. finiteness principles for rational points; • classify singularities and know the significant aspects of the dimension theory of commutative algebra and algebraic geometry; • get to know connections to complex analysis and to complex geometry. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Algebraic geometry" confidently; • explain complex issues of the area "Algebraic geometry"; • apply methods of the area "Algebraic geometry" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3321.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH
Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Algebraic geometry"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3121
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3121 "Introduction to algebraic geometry"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3322: Advances in algebraic number theory**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Algebraic number theory" enables students to learn methods, concepts, theories and applications in the areas "Algebraic number theory" and "Algorithmic number theory". During the course of the cycle students will be successively introduced to current theoretical and/or applied research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued in relation to algebra. Students • know Noetherian and Dedekind rings and the class groups; • are familiar with discriminants, differents and bifurcation theory of Hilbert; • know geometrical number theory with applications to the unit theorem and the finiteness of class groups as well as the algorithmic aspects of lattice theory (LLL); • are familiar with L-series and zeta functions and discuss the algebraic meaning of their residues; • know densities, the Tchebotarew theorem and applications; • work with orders, S-integers and S-units; • know the class field theory of Hilbert, Takagi and Idele theoretical field theory; • are familiar with Zp-extensions and their Iwasawa theory; • discuss the most important hypotheses of Iwasawa theory and their consequences. Concerning algorithmic aspects of number theory, the following competencies are pursued. Students • work with algorithms for the identification of short lattice bases, nearest points in lattices and the shortest vectors; • are familiar with basic algorithms of number theory in long arithmetic like GCD, fast number and polynomial arithmetic, interpolation and evaluation and prime number tests; • use the sieving method for factorisation and calculation of discrete logarithms in finite fields of great characteristics; • discuss algorithms for the calculation of the zeta function of elliptic curves and Abelian varieties of finite fields; • calculate class groups and fundamental units; • calculate Galois groups of absolute number fields. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Algebraic number theory" confidently; • explain complex issues of the area "Algebraic number theory"; • apply methods of the area "Algebraic number theory" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3322.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Algebraic number theory"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3122
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3122 "Introduction to algebraic number theory"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3323: Advances in algebraic structures	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Algebraic structures" students get to know different algebraic structures, amongst others Lie algebras, Lie groups, analytical groups, associative algebras as well as the tools from algebra, geometry and category theory that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic structures use concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic structures and supplement one another complementarily. The following content-related competencies are pursued. Students • know basic concepts like rings, modules, algebras and Lie algebras; • know important examples of Lie algebras and algebras; • know special classes of Lie groups and their special characteristics; • know classification theorems for finite-dimensional algebras; • apply basic concepts of category theory to algebras and modules; • know group actions and their basic classifications; • apply the enveloping algebra of Lie algebras; • apply ring and module theory to basic constructs of algebraic geometry; • use combinatorial tools for the study of associative algebras and Lie algebras; • acquire solid knowledge of the representation theory of Lie algebras, finite groups and compact Lie groups as well as the representation theory of semisimple Lie groups; • know Hopf algebras as well as their deformation and representation theory. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Algebraic structures" confidently; • explain complex issues of the area "Algebraic structures"; • apply methods of the area "Algebraic structures" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3323.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Algebraic structures"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3123
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3123 "Introduction to algebraic structures"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3324: Advances in groups, geometry and dynamical systems	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

In the modules of the cycle "Groups, geometry and dynamical systems" students get to know the most important classes of groups as well as the algebraic, geometrical and analytical tools that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis.

Group theory uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of the area "Groups, geometry and dynamical systems" that supplement one another complementarily. The following content-related competencies are pursued. Students

- know basic concepts of groups and group homomorphisms;
- know important examples of groups;
- know special classes of groups and their special characteristics;
- apply basic concepts of category theory to groups and define spaces via universal properties;
- apply the concepts of functors to obtain algebraic invariants;
- know group actions and their basic classification results;
- know the basics of group cohomology and compute these for important examples;
- know the basics of geometrical group theory like growth characteristics;
- know self-similar groups, their basic constructs as well as examples with interesting characteristics;
- use geometrical and combinatorial tools for the study of groups;
- know the basics of the representation theory of compact Lie groups.

Core skills:

After having successfully completed the module, students will be able to

- handle methods and concepts of the area "Groups, geometry and dynamical systems" confidently;
- explain complex issues of the area "Groups, geometry and dynamical systems";
- apply methods of the area "Groups, geometry and dynamical systems" to new problems in this area.

Workload:

Attendance time:
84 h
Self-study time:
186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3324.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Groups, geometry and dynamical systems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3124
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3124 "Introduction to groups, geometry and dynamical systems"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3331: Advances in inverse problems**	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Inverse problems" enables students to learn methods, concepts, theories and applications in the area of "Inverse problems". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the phenomenon of illposedness and identify the degree of illposedness of typical inverse problems; • evaluate different regularisation methods for ill posed inverse problems under algorithmic aspects and with regard to various a priori information and distinguish concepts of convergence for such methods with deterministic and stochastic data errors; • analyse the convergence of regularisation methods with the help of spectral theory of bounded self-adjoint operators; • analyse the convergence of regularisation methods with the help of complex analysis; • analyse regularisation methods from stochastic error models; • apply fully data-driven models for the choice of regularisation parameters and evaluate these for concrete problems; • model identification problems in natural sciences and technology as inverse problems of partial differential equations where the unknown is e. g. a coefficient, an initial or a boundary condition or the shape of a region; • analyse the uniqueness and conditional stability of inverse problems of partial differential equations; • deduce sampling and testing methods for the solution of inverse problems of partial differential equations and analyse the convergence of such methods; • formulate mathematical models of medical imaging like computer tomography (CT) or magnetic resonance tomography (MRT) and know the basic characteristics of corresponding operators. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Inverse problems" confidently; • explain complex issues of the area "Inverse problems"; • apply methods of the area "Inverse problems" to new problems in this area.	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3331.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Inverse problems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3131
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3131 "Introduction to inverse problems"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3332: Advances in approximation methods	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Approximation methods" enables students to learn methods, concepts, theories and applications in the area of "Approximation methods", so the approximation of one- and multidimensional functions as well as for the analysis and approximation of discrete signals and images. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the modelling of approximation problems in suitable finite- and infinite-dimensional vector spaces; • can confidently handle models for the approximation of one- and multidimensional functions in Banach and Hilbert spaces; • know and use parts of classical approximation theory, e. g. Jackson and Bernstein theorems for the approximation quality for trigonometrical polynomials, approximation in translationally invariant spaces; polynomial reductions and Strang-Fix conditions; • acquire knowledge of continuous and discrete approximation problems and their corresponding solution strategies both in the one- and multidimensional case; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods for the efficient solution of the approximation problems on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge about linear and non-linear approximation methods for multidimensional data; • are informed about current developments of efficient data approximation and data analysis; • adapt solution strategies for the data approximation using special structural characteristics of the approximation problem that should be solved. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Approximation methods" confidently; • explain complex issues of the area "Approximation methods"; • apply methods of the area "Approximation methods" to new problems in this area.	Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3332.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Approximation methods"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3132
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3132 "Introduction to approximation methods"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3333: Advances in numerics of partial differential equations	9 C 6 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Numerics of partial differential equations" enables students to learn methods, concepts, theories and applications in the area of "Numerics of partial differential equations". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of linear partial differential equations, e. g. questions of classification as well as existence, uniqueness and regularity of the solution; • know the basics of the theory of linear integral equations; • are familiar with basic methods for the numerical solution of linear partial differential equations with finite difference methods (FDM), finite element methods (FEM) as well as boundary element methods (BEM); • analyse stability, consistence and convergence of FDM, FEM and BEM for linear problems; • apply methods for adaptive lattice refinement on the basis of a posteriori error approximations; • know methods for the solution of larger systems of linear equations and their preconditioners and parallelisation; • apply methods for the solution of larger systems of linear and stiff ordinary differential equations and are familiar with the problem of differential algebraic problems; • apply available software for the solution of partial differential equations and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge in the theory as well as development and application of numerical solution strategies in a special area of partial differential equations, e. g. in variation problems with constraints, singularly perturbed problems or of integral equations; • know propositions about the theory of non-linear partial differential equations of monotone and maximally monotone type as well as suitable iterative solution methods. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Numerics of partial differential equations" confidently; • explain complex issues of the area "Numerics of partial differential equations";	Attendance time: 84 h Self-study time: 186 h

• apply methods of the area "Numerics of partial differential equations" to new problems in this area.	

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3333.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Numerics of partial differential equations"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3133
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3133 "Introduction to numerics of partial differential equations"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3334: Advances in optimisation**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Optimisation" enables students to learn methods, concepts, theories and applications in the area of "Optimisation", so the discrete and continuous optimisation. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • identify optimisation problems in application-oriented problems and formulate these as mathematical programmes; • evaluate the existence and uniqueness of the solution of an optimisation problem; • identify structural characteristics of an optimisation problem, amongst others the existence of a finite candidate set, the structure of the underlying level set; • know which special characteristics of the target function and the constraints (like (virtual) convexity, dc functions) for the development of solution strategies can be utilised; • analyse the complexity of an optimisation problem; • classify a mathematical programme in a class of optimisation problems and know current solution strategies for it; • develop optimisation methods and adapt general methods to special problems; • deduce upper and lower bounds for optimisation problems and understand their meaning; • understand the geometrical structure of an optimisation problem and apply it for solution strategies; • distinguish between proper solution methods, approximation methods with quality guarantee and heuristics and evaluate different methods on the basis of the quality of the found solutions and their computing times; • acquire advanced knowledge in the development of solution strategies on the basis of a special area of optimisation, e. g. integer optimisation, optimisation of networks or convex optimisation; • acquire advanced knowledge for the solution of special optimisation problems of an application-oriented area, e. g. traffic planning or location planning; • handle advanced optimisation problems, like e. g. optimisation problems with uncertainty or multi-criteria optimisation problems. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Optimisation" confidently; • explain complex issues of the area "Optimisation"; • apply methods of the area "Optimisation" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3334.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Optimisation"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3134
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3134 "Introduction to optimisation"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3337: Advances in variational analysis	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Variational analysis" enables students to learn methods, concepts, theories and applications in the area of "Variational analysis" and continuous optimisation. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students

- understand basic concepts of convex and variational analysis for finite- and infinite-dimensional problems;
- master the characteristics of convexity and other concepts of the regularity of sets and functions to evaluate the existence and regularity of the solutions of variational problems;
- understand basic concepts of the convergence of sets and continuity of set-valued functions;
- understand basic concepts of variational geometry;
- calculate and use generalised derivations (subderivatives and subgradients) of non-smooth functions;
- understand the different concepts of regularity of set-valued functions and their effects on the calculation rules for subderivatives of non-convex functionals;
- analyse constrained and parametric optimisation problems with the help of duality theory;
- calculate and use the Legendre-Fenchel transformation and infimal convulutions;
- formulate optimality criteria for continuous optimisation problems with tools of convex and variational analysis;
- apply tools of convex and variational analysis to solve generalised inclusions that e. g. originate from first-order optimality criteria;
- understand the connection between convex functions and monotone operators;
- examine the convergence of fixed point iterations with the help of the theory of monotone operators;
- deduce methods for the solution of smooth and non-smooth continuous constrained optimisation problems and analyse their convergence;
- apply numerical methods for the solution of smooth and non-smooth continuous constrained programs to current problems;
- model application problems with variational inequations, analyse their characteristics and are familiar with numerical methods for the solution of variational inequations;
- know applications of control theory and apply methods of dynamic programming;
- use tools of variational analysis in image processing and with inverse problems;
- know basic concepts and methods of stochastic optimisation.

Core skills:

Workload:
Attendance time:
84 h
Self-study time:
186 h

After having successfully completed the module, students will be able to • handle methods and concepts of the area "Variational analysis" confidently; • explain complex issues of the area "Variational analysis"; • apply methods of the area "Variational analysis" to new problems in this area.	

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3337.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Variational analysis"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3137
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3137 "Introduction in variational analysis"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3338: Advances in image and geometry processing	9 C 6 WLH

Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Image and geometry processing" enables students to learn and apply methods, concepts, theories and applications in the area of "Image and geometry processing", so the digital image and geometry processing. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students

- are familiar with the modelling of problems of image and geometry processing in suitable finite- and infinite-dimensional vector spaces;
- learn basic methods for the analysis of one- and multidimensional functions in Banach and Hilbert spaces;
- learn basic mathematical concepts and methods that are used in image processing, like Fourier and Wavelet transform;
- learn basic mathematical concepts and methods that play a central role in geometry processing, like curvature of curves and surfaces;
- acquire knowledge about continuous and discrete problems of image data analysis and their corresponding solution strategies;
- know basic concepts and methods of topology;
- are familiar with visualisation software;
- apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically;
- know which special characteristics of an image or of a geometry can be extracted and worked on with which methods;
- evaluate different numerical methods for the efficient analysis of multidimensional data on the basis of the quality of the solutions, the complexity and their computing time;
- acquire advanced knowledge about linear and non-linear methods for the geometrical and topological analysis of multidimensional data;
- are informed about current developments of efficient geometrical and topological data analysis;
- adapt solution strategies for the data analysis using special structural characteristics of the given multidimensional data.

Core skills:

After having successfully completed the module, students will be able to

- handle methods and concepts of the area "Image and geometry processing" confidently;
- explain complex issues of the area "Image and geometry processing";

Workload:

Attendance time:

84 h

Self-study time:

186 h

• apply methods of the area "Image and geometry processing" to new problems in this area.	

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3338.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Image and geometry processing"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3138
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3138 "Introduction to image and geometry processing"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3339: Advances in scientific computing / applied mathematics**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Scientific computing / Applied mathematics" enables students to learn and apply methods, concepts, theories and applications in the area of "Scientific computing / Applied mathematics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of basic mathematical models of the corresponding subject area, especially about the existence and uniqueness of solutions; • know basic methods for the numerical solution of these models; • analyse stability, convergence and efficiency of numerical solution strategies; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • are informed about current developments of scientific computing, like e. g. GPU computing and use available soft- and hardware; • use methods of scientific computing for solving application problems, like e. g. of natural and business sciences. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Scientific computing / applied mathematics" confidently; • explain complex issues of the area "Scientific computing / applied mathematics"; • apply methods of the area "Scientific computing / applied mathematics" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3339.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Scientific computing / applied mathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3139
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3139 "Introduction to scientific computing / applied mathematics"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations:
Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3341: Advances in applied and mathematical stochastics**	9 C 6 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Applied and mathematical stochastics" enables students to understand and apply a broad range of problems, theories, modelling and proof techniques of stochastics. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued: Students • are familiar with advanced concepts of probability theory established on measure theory and apply them independently; • are familiar with substantial concepts and approaches of probability modelling and inferential statistics; • know basic characteristics of stochastic processes as well as conditions for their existence and uniqueness; • have a pool of different stochastic processes in time and space at their disposal and characterise those, differentiate them and quote examples; • understand and identify basic characteristics of invariance of stochastic processes like stationary processes and isotropy; • analyse the convergence characteristic of stochastic processes; • analyse regularity characteristics of the paths of stochastic processes; • adequately model temporal and spatial phenomena in natural and economic sciences as stochastic processes, if necessary with unknown parameters; • analyse probabilistic and statistic models regarding their typical characteristics, estimate unknown parameters and make predictions for their paths on areas not observed / at times not observed; • discuss and compare different modelling approaches and evaluate the reliability of parameter estimates and predictions sceptically. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Applied and mathematical stochastics" confidently; • explain complex issues of the area "Applied and mathematical stochastics"; • apply methods of the area "Applied and mathematical stochastics" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3341.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Applied and mathematical stochastics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3141
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3141 "Introduction to applied and mathematical stochastics"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen Module B.Mat.3342: Advances in stochastic processes	9 C 6 WLH

Learning outcome, core skills:	Workload:
Learning outcome: The successful completion of modules of the cycle "Stochastic processes" enables students to learn and apply methods, concepts, theories and proof techniques in the area of "Stochastic processes" and use these for the modelling of stochastic systems. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with advanced concepts of probability theory established on measure theory and apply them independently; • know basic characteristics as well as existence and uniqueness results for stochastic processes and formulate suitable probability spaces; • understand the relevance of the concepts of filtration, conditional expectation and stopping time for the theory of stochastic processes; • know fundamental classes of stochastic processes (like e. g. Poisson processes, Brownian motions, Levy processes, stationary processes, multivariate and spatial processes as well as branching processes) and construct and characterise these processes; • analyse regularity characteristics of the paths of stochastic processes; • construct Markov chains with discrete and general state spaces in discrete and continuous time, classify their states and analyse their characteristics; • are familiar with the theory of general Markov processes and characterise and analyse these with the use of generators, semigroups, martingale problems and Dirichlet forms; • analyse martingales in discrete and continuous time using the corresponding martingale theory, especially using martingale equations, martingale convergence theorems, martingale stopping theorems and martingale representation theorems; • formulate stochastic integrals as well as stochastic differential equations with the use of the Ito calculus and analyse their characteristics; • are familiar with stochastic concepts in general state spaces as well as with the topologies, metrics and convergence theorems relevant for stochastic processes; • know fundamental convergence theorems for stochastic processes and generalise these; • model stochastic systems from different application areas in natural sciences and technology with the aid of suitable stochastic processes; • analyse models in mathematical economics and finance and understand evaluation methods for financial products. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Stochastic processes" confidently;	Attendance time: 84 h Self-study time: 186 h

• explain complex issues of the area "Stochastic processes"; • apply methods of the area "Stochastic processes" to new problems in this area.	

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3342.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Stochastic processes"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3142
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3142 "Introduction to stochastic processes"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3343: Advances in stochastic methods of economathematics**	9 C 6 WLH
Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Stochastic methods of economathematics" enables students to learn methods, concepts, theories and applications in this area. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master problems, basic concepts and stochastic methods of economathematics; • understand stochastic connections; • understand references to other mathematical areas; • get to know possible applications in theory and practice; • gain insight into the connection of mathematics and economic sciences. **Core skills:** After having successfully completed the module, students will be able to • handle methods and concepts of the area "Stochastic methods of economathematics" confidently; • explain complex issues of the area "Stochastic methods of economathematics"; • apply methods of the area "Stochastic methods of economathematics" to new problems in this area.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** B.Mat.3343.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	9 C

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Stochastic methods of economathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3143
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency:	**Duration:** 1 semester[s]

Usually subsequent to the module B.Mat.3143 "Introduction to stochastic methods of economathematics"	
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3344: Advances in mathematical statistics**	9 C 6 WLH

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Learning outcome, core skills:

Learning outcome:

The successful completion of modules of the cycle "Mathematical statistics" enables students to learn methods, concepts, theories and applications in the area of "Mathematical statistics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students

- are familiar with the most important methods of mathematical statistics like estimates, testing, confidence propositions and classification and use them in simple models of mathematical statistics;
- evaluate statistical methods mathematically precisely via suitable risk and loss concepts;
- analyse optimality characteristics of statistical estimate methods via lower and upper bounds;
- analyse the error rates of statistical testing and classification methods based on the Neyman Pearson theory;
- are familiar with basic statistical distribution models that base on the theory of exponential indexed families;
- know different techniques to obtain lower and upper risk bounds in these models;
- are confident in modelling typical data structures of regression;
- analyse practical statistical problems in a mathematically accurate way with the techniques learned on the one hand and via computer simulations on the other hand;
- are able to mathematically analyse resampling methods and apply them purposively;
- are familiar with advanced tools of non-parametric statistics and empirical process theory;
- independently become acquainted with a current topic of mathematical statistics;
- evaluate complex statistical methods and enhance them in a problem-oriented way.

Core skills:

After having successfully completed the module, students will be able to

- handle methods and concepts of the area "Mathematical statistics" confidently;
- explain complex issues of the area "Mathematical statistics";
- apply methods of the area "Mathematical statistics" to new problems in this area

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Workload:
Attendance time:
84 h
Self-study time:
186 h

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Course: Lecture course (Lecture)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:**	9 C

B.Mat.3344.Ue: Achievement of at least 50% of the exercise points as well as committed participation, presentation of solutions	

Course: Exercise session (Exercise)	2 WLH

Examination requirements: Proof of advancement of knowledge and competencies acquired in the introductory module of the area "Mathematical statistics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3144
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: Usually subsequent to the module B.Mat.3144 "Introduction to mathematical statistics"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 4
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3413: Seminar on differential geometry**	3 C 2 WLH
Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Differential geometry" enables students to learn methods, concepts, theories and applications in the area "Differential geometry". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master the basic concepts of differential geometry; • develop a spatial sense using the examples of curves, surfaces and hypersurfaces; • develop an understanding of the basic concepts of differential geometry like "space" and "manifolds", "symmetry" and "Lie group", "local structures" and "curvature", "global structure" and "invariants" as well as "integrability"; • master (variably weighted and sorted depending on the current courses offered) the theory of transformation groups and symmetries as well as the analysis on manifolds, the theory of manifolds with geometric structures, complex differential geometry, gauge field theory and their applications as well as the elliptical differential equations of geometry and gauge field theory; • develop an understanding for geometrical constructs, spatial patterns and the interaction of algebraic, geometrical, analytical and topological methods; • acquire the skill to apply methods of analysis, algebra and topology for the treatment of geometrical problems; • are able to import geometrical problems to a broader mathematical and physical context. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Differential geometry" and present it in a talk; • conduct scholarly debates in a familiar context.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C
Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Differential geometry"	

Admission requirements:	**Recommended previous knowledge:**

none	B.Mat.3113
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3414: Seminar on algebraic topology**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: In the modules of the cycle "Algebraic topology" students get to know the most important classes of topological spaces as well as algebraic and analytical tools for studying these spaces and the mappings between them. The students use these tools in geometry, mathematical physics, algebra and group theory. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic topology uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic topology and supplement one another complementarily. The following content-related competencies are pursued. Students • know the basic concepts of set-theoretic topology and continuous mappings; • construct new topologies from given topologies; • know special classes of topological spaces and their special characteristics like CW complexes, simplicial complexes and manifolds; • apply basic concepts of category theory to topological spaces; • use concepts of functors to obtain algebraic invariants of topological spaces and mappings; • know the fundamental group and the covering theory as well as the basic methods for the computation of fundamental groups and mappings between them; • know homology and cohomology, calculate those for important examples and with the aid of these deduce non-existence of mappings as well as fixed-point theorems; • calculate homology and cohomology with the aid of chain complexes; • deduce algebraic characteristics of homology and cohomology with the aid of homological algebra; • become acquainted with connections between analysis and topology; • apply algebraic structures to deduce special global characteristics of the cohomology of a local structure of manifolds. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Algebraic topology" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes)	3 C

Examination prerequisites: Participation in the seminar	
Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Algebraic topology"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3114
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations:
Instructor: Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3421: Seminar on algebraic geometry	3 C 2 WLH

Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Algebraic geometry" students get to know the most important classes of algebraic varieties and schemes as well as the tools for studying these objects and the mappings between them. The students apply these skills to problems of arithmetic or complex analysis. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic geometry uses and connects concepts of algebra and geometry and can be used versatilely. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic geometry and supplement one another complementarily. The following content-related competencies are pursued. Students • are familiar with commutative algebra, also in greater detail; • know the concepts of algebraic geometry, especially varieties, schemes, sheafs, bundles; • examine important examples like elliptic curves, Abelian varieties or algebraic groups; • use divisors for classification questions; • study algebraic curves; • prove the Riemann-Roch theorem and apply it; • use cohomological concepts and know the basics of Hodge theory; • apply methods of algebraic geometry to arithmetical questions and obtain e. g. finiteness principles for rational points; • classify singularities and know the significant aspects of the dimension theory of commutative algebra and algebraic geometry; • get to know connections to complex analysis and to complex geometry. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Algebraic geometry" and present it in a talk; • conduct scholarly debates in a familiar context.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements:	

Autonomous permeation and presentation of complex mathematical issues in the area "Algebraic geometry"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3121
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3422: Seminar on algebraic number theory	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Algebraic number theory" enables students to learn methods, concepts, theories and applications in the areas "Algebraic number theory" and "Algorithmic number theory". During the course of the cycle students will be successively introduced to current theoretical and/or applied research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued in relation to algebra. Students • know Noetherian and Dedekind rings and the class groups; • are familiar with discriminants, differents and bifurcation theory of Hilbert; • know geometrical number theory with applications to the unit theorem and the finiteness of class groups as well as the algorithmic aspects of lattice theory (LLL); • are familiar with L-series and zeta functions and discuss the algebraic meaning of their residues; • know densities, the Tchebotarew theorem and applications; • work with orders, S-integers and S-units; • know the class field theory of Hilbert, Takagi and Idele theoretical field theory; • are familiar with Zp-extensions and their Iwasawa theory; • discuss the most important hypotheses of Iwasawa theory and their consequences. Concerning algorithmic aspects of number theory, the following competencies are pursued. Students • work with algorithms for the identification of short lattice bases, nearest points in lattices and the shortest vectors; • are familiar with basic algorithms of number theory in long arithmetic like GCD, fast number and polynomial arithmetic, interpolation and evaluation and prime number tests; • use the sieving method for factorisation and calculation of discrete logarithms in finite fields of great characteristics; • discuss algorithms for the calculation of the zeta function of elliptic curves and Abelian varieties of finite fields; • calculate class groups and fundamental units; • calculate Galois groups of absolute number fields. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Variational analysis" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Algebraic number theory"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3122
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen Module B.Mat.3423: Seminar on algebraic structures	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: In the modules of the cycle "Algebraic structures" students get to know different algebraic structures, amongst others Lie algebras, Lie groups, analytical groups, associative algebras as well as the tools from algebra, geometry and category theory that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Algebraic structures use concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of algebraic structures and supplement one another complementarily. The following content-related competencies are pursued. Students • know basic concepts like rings, modules, algebras and Lie algebras; • know important examples of Lie algebras and algebras; • know special classes of Lie groups and their special characteristics; • know classification theorems for finite-dimensional algebras; • apply basic concepts of category theory to algebras and modules; • know group actions and their basic classifications; • apply the enveloping algebra of Lie algebras; • apply ring and module theory to basic constructs of algebraic geometry; • use combinatorial tools for the study of associative algebras and Lie algebras; • acquire solid knowledge of the representation theory of Lie algebras, finite groups and compact Lie groups as well as the representation theory of semisimple Lie groups; • know Hopf algebras as well as their deformation and representation theory. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Algebraic structures" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Algebraic structures"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3123
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3424: Seminar on groups, geometry and dynamical systems**	3 C 2 WLH
Learning outcome, core skills: **Learning outcome:** In the modules of the cycle "Groups, geometry and dynamical systems" students get to know the most important classes of groups as well as the algebraic, geometrical and analytical tools that are necessary for their study and applications. They are introduced to current research questions and enabled to carry out independent contributions to research, e. g. within the scope of a Master's thesis. Group theory uses concepts and tools of algebra, geometry and analysis and can be applied to these areas. In the course offer several aspects are considered at a time and a cycle will only cover some of the learning objectives mentioned below. The introduction to the cycle and the specialisation in the cycle will normally cover different aspects of the area "Groups, geometry and dynamical systems" that supplement one another complementarily. The following content-related competencies are pursued. Students • know basic concepts of groups and group homomorphisms; • know important examples of groups; • know special classes of groups and their special characteristics; • apply basic concepts of category theory to groups and define spaces via universal properties; • apply the concepts of functors to obtain algebraic invariants; • know group actions and their basic classification results; • know the basics of group cohomology and compute these for important examples; • know the basics of geometrical group theory like growth characteristics; • know self-similar groups, their basic constructs as well as examples with interesting characteristics; • use geometrical and combinatorial tools for the study of groups; • know the basics of the representation theory of compact Lie groups. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Groups, geometry and dynamical systems" and present it in a talk; • conduct scholarly debates in a familiar context.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C
Examination requirements:	

Autonomous permeation and presentation of complex mathematical issues in the area "Groups, geometry and dynamical systems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3124
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Mathematical Institute

Georg-August-Universität Göttingen **Module B.Mat.3431: Seminar on inverse problems**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Inverse problems" enables students to learn methods, concepts, theories and applications in the area of "Inverse problems". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the phenomenon of illposedness and identify the degree of illposedness of typical inverse problems; • evaluate different regularisation methods for ill posed inverse problems under algorithmic aspects and with regard to various a priori information and distinguish concepts of convergence for such methods with deterministic and stochastic data errors; • analyse the convergence of regularisation methods with the help of spectral theory of bounded self-adjoint operators; • analyse the convergence of regularisation methods with the help of complex analysis; • analyse regularisation methods from stochastic error models; • apply fully data-driven models for the choice of regularisation parameters and evaluate these for concrete problems; • model identification problems in natural sciences and technology as inverse problems of partial differential equations where the unknown is e. g. a coefficient, an initial or a boundary condition or the shape of a region; • analyse the uniqueness and conditional stability of inverse problems of partial differential equations; • deduce sampling and testing methods for the solution of inverse problems of partial differential equations and analyse the convergence of such methods; • formulate mathematical models of medical imaging like computer tomography (CT) or magnetic resonance tomography (MRT) and know the basic characteristics of corresponding operators. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Inverse problems" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes, in case of block seminar approx. 45 minutes) **Examination prerequisites:**	3 C

Teilnahme am Seminar	

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Inverse problems"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3131
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3432: Seminar on approximation methods**	3 C 2 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Approximation methods" enables students to learn methods, concepts, theories and applications in the area of "Approximation methods", so the approximation of one- and multidimensional functions as well as for the analysis and approximation of discrete signals and images. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the modelling of approximation problems in suitable finite- and infinite-dimensional vector spaces; • can confidently handle models for the approximation of one- and multidimensional functions in Banach and Hilbert spaces; • know and use parts of classical approximation theory, e. g. Jackson and Bernstein theorems for the approximation quality for trigonometrical polynomials, approximation in translationally invariant spaces; polynomial reductions and Strang-Fix conditions; • acquire knowledge of continuous and discrete approximation problems and their corresponding solution strategies both in the one- and multidimensional case; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods for the efficient solution of the approximation problems on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge about linear and non-linear approximation methods for multidimensional data; • are informed about current developments of efficient data approximation and data analysis; • adapt solution strategies for the data approximation using special structural characteristics of the approximation problem that should be solved. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Approximation methods" and present it in a talk; • conduct scholarly debates in a familiar context.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Approximation methods"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3132
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3433: Seminar on numerics of partial differential equations**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Numerics of partial differential equations" enables students to learn methods, concepts, theories and applications in the area of "Numerics of partial differential equations". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of linear partial differential equations, e. g. questions of classification as well as existence, uniqueness and regularity of the solution; • know the basics of the theory of linear integral equations; • are familiar with basic methods for the numerical solution of linear partial differential equations with finite difference methods (FDM), finite element methods (FEM) as well as boundary element methods (BEM); • analyse stability, consistence and convergence of FDM, FEM and BEM for linear problems; • apply methods for adaptive lattice refinement on the basis of a posteriori error approximations; • know methods for the solution of larger systems of linear equations and their preconditioners and parallelisation; • apply methods for the solution of larger systems of linear and stiff ordinary differential equations and are familiar with the problem of differential algebraic problems; • apply available software for the solution of partial differential equations and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge in the theory as well as development and application of numerical solution strategies in a special area of partial differential equations, e. g. in variation problems with constraints, singularly perturbed problems or of integral equations; • know propositions about the theory of non-linear partial differential equations of monotone and maximally monotone type as well as suitable iterative solution methods. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Numerics of partial differential equations" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Numerical methods of partial differential equations"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3133
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3434: Seminar on optimisation	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Optimisation" enables students to learn methods, concepts, theories and applications in the area of "Optimisation", so the discrete and continuous optimisation. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • identify optimisation problems in application-oriented problems and formulate these as mathematical programmes; • evaluate the existence and uniqueness of the solution of an optimisation problem; • identify structural characteristics of an optimisation problem, amongst others the existence of a finite candidate set, the structure of the underlying level set; • know which special characteristics of the target function and the constraints (like (virtual) convexity, dc functions) for the development of solution strategies can be utilised; • analyse the complexity of an optimisation problem; • classify a mathematical programme in a class of optimisation problems and know current solution strategies for it; • develop optimisation methods and adapt general methods to special problems; • deduce upper and lower bounds for optimisation problems and understand their meaning; • understand the geometrical structure of an optimisation problem and apply it for solution strategies; • distinguish between proper solution methods, approximation methods with quality guarantee and heuristics and evaluate different methods on the basis of the quality of the found solutions and their computing times; • acquire advanced knowledge in the development of solution strategies on the basis of a special area of optimisation, e. g. integer optimisation, optimisation of networks or convex optimisation; • acquire advanced knowledge for the solution of special optimisation problems of an application-oriented area, e. g. traffic planning or location planning; • handle advanced optimisation problems, like e. g. optimisation problems with uncertainty or multi-criteria optimisation problems. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Optimisation" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Optimisation"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3134
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3437: Seminar on variational analysis	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Variational analysis" enables students to learn methods, concepts, theories and applications in variational analysis and continuous optimisation. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • understand basic concepts of convex and variational analysis for finite- and infinite-dimensional problems; • master the characteristics of convexity and other concepts of the regularity of sets and functions to evaluate the existence and regularity of the solutions of variational problems; • understand basic concepts of the convergence of sets and continuity of set-valued functions; • understand basic concepts of variational geometry; • calculate and use generalised derivations (subderivatives and subgradients) of non-smooth functions; • understand the different concepts of regularity of set-valued functions and their effects on the calculation rules for subderivatives of non-convex functionals; • analyse constrained and parametric optimisation problems with the help of duality theory; • calculate and use the Legendre-Fenchel transformation and infimal convulutions; • formulate optimality criteria for continuous optimisation problems with tools of convex and variational analysis; • apply tools of convex and variational analysis to solve generalised inclusions that e. g. originate from first-order optimality criteria; • understand the connection between convex functions and monotone operators; • examine the convergence of fixed point iterations with the help of the theory of monotone operators; • deduce methods for the solution of smooth and non-smooth continuous constrained optimisation problems and analyse their convergence; • apply numerical methods for the solution of smooth and non-smooth continuous constrained programs to current problems; • model application problems with variational inequations, analyse their characteristics and are familiar with numerical methods for the solution of variational inequations; • know applications of control theory and apply methods of dynamic programming; • use tools of variational analysis in image processing and with inverse problems; • know basic concepts and methods of stochastic optimisation. **Core skills:**	Attendance time: 28 h Self-study time: 62 h

After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Variational analysis" and present it in a talk; • conduct scholarly debates in a familiar context.	

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Variational analysis"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3137
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen Module B.Mat.3438: Seminar on image and geometry processing	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Image and geometry processing" enables students to learn and apply methods, concepts, theories and applications in the area of "Image and geometry processing", so the digital image and geometry processing. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the modelling of problems of image and geometry processing in suitable finite- and infinite-dimensional vector spaces; • learn basic methods for the analysis of one- and multidimensional functions in Banach and Hilbert spaces; • learn basic mathematical concepts and methods that are used in image processing, like Fourier and Wavelet transform; • learn basic mathematical concepts and methods that play a central role in geometry processing, like curvature of curves and surfaces; • acquire knowledge about continuous and discrete problems of image data analysis and their corresponding solution strategies; • know basic concepts and methods of topology; • are familiar with visualisation software; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • know which special characteristics of an image or of a geometry can be extracted and worked on with which methods; • evaluate different numerical methods for the efficient analysis of multidimensional data on the basis of the quality of the solutions, the complexity and their computing time; • acquire advanced knowledge about linear and non-linear methods for the geometrical and topological analysis of multidimensional data; • are informed about current developments of efficient geometrical and topological data analysis; • adapt solution strategies for the data analysis using special structural characteristics of the given multidimensional data. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Image and geometry processing" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Image and geometry processing"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3138
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3439: Seminar on scientific computing / applied mathematics**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Scientific computing / Applied mathematics" enables students to learn and apply methods, concepts, theories and applications in the area of "Scientific computing / Applied mathematics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of basic mathematical models of the corresponding subject area, especially about the existence and uniqueness of solutions; • know basic methods for the numerical solution of these models; • analyse stability, convergence and efficiency of numerical solution strategies; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • are informed about current developments of scientific computing, like e. g. GPU computing and use available soft- and hardware; • use methods of scientific computing for solving application problems, like e. g. of natural and business sciences. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Scientific computing / applied mathematics" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Scientific computing / applied mathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3139
Language: English	**Person responsible for module:** Dean of studies mathematics

Course frequency: not specified	Duration: 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations:
Instructor: Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module B.Mat.3441: Seminar on applied and mathematical stochastics**	3 C 2 WLH

Learning outcome, core skills:	**Workload:**
Learning outcome: The successful completion of modules of the cycle "Applied and mathematical stochastics" enables students to understand and apply a broad range of problems, theories, modelling and proof techniques of stochastics. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued: Students • are familiar with advanced concepts of probability theory established on measure theory and apply them independently; • are familiar with substantial concepts and approaches of probability modelling and inferential statistics; • know basic characteristics of stochastic processes as well as conditions for their existence and uniqueness; • have a pool of different stochastic processes in time and space at their disposal and characterise those, differentiate them and quote examples; • understand and identify basic characteristics of invariance of stochastic processes like stationary processes and isotropy; • analyse the convergence characteristic of stochastic processes; • analyse regularity characteristics of the paths of stochastic processes; • adequately model temporal and spatial phenomena in natural and economic sciences as stochastic processes, if necessary with unknown parameters; • analyse probabilistic and statistic models regarding their typical characteristics, estimate unknown parameters and make predictions for their paths on areas not observed / at times not observed; • discuss and compare different modelling approaches and evaluate the reliability of parameter estimates and predictions sceptically. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Applied and mathematical stochastics" and present it in a talk; • conduct scholarly debates in a familiar context.	Attendance time: 28 h Self-study time: 62 h

Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C

Examination requirements:	

Autonomous permeation and presentation of complex mathematical issues in the area "Applied and mathematical stochastics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3141
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen **Module B.Mat.3443: Seminar on stochastic methods of economathematics**	3 C 2 WLH
Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Stochastic methods of economathematics" enables students to learn methods, concepts, theories and applications in this area. During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • master problems, basic concepts and stochastic methods of economathematics; • understand stochastic connections; • understand references to other mathematical areas; • get to know possible applications in theory and practice; • gain insight into the connection of mathematics and economic sciences. **Core skills:** After having successfully completed the module, students will be able to • become acquainted with a mathematical topic in the area "Stochastic methods of economathematics" and present it in a talk; • conduct scholarly debates in a familiar context.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Seminar (2 SWS) (Seminar)	
Examination: Oral Presentation (approx. 75 minutes) **Examination prerequisites:** Participation in the seminar	3 C
Examination requirements: Autonomous permeation and presentation of complex mathematical issues in the area "Stochastic methods of economathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3143
Language: English	**Person responsible for module:** Dean of studies mathematics
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Mathematical Stochastics

Georg-August-Universität Göttingen Module B.Phy.1201: Analytical mechanics	8 C 6 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls können die Studierenden... • die Begriffe und Methoden der klassischen theoretischen Mechanik anwenden; • komplexe mechanische Systeme modellieren und mit den Erlernten formalen Techniken behandeln.	**Workload:** Attendance time: 84 h Self-study time: 156 h

Course: Vorlesung mit Übung	
Examination: Written examination (180 minutes) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. **Examination requirements:** Newton'sche Mechanik (Zentralkraftproblem, Streuquerschnitte); Lagrange-Formalismus (Variationsprinzipien, Nebenbedingungen und Zwangskräfte, Symmetrien und Erhaltungssätze); Starre Körper (Euler-Winkel, Trägheitstensor und Hauptachsentransformation, Euler-Gleichungen); Kleine Schwingungen; Hamilton-Formalismus (Legendre-Transformation, Phasenraum, Liouville'scher Satz, Poisson-Klammern).	8 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** StudiendekanIn der Fakultät für Physik
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 2
Maximum number of students: 180	

Georg-August-Universität Göttingen Module B.Phy.1203: Quantum Mechanics I	8 C 6 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls können die Studierenden... • die Begriffe, Interpretation und mathematischen Methoden der Quantentheorie anwenden; • einfache Potentialprobleme mit den erlernten mathematischen Techniken behandeln.	**Workload:** Attendance time: 84 h Self-study time: 156 h
Course: Vorlesung mit Übung	
Examination: Written examination (180 minutes) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. **Examination requirements:** Kenntnis des konzeptionellen Rahmens, der Prinzipien und Methoden der Quantenmechanik: Wellenmechanik und Schrödinger-Gleichung. Statistische Interpretation von Quantensystemen; Eindimensionale Modellsysteme, gebundene Zustände und Streuzustände; Formulierung der Quantenmechanik (Hilbertraum, lineare Operatoren, unitäre Transformationen, Operatoren und Messgrößen, Symmetrie und Erhaltungsgrößen); Heisenberg-Bild; Quantisierung des Drehimpulses und Spin; Wasserstoffatom; Näherungsverfahren (Störungsrechnung, Variationsverfahren); Mehrteilchensysteme.	8 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** StudiendekanIn der Fakultät für Physik
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 4
Maximum number of students: 180	

Georg-August-Universität Göttingen **Module B.Phy.1204: Statistical Physics**	8 C 6 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls können die Studierenden... • die Konzepte und Methoden der statistischen Physik anwenden; • einfache thermodynamische Systeme modellieren und mit den erlernten mathematischen Techniken behandeln.	**Workload:** Attendance time: 84 h Self-study time: 156 h

Course: Vorlesung mit Übung	
Examination: Written examination (180 minutes) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein.	8 C

Examination requirements: Thermodynamik (Hauptsätze, Potentiale, Gleichgewichtsbedingungen, Phasenübergänge); Statistik (Wahrscheinlichkeitsverteilungen, Zentralwertsatz); Statistische Ensembles; Ergodenhypothese; Statistische Deutung der Thermodynamik; Zustandssumme; Theorie der Phasenübergänge; Quantenstatistik.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** StudiendekanIn der Fakultät für Physik
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5
Maximum number of students: 180	

Georg-August-Universität Göttingen **Module B.Phy.1511: Introduction to Particle Physics**	8 C 6 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls kennen die Studierenden physikalische Fakten und Modellvorstellungen über den Aufbau der Atomkerne und die Eigenschaften von Elementarteilchen. Außerdem sollten sie mit den grundlegenden Begriffen und Modellen der Kern- und Teilchenphysik umgehen können.	**Workload:** Attendance time: 84 h Self-study time: 156 h

Course: Einführung in die Kern- und Teilchenphysik	
Examination: Klausur (120 Min.) oder mdl. Prüfung (ca. 30 Min.) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein.	8 C

Examination requirements: Eigenschaften und Spektroskopie von stabilen und instabilen Atomkernen; Eigenschaften von Elementarteilchen und Experimente der Hochenergiephysik; Grundlagen der Teilchenbeschleunigerphysik.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** StudiendekanIn der Fakultät für Physik
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: 180	

Georg-August-Universität Göttingen **Module B.Phy.1521: Introduction to Solid State Physics**	8 C 6 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls haben die Studierenden die Grundlagen und die physikalische Erscheinungen der Zusammenhalt der Ionen und Elektronen in einem Festkörper mit idealen periodischen Anordnung der konstituierenden Atomen verinnerlicht. Basierend auf der Eigenschaften freier Atomen und deren Wechselwirkung im Kristallgitter wird ein grundlegendes Verständnis verschiedener kollektiven Phänomene gewonnen. Dazu gehören beispielsweise die elektronische Bandstruktur im periodischen Gitterpotential (Dynamik der Elektronen) sowie die Gitterschwingungen (Dynamik der Ionen), die Elektrizitätsleitung - auch in niederdimensionalen Strukturen - sowie thermische Eigenschaften (spezifische Wärme).	**Workload:** Attendance time: 84 h Self-study time: 156 h
Course: Vorlesung und Übung Einführung in die Festkörperphysik	
Examination: Klausur (120 min.) oder mdl. Prüfung (ca. 30 min.) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. **Examination requirements:** Grundlagen, Phänomene und Modelle für Elektronen- und Gitterdynamik in Festkörpern. Insbesondere, Chemische Bindung in Festkörpern, Atomare Kristallstruktur, Streuung an periodischen Strukturen, das Elektronengas ohne Wechselwirkung (Freie Elektronen), das Elektronengas mit Wechselwirkung (Abschirmung, Plasmonen), das periodische Potential (Bandstrukturd der Kristall-Elektronen), Gitterschwingungen (Phononen) und spezifische Wärme	8 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Angela Rizzi
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** 5 - 6
Maximum number of students: 120	

Georg-August-Universität Göttingen **Module B.Phy.1531: Introduction to Materials Physics**	4 C 4 WLH
Learning outcome, core skills: This 2 week long intensive course is offered between the winter and summer semesters. It applies the knowledge obtained in the Einführung in die Festkörperphysik and Thermodynamik und statistische Physik to understanding the structure, properties and dynamic behavior of the materials we use in our everyday lives. **Learning outcomes:** crystal defects, disordered systems, impurities, crystalline mixtures and alloys, phase diagrams, phase transformations, diffusion, kinetics, materials selection, structure-property relations. **Core skills:** The students will gain an understanding of the different materials classes that we use in everyday life, including: how properties of materials are determined by their atomic scale structure, which driving forces determine the structure of equilibrium phases, and how kinetic processes control phase transformations and the dynamics of non-equilibrium processes.	**Workload:** Attendance time: 56 h Self-study time: 64 h

Course: Introduction to Materials Physics (Lecture)	2 WLH
Examination: Written or oral examWritten exam (120 minutes) or oral examination (approximately 30 minutes) **Examination prerequisites:** 50% of the homework problems must be solved successfully. **Examination requirements:** Crystal defects, disordered systems, impurities, crystalline mixtures and alloys, phase diagrams, phase transformations, diffusion, kinetics, materials selection.	4 C

Course: Introduction to Materials Physics (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** • Experimentelle Methoden der Materialphysik, • Einführung in die Festkörperphysik, • Thermodynamik und statistische Physik
Language: English	**Person responsible for module:** Prof.in Cynthia Ann Volkert
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module B.Phy.1541: Introduction to Geophysics**	4 C 3 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls können die Studierenden mit den grundlegenden Begriffen und Modellen der Geophysik umgehen: • Treibhauseffekt • Gravimetrie • Seismologie • Elektromagnetische Tiefenforschung • Altersbestimmung • Gezeiten • Konvektion • Erdmagnetfeld • Fraktale und chaotische Prozesse • Plattentektonik	**Workload:** Attendance time: 42 h Self-study time: 78 h

Course: Vorlesung und Übung zu Einführung in die Geophysik	
Examination: Klausur (120 min.) oder mdl. Prüfung (ca. 30 min.) **Examination prerequisites:** Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. **Examination requirements:** Grundlagen der Geophysik, insbes. Plattentektonik, Erdbeben	4 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Andreas Tilgner
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 6; Master: 1 - 2
Maximum number of students: 120	

Georg-August-Universität Göttingen Module B.Phy.1551: Introduction to Astrophysics	8 C 6 WLH
Learning outcome, core skills: After successful completion of the module students are familiar with the basic concepts of astrophysics in observation and theory. In particular, they • have gained an overview of observational techniques in astronomy • understand the basic physics of the formation, structure and evolution of stars and planets have learned about the classification and structure of normal and active galaxies • understand the basic physics of homogeneous cosmology and cosmological structure formation	**Workload:** Attendance time: 84 h Self-study time: 156 h
Course: Lecture and exercises for introduction to astrophysics	
Examination: oral (approx. 30 minutes) or written (120 min.) exam **Examination prerequisites:** At least 50% of the homework of the excercises have to be solved successfully. **Examination requirements:** Observational techniques, Planets and exoplanets, planet formation, stellar formation, structure and evolution, galaxies, AGN and quasars, cosmology, structure formation	8 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Jens Carsten Niemeyer
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1
Maximum number of students: 120	

Georg-August-Universität Göttingen **Module B.Phy.1561: Introduction to Physics of Complex Systems**	6 C 6 WLH

Learning outcome, core skills: Sound knowledge of essential methods and concepts from Nonlinear Dynamics and Complex Systems Theory, including practical skills for analysis and simulation (using, for example, the programming language python) of dynamical systems.	**Workload:** Attendance time: 84 h Self-study time: 96 h

Course: Introduction to Physics of Complex Systems (Lecture)	4 WLH
Examination: written examination (120 Min.) or oral examination (approx. 30 Min.) **Examination prerequisites:** At least 50% of the homework of the excercises have to be solved successfully. **Examination requirements:** • Knowledge of fundamental principles and methods of Nonlinear Physics • Modern experimental techniques and theoretical models of Complex Systems theory.	6 C

Course: Introduction to Physics of Complex Systems (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Basic programming skills (for the exercises)
Language: English, German	**Person responsible for module:** Prof. Dr. Stefan Klumpp Prof. Dr. Ulrich Parlitz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 2
Maximum number of students: 120	

Georg-August-Universität Göttingen **Module B.Phy.1571: Introduction to Biophysics**	6 C 6 WLH

Learning outcome, core skills: After attending this course, students will have basic knowledge about • the build-up of cells and the function of the components • transport phenomena on small length scales, derivation and solution of the diffusion equation • laminar hydrodynamics and its application in biological systems (flow, swimming, motility) • reaction kinetics and cooperativity, including enzymes • non-covalent interaction forces • self-assembly • biological (lipid) membrane build-up and dynamics • biopolymer physics and cytoskeletal filaments, including filament and cell mechanics • neurobiophysics • experimental methods, including state-of-the-art microscopy	**Workload:** Attendance time: 84 h Self-study time: 96 h

Course: Introduction to Biophysics (Lecture) *Contents*: components of the cell; diffusion, Brownian motion and random walks; low Reynolds number hydrodynamics; chemical reactions, cooperativity and enzymes; biomolecular interaction forces and self-assembly; membranes; polymer physics and mechanics of the cytoskeleton; neurobiophysics; experimental methods and microscopy	4 WLH
Examination: Written exam (120 min.) or oral exam (ca. 30 min.) **Examination prerequisites:** At least 50% of the homework problems have to be solved successfully. **Examination requirements:** Knowledge of the fundamental principles, theoretical descriptions and experimental methods of biophysics.	6 C

Course: Introduction to Biophysics (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Sarah Köster
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 2
Maximum number of students: 100	

Georg-August-Universität Göttingen **Module B.Phy.5601: Theoretical and Computational Neuroscience I**	3 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden... • ein vertieftes Verständnis folgender Themen entwickelt haben: TCN I: biophysikalische Grundlagen neuronaler Anregbarkeit, mathematische Grundlagen neuronaler Anregbarkeit, Input-Output Beziehungen und Bifurkationen, Klassifizierung, Existenz, Stabilitaet und Koexistenz sychroner und asynchroner Zustaende in spikenden neuronalen Netzwerken; • Methoden und Methodenentwicklung für die Analyse hochdimensionaler Modelle ratenkodierter Einheiten in Feldmodellen verstehen; • die Handhabung von Bifurkationsszenarien und zugehörigen Instabilitäten verstanden haben.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Collective Dynamics Biological Neural Networks I (Lecture)	

Exactly one of the following examinations must be successfully completed:	
Examination: Written examination (120 minutes)	3 C
Examination: Oral examinationMündliche Prüfung (approx. 30 minutes)	3 C
Examination: Vortrag (2 Wochen Vorbereitungszeit) (30 minutes)	3 C

Examination requirements: Grundlagen der Membranbiophysi;, Bifurkationen anregbarer Systeme; Verständnis der Grundlagen der Modellierungsansätze der Neurophysik; kollektive Zustände spikender neuronaler Netzwerke; insbesondere Synchonizität; Balanced State; Phase-Locking und diesen Zuständen unterliegenden lokalen und Netzwerkeigenschaften: Netzwerktopologie; Delays; inhibitorische und exzitatorische Kopplung; sparse random networks	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Fred Wolf
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 4 - 6; Master: 1
Maximum number of students: 90	

Georg-August-Universität Göttingen **Module B.Phy.5602: Theoretical and Computational Neuroscience II**	3 C 2 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls sollten Studierende... • das vertiefte Verständnis folgender Themen entwickelt haben: TCN II: Grundlagen neuronaler Anregbarkeit, Input-Output Beziehungen bei Einzelneuronen, eindimensionale Feldmodelle (Feature Selectivity, Contrastinvariance), zweidimensionale Feldmodell (Zusammenwirken von kurz- und langreichweitigen Verbindungen sowie lokaler Nichtlinearitaeten), Amplitudengleichungen und ihre Loesungen; • Methoden und Methodenentwicklung für die Analyse spikender neuronaler Netzwerke mit und ohne Delays, Handhabung von Bifurkationsszenarien und zugehörigen Instabilitäten verstehen.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Collective Dynamics Biological Neural Networks II (Lecture)	

Exactly one of the following examinations must be successfully completed:	
Examination: Written examination (120 minutes)	3 C
Examination: Oral examination (approx. 30 minutes)	3 C
Examination: Seminarvortrag (2 Wochen Vorbereitungszeit) (30 minutes)	3 C
Examination requirements: Ratenmodelle von Einzelneuronen; Feldansatz in der theoretischen Neurophysik; Grundlagen der Bifurkationen anregbarer System; Verständnis der Grundlagen der Modellierungsansätze der Neurophysik; Zusammenhang diskrete/kontinuierliche Modelle; kollektive Zustände ein- und zweidimensionaler Feldmodelle, insbesondere ring model of feature selectivity; orientation preference maps.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Fred Wolf
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 4 - 6; Master: 1
Maximum number of students: 90	

Georg-August-Universität Göttingen **Module B.Phy.5605: Computational Neuroscience: Basics**	3 C 2 WLH

Learning outcome, core skills: **Goals:** Introduction to the different fields of Computational Neuroscience: • Models of single neurons, • Small networks, • Implementation of all simple as well as more complex numerical computations with few neurons. • Aspects of sensory signal processing (neurons as ‚filters'), • Development of topographic maps of sensory modalities (e.g. visual, auditory) in the brain, • First models of brain development, • Basics of adaptivity and learning, • Basic models of cognitive processing. **Kompetenzen/Competences:** On completion the students will have gained… • … overview over the different sub-fields of Computational Neuroscience; • … first insights and comprehension of the complexity of brain function ranging across all sub-fields; • … knowledge of the interrelations between mathematical/modelling methods and the to-be-modelled substrate (synapse, neuron, network, etc.); • … access to the different possible model level in Computational Neuroscience.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Computational Neuroscience: Basics (Lecture)	
Examination: Written examination (45 minutes) **Examination requirements:** Actual examination requirements: Having gained overview across the different sub-fields of Computational Neuroscience; Having acquired first insights into the complexity of across the whole bandwidth of brain function; Having learned the interrelations between mathematical/modelling methods and the to-be-modelled substrate (synapse, neuron, network, etc.) Being able to realize different level of modelling in Computational Neuroscience.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 2 - 6; Master: 1 - 4

Georg-August-Universität Göttingen Module B.Phy.5651: Advanced Computational Neuroscience	3 C 2 WLH
Learning outcome, core skills: Participants in the course can explain and relate biological foundations and mathematical modelling of selected (neuronal) algorithms for learning and pattern formation. Based on the the algorithms' properties, they can discuss and derive possible technical applications (robots).	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Advanced Computational Neuroscience I (Lecture)	
Examination: Written examination (90 Min.) or oral examination (approx. 20 Min.) **Examination requirements:** Algorithms for learning: • Unsupervised Learning (Hebb, Differential Hebb), • Reinforcement Learning, • Supervised Learning Algorithms for pattern formation. Biological motivation and technical Application (robots).	3 C

Admission requirements: none	**Recommended previous knowledge:** Basics Computational Neuroscience
Language: English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 50	

Additional notes and regulations:
Hinweis: Die B.Phy.5652 kann als vorlesungsbegleitendes Praktikum besucht werden.

Georg-August-Universität Göttingen Module B.Phy.5652: Advanced Computational Neuroscience II	3 C 2 WLH
Learning outcome, core skills: Participants in the course can implement, test, and evaluate the properties of selected (neuronal) algorithms for learning and pattern formation.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Advanced Computational Neuroscience II	
Examination: 4 Protocols (max. 3 Pages) and Presentations (ca. 10 Min.), not graded **Examination requirements:** Algorithms for learning: • Unsupervised Learning (Hebb, Differential Hebb), • Reinforcement Learning, • Supervised Learning Algorithms for pattern formation. Biological motivation and technical Application (robots). *For each of the 4 programming assignments 1 protocol (ca. 3 pages) and 1 oral presentations (demonstration and discussion of the program, ca. 10 min).*	3 C

Admission requirements: B.Phy.5651 (can be taken in parallel to B.Phy.5652)	**Recommended previous knowledge:** Programming in C++, basic numerical algorithms, Grundlagen Computational Neuroscience B.Phy.5504: Computational Physics (Scientific Computing)
Language: English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: three times	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 24	

Georg-August-Universität Göttingen **Module B.Phy.5676: Computer Vision and Robotics**	9 C 6 WLH

Learning outcome, core skills: After successful completion of this module, students are familiar with • the basic concepts of computer vision (CV), • low level hardware components and their functions, • building and programming a robot, and • computer vision and robotics algorithms.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Introduction to Computer Vision and Robotics (Lecture) *Contents*: On-Off Controller, PID Controller, Moving Average Filter, Exponential Moving Average Filter, Kalman Filter, A*, Dijkstra, RRT, Q-Learning , Inverse and Forward Kinematics, Movement Generation Methods, Smoothing and Median Filtering, Bilateral Filtering, Non-Local Means, Connected Components , Morphological Operators , Line Detection, Circle Detection, Feature Detection, Advanced image segmentation algorithms.	2 WLH
Course: Practical Course on Computer Vision and Robotics (Lecture) *Contents*: Building a robot, solving a graph problem using the robot and executing the found solution by the robot in a real-world scenario involving perception and navigation	2 WLH
Course: Tutorial on Computer Vision and Robotics (Tutorial) *Contents*: In the accompanying tutorial sessions students deepen and broaden their knowledge from the lectures	2 WLH
Examination: Written report (approx. 10 p.) and Oral Exam (approx. 30 minutes) **Examination requirements:** Written report requirements: The students must be able • to describe their project in a written report • to explain given problems and used solutions for navigation- and perception problems of robots Oral Examination requirements: The students must be able • to repeat and explain lecture material • to explain control algorithms for a robot, and • to identify and understand low level hardware components as robot sensors and actuators.	9 C

Admission requirements: none	**Recommended previous knowledge:** Programming in Python
Language: English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

three times	Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 24	

Additional notes and regulations: Ausschluss: Dieses Modul darf nicht belegt werden, wenn B.Phy.5667 oder B.Phy.5668 schon belegt wurden.

Georg-August-Universität Göttingen Module B.WIWI-OPH.0009: Law	8 C 6 WLH
Learning outcome, core skills: After successful completion of the module: • students have acquired basic knowledge of civil and commercial law, • students have learned to differentiate between an obligation transaction and a disposal transaction as well as between contractual and tortious claims, • students know the main types of contracts, • know the dogmatic conceptions of civil law in their systematic, ideal and practical significance, • students know the methods of interpreting the law (wording, systematic, historical, teleological interpretation) and can apply them, • know how to apply the technique of case resolution in the field of civil law, • students are able to apply the acquired knowledge in solving relevant cases and critically deal with the legal issues raised.	**Workload:** Attendance time: 84 h Self-study time: 156 h
Course: Law (Lecture)	4 WLH
Course: Law (Exercise)	2 WLH
Examination: Written examination (120 minutes)	8 C
Examination requirements: Through the module examination, students demonstrate that they: • have basic knowledge of civil and commercial law, • master selected facts of civil law, • master the associated methodological principles and • approach a civil case systematically and be able to resolve it in a defensible manner.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Joachim Münch
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.Bio.141: General and applied microbiology**	3 C 3 WLH
Learning outcome, core skills: **Learning outcome:** Evolution and phylogenetic system; morphology and cell biology; communities and biocoenosis of bacteria and archaea; gene expression and molecular control (transcription, translation); posttranslational control, protein stability and proteomics; genetic networks; molecular switches and signal transduction; microbial developmental biology; mechanisms of pathogenicity of important pathogens; development of new antimicrobial agents; diversity of the metabolism in bacteria and archaea as basis for biotechnological applications; industrial microbiology. **Core skills:** Knowledge of microorganisms relevant for biotechnology and medicine, ability to identify these organisms and to analyse them with molecular methods.	**Workload:** Attendance time: 42 h Self-study time: 48 h
Course: lecture: General and applied microbiology (Lecture)	3 WLH
Examination: Written examination (90 minutes)	3 C
Examination requirements: detailed knowledge in cell biology, biochemistry and genetics of procaryotic microorgansims	

Admission requirements: can't be combined with core module M.Bio.101	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jörg Stülke
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.Bio.142: Molecular genetics and microbial cell biology**	3 C 3 WLH
Learning outcome, core skills: Advanced knowledge of Molecular Genetics and microbial cell biology through case studies of model systems of molecular mycology (yeasts and filamentous fungi). Acquisation of knowledge up to the "Review" level in one topic.	**Workload:** Attendance time: 42 h Self-study time: 48 h
Course: Molecular genetics and microbial cell biology (Lecture)	3 WLH
Examination: Written examination (90 minutes)	3 C
Examination requirements: detailed knowledge in cell biology, biochemistry and genetics of eucaryotic microorgansims	

Admission requirements: Can´t be combined with core module M.Bio.102 or key competence module M.Bio.172.	**Recommended previous knowledge:** • Watson, Molecular Biology of the Gene, Pearson, 7th Edition • Alberts, Molecular Biology of the Cell, Garland, 5th Edition
Language: English	**Person responsible for module:** Prof. Dr. Gerhard Braus
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.Bio.144: Cellular and molecular biology of plant-microbe interactions**	3 C 3 WLH

Learning outcome, core skills: Introduction into theory and methods for the analysis of plant-microbe interactions on the cell biological and molecular level.	**Workload:** Attendance time: 42 h Self-study time: 48 h

Course: lecture: Plant-microbe-interactions (Lecture)	3 WLH
Examination: Written examination (54 minutes)	3 C

Examination requirements: knowledge of basic concepts in plant-microbe-interactions	

Admission requirements: Can´t be combined with core module M.Bio.104	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Volker Lipka
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.Bio.310: Systems biology**	12 C 14 WLH

Learning outcome, core skills: Subject of this module are the formal description, modeling, analysis and simulation of complex interactions between the components (molecules, cells, organs) of living systems on different levels of abstraction. Biomolecular networks, like networks of metabolic signaling and transduction will be introduced and various graph based abstractions of interaction networks will be demonstrated (entity interaction graph, boolean networks, Petri networks). The students will get to know basics of the graph theory (analysis of paths, cluster coefficients, centrality, etc.) and they will learn how to apply the respective theory to biomolecular networks. The students will be introduced to different high-throughput techniques and their application to biomolecular networks. The simulation of molecular networks will be presented by selected examples.	**Workload:** Attendance time: 147 h Self-study time: 213 h

Course: Bioinformatics of systems biology (Lecture)	2 WLH
Examination: Oral examination (approx. 30 minutes)	6 C

Course: Bioinformatics of systems biology (Exercise)	2 WLH
Course: Bioinformatics of systems biology (Seminar)	1 WLH

Course: Methods course 'Modelling and analysis of biological systems' 3 weeks full time	9 WLH
Examination: Minutes / Lab report (max. 10 pages) **Examination prerequisites:** oral presentation (ca. 30 min), regular attendance	6 C

Examination requirements: Ability to model, analyze and simulate biomolecular networks	

Admission requirements: can't be combined with M.Bio.340	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Tim Beißbarth
Course frequency: each summer semester; verschieden; siehe Lehrveranstaltungen	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.Bio.323: Introduction to Bayesian Statistics and Information Theory**	12 C 12 WLH

Learning outcome, core skills: The students learn the basic concepts and main applications of Bayesian Statistics, in particular Bayesian probabilities, parameter estimation and Bayesian credible intervals, importance and choice of prior distributions based on prior knowledge, Bayesian hypothesis testing, model tests and MCMC methods. All concepts will be presented in lectures and worked with in hands-on computer assignments. The module closes with a foray into information theory.	**Workload:** Attendance time: 195 h Self-study time: 165 h

Course: Introduction to Bayesian Inference and Information Theory (Lecture)	3 WLH
Course: Classical problems in Bayesian Interference (Seminar)	1 WLH

Course: Programmierkurs	8 WLH

Examination: Written examination (90 minutes) **Examination prerequisites:** regular attendance, oral presentation in seminar	12 C

Examination requirements: Knowledge of the foundations of Bayesian probabilities and statistics and the ability to solve simple classic problems in Bayesian Inference.	

Admission requirements: basic computer knowledge, basic experience in coding	**Recommended previous knowledge:** basics in probability calculation
Language: English	**Person responsible for module:** Prof. Dr. Michael Wibral
Course frequency: each winter semester	**Duration:**
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 10	

Georg-August-Universität Göttingen Module M.Bio.344: Neurobiology 1 (key competence module)	3 C 2 WLH
Learning outcome, core skills: Profound knowledge of essential techniques in molecular, cellular and systemic neuroscience and their application.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: From gene to behavior (Lecture)	2 WLH
Examination: Written examination (60 minutes)	3 C
Examination requirements: Theoretical knowledge of the basic methods in neuroscience based on the contents of the lecture.	

Admission requirements: can't be combined with module M.Bio.304	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Göpfert
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 27	

Georg-August-Universität Göttingen **Module M.Bio.359: Development and plasticity of the nervous system (lecture)**	3 C 2 WLH

Learning outcome, core skills: The basics of the development and plasticity of the vertebrate nervous system are presented. Special emphasis is on the 3 following subjects: i) early development of the nervous system (induction and pattern formation, formation and survival of nerve cells, development of specific axonal projections, synaptogenesis), ii) developmental plasticity (experience- and activity-dependent development of the brain, critical periods) and iii) adult plasticity and regeneration (learning-induced plasticity, cellular mechanisms of plastic changes, neurogenesis, therapies after brain lesions). Deepened knowledge, up-to-date research results and understanding of scientific approaches in the field of the development and plasticity of the nervous system.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: lecture: Development and plasticity of the nervous system (Lecture)	2 WLH
Examination: Oral examination (approx. 15 minutes)	3 C

Examination requirements: Profound knowledge of recent reserach and understanding of scientific methods in the field of development and plasticity of the nervous system.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Siegrid Löwel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 35	

Georg-August-Universität Göttingen **Module M.Bio.360: Development and plasticity of the nervous system (seminar)**	3 C 2 WLH
Learning outcome, core skills: The students learn to present up-to-date publications on the development and plasticity of the nervous system and to discuss the results critically in a seminar report. Deepened knowledge, up-to-date research results and understanding of scientific approaches in the field of the development and plasticity of the nervous system. Critical discussion of up-to-date literature, scientific debate, sharpening of critical thought, promotion of multidisciplinarity. Training in presentation techniques and scientific writing.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: seminar: Development and plasticity of the nervous system (Seminar)	2 WLH
Examination: oral presentation (~ 20 min) and essay (~ 8 pages)	3 C
Examination requirements: Profound knowledge of recent research and scientific methods in the field of development and plasticity of the nervous system.	

Admission requirements: attendance of M.Bio.359	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Siegrid Löwel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Bio.375: Neurorehabilitation Technologies: Introduction and Applications**	2 C 2 WLH

Learning outcome, core skills: Students are able to describe the state of the art in Neurorehabilitation technologies and understand the basics of the related physiological processes. They are in a position to discuss and evaluate current trends as well as to recognize limitations of available assistive and (neuro)rehabilitation technology. The programming and lab exercises will allow students to address variety of practical Neurorehabilitation challenges.	**Workload:** Attendance time: 28 h Self-study time: 32 h

Course: Introduction to Neurorehabilitation Technologies (Seminar) *Contents*: • Basic motor physiology • Biophysiological signal acquisition and processing • Invasive and non-invasive man-machine interfaces • Upper limb related technologies • Lower limb related technologies • Feedback for sensory-motor integration and rehabilitation • Selected topics on advanced technologies and their applications	1 WLH
Examination: Presentation (approx. 20 min.) and written elaboration (max. 5 pages), not graded **Examination prerequisites:** Participation and successful completion of all laboratory exercises.	3 C

Course: Neurorehabilitation Technologies (Exercise) *Contents*: • Biophysiological signal acquisition and processing • Prosthesis control • Motion analysis	1 WLH

Examination requirements: Students show that they are able to present and critically reflect scientific publications. They are familiar with the basic principles of neurorehabilitation technologies.	

Admission requirements: none	**Recommended previous knowledge:** basic programming skills (B.Inf.1801/1802) basic knowledge in neurophysiology (B.Bio.123; M.Bio.304)
Language: English	**Person responsible for module:** Prof. Dr. Arndt Schilling; Dr. Marko Markovic
Course frequency: each winter semester1	**Duration:**

Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 16	

Additional notes and regulations: Literature suggestions will be handed out at the beginning of each term. However, the students are expected to independently perform literature research on the selected topic.

Georg-August-Universität Göttingen **Module M.CoBi.541: Bioinformatics and its areas of application**	4 C 3 WLH

Learning outcome, core skills: The students will acquire knowledge on a diverse range of topics - both applied as well as purely bioinformatical. For this, there will be research-oriented lectures. On the applied side, these topics prominently feature - but are not limited to - the different types of "omics"-approaches available to answer biological questions (genomics, transcriptomics, phylogenomics, metabolomics, proteomics, CHIP-Seq, comparative genomics, phenomics etc). They will learn about feasibility and different approaches to data analysis. Furthermore, students will learn about the digitization of the biological sciences, featuring aspescts such as machine readable phenotypic annotation of morphology, phenotypic database, biological image analysis and more. Finally, the students will acquire knowledge on algorithmic and statistical aspects of bioinformatics, featuring the latest developments and challenges in the development of new bioinformatic tools for life sciences.	**Workload:** Attendance time: 42 h Self-study time: 78 h

Course: Bioinformatics and its areas of application (Lecture) *Contents*: This course provides an appetizer of the various applications and uses of bioinformatics - especially those represented by research on Göttingen Campus.	3 WLH
Examination: Term Paper (max. 10 pages), not graded **Examination requirements:** Students show that they gained an overview of the diversity of areas of application for algorithmic and applied bioinformatics - including tools for computational biology to solve biological questions - as well as in depth knowledge on a topic of choice for the essay.	4 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jan de Vries
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.CoBi.572: Biology for Bioinformaticians**	8 C 6 WLH

Learning outcome, core skills: This course aims to teach the principles of biology required for aspiring bioinformaticians and computational biologists. The students will learn about the basics of the building blocks of life. An introduction to molecular biology will cover aspects of cell biology, developmental biology, principles of genetics and genome biology, microbiology, protein biology and enzymology, and biochemistry as well as metabolism. Furthermore, they will get a glimpse into biodiversity through an introduction organismal diversity across uni- and multicellular life. This will be contextualized by a basic (molecular) evolutionary biological framework.	**Workload:** Attendance time: 84 h Self-study time: 156 h

Course: Biology for (bio)informaticians	4 WLH
Examination: Written examination (90 minutes)	8 C

Course: Biology for (bio)informaticians Tutorial (Tutorial)	2 WLH

Examination requirements: knowledge of the basics in molecular biology (cell biology, microbiology, genetics, neurobiology, developmental biology, biochemistry) as well as biodiversity (microorganisms, plants, fungi, animals)	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Kai Heimel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.DH.016: Multimodality	9 C 4 WLH
Learning outcome, core skills: Die Studierenden • können textuelle und audio-visuelle Äußerungen in ihre Verwendungskontexte, den historischen Diskurs oder die moderne Forschungssituation einbinden; • kennen Möglichkeiten der digitalen Vermittlung zwischen den “stummen” Artefakten und den historischen oder zeitgenössischen Verhältnissen; • besitzen die Fähigkeit, die Bedeutung historischer, kultureller oder aktueller Kontexte mit digitalen Methoden zu analysieren und in einer grundsätzlichen Methodenreflexion zu diskutieren; • sind in der Lage, die wissenschaftliche Kategorisierungen von Personen, Bildern und Objekten, Räumen, Vorstellungen oder Prozessen digital zu modellieren und zueinander in Beziehung zu setzen; • sind imstande, die verwendeten Lösungsansätze in Hinblick auf ihre wissenschaftlichen, gesellschaftlichen und ethischen Folgen zu bewerten und das analytische Wissen reflexiv auf sich selbst und ihr Handeln anzuwenden.	**Workload:** Attendance time: 56 h Self-study time: 214 h
Course: Übung	2 WLH
Course: Seminar	2 WLH
Examination: Referat (ca. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden reflektieren Ergebnisse der Visual Culture Studies und der Multimodalitätsforschung und besitzen die Fähigkeit, Methoden und Theoriebildungen zu evaluieren und in Ansätzen zu modifizieren. Die Prüfung ist im Seminar zu erbringen.	9 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner Prof. Dr. Jörg Wesche
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.12: Theories and Research Questions in Computational Literature Analysis**	9 C 4 WLH
Learning outcome, core skills: The students • have an overview of methods and research questions in digital literary studies; • know computer-assisted procedures for indexing, processing, analysing and presenting literary works; • are also familiar with different forms of digital literature (such as fan fiction, collaborative fiction, computer-generated literary works or lay and expert reviews); • know possibilities of digital mediation between the texts and the historical or contemporary circumstances as well as the analysis of their meanings and have the ability to discuss these in a fundamental reflection on methods; • are able to evaluate the approaches used and to reflexively apply the analytical knowledge to themselves and their actions; • are able to digitally model the scientific categorisations of persons, texts, spaces, ideas or processes and relate them visually to each other.	**Workload:** Attendance time: 56 h Self-study time: 214 h
Course: Seminar	2 WLH
Examination: Presentation (approx. 30 min.) with written elaboration (max. 15 pages) **Examination prerequisites:** Regular participation in the seminar as well as successful digital implementation of the given exercises. **Examination requirements:** Students reflect on the results of specific research in literary studies and have the ability to evaluate and modify methods and theories. The examination is to be taken in the seminar.	9 C
Course: Exercise	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Anna Dorofeeva
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.13: Theories and Research Questions in Computational Image Analysis**	9 C 4 WLH
Learning outcome, core skills: The students • know the possibilities of a comprehensive digital image indexing and analysis, which includes not only colour, contrast and form but also the content and compositional structures contained in the images; • possess the ability to analyse humanities questions from the core areas of image and information science using computer-assisted methods; • are able to digitally model the specific characteristics of images and relate them to each other; • are able to evaluate the solution approaches used and to apply the analytical knowledge reflexively to themselves and their actions.	**Workload:** Attendance time: 56 h Self-study time: 214 h
Course: Seminar	2 WLH
Examination: Presentation (approx. 30 min.) with written elaboration (max. 15 pages) **Examination prerequisites:** Regular participation in the seminar as well as successful digital implementation of the given exercises. **Examination requirements:** The students reflect on the results of specific research in the field of image science and have the ability to evaluate methods and theories and to modify them in approaches.	9 C
Course: Exercise	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.14: Theories and Research Questions in Computational Object Analysis / Materiality	9 C 4 WLH

Learning outcome, core skills:	Workload:
The students • know the possibilities of comprehensive digital material indexing and analysis, which, in addition to the form, also includes the properties with regard to their materiality and formal variability of an object and its inherent possibilities of use; • possess the ability to analyse research topics from the humanities from the core areas of object and information science with computer-assisted methods; • are able to digitally model the specific characteristics of objects and their shape and relate them to each other; • are able to evaluate the approaches used and to reflexively apply the analytical knowledge to themselves and their actions.	Attendance time: 56 h Self-study time: 214 h

Course: Seminar	2 WLH
Examination: Presentation (approx. 30 min.) with written elaboration (max. 15 pages) **Examination prerequisites:** regRegular participation in the seminar as well as successful digital implementation of the given exercises. **Examination requirements:** The students reflect on the results of specific object science research and have the ability to evaluate methods and theories and to modify them in approaches.	9 C

Course: Exercise	2 WLH

Admission requirements: none	Recommended previous knowledge: none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.15: Theories and Research Questions in Computational Spatial Analysis**	9 C 4 WLH
Learning outcome, core skills: The students • have in-depth knowledge of the theory and application of geoinformation systems (GIS) and digital building surveys; • possess the ability to analyse research topics from the humanities from the core areas of geosciences and information science using computer-based methods; • are able to digitally model the specific characteristics of buildings and topographical features and their form and relate them to each other; • are able to evaluate the approaches used and to reflexively apply the analytical knowledge to themselves and their actions.	**Workload:** Attendance time: 56 h Self-study time: 214 h
Course: Seminar	2 WLH
Examination: Presentation (approx. 30 min.) with written elaboration (max. 15 pages) **Examination prerequisites:** Regular participation in the seminar as well as successful digital implementation of the given exercises. **Examination requirements:** The students reflect on the results of specific research in image and object science on the contextuality of things and have the ability to evaluate methods and theories and to modify them in approaches. The examination is to be taken in the seminar.	9 C
Course: Exercise	2 WLH

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.17: Digital Palaeography in Theory and Practice**	9 C 4 WLH

Learning outcome, core skills: Die Studierenden • haben einen Überblick über Methoden und Forschungsfragen der digitalen Paläographie; • kennen computergestützte Verfahren zur Erschließung, Aufbereitung, Analyse und Präsentation von Handschriften; • sind auch mit verschiedenen Schriftformen vertraut; • kennen Möglichkeiten der digitalen Vermittlung zwischen den Manuskripten und den historischen oder zeitgenössischen Verhältnissen sowie der Analyse ihrer Bedeutungen und besitzen die Fähigkeit, diese in einer grundsätzlichen Methodenreflexion zu diskutieren; • sind imstande, die verwendeten Lösungsansätze zu bewerten und das analytische Wissen reflexiv auf sich selbst und ihr Handeln anzuwenden; • sind in der Lage, die wissenschaftlichen, gesellschaftlichen und ethischen Kategorisierungen von Personen, Texten, Räumen, Vorstellungen oder Prozessen digital zu modellieren, zu reflektieren und visuell zueinander in Beziehung zu setzen.	**Workload:** Attendance time: 56 h Self-study time: 214 h

Course: Übung	2 WLH

Course: Seminar	2 WLH
Examination: Referat (ca. 30 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination prerequisites:** regelmäßige Teilnahme am Seminar sowie erfolgreiche digitale Umsetzung der gestellten Übungsaufgaben. **Examination requirements:** Die Studierenden reflektieren Ergebnisse spezifisch paläographischer Forschung und besitzen die Fähigkeit, Methoden und Theoriebildungen zu evaluieren und in Ansätzen zu modifizieren. Die Prüfungsleistung ist im Seminar zu erbringen.	9 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Anna Dorofeeva
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 4
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.20a: Research Project Computational Language Analysis	12 C 2 WLH

Learning outcome, core skills: The students • are able to work on a complex research question from the field of linguistics with the help of digital technologies, e.g. to carry out a linguistic analysis of internet documents (such as tweets); • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h

Course: Project *Course frequency:* each summer semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of linguistic research. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C

Course: Colloquium *Course frequency:* each summer semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Caroline Sporleder Prof. Dr. Marco Coniglio
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.20b: Project Computational Language Analysis**	9 C 2 WLH

Learning outcome, core skills: The students • are able to work on a research question from the field of linguistics with the help of digital technologies, e.g. to analyse language documents or to visualise historical references of reception; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of linguistic research. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Caroline Sporleder Prof. Dr. Marco Coniglio
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.21a: Research Project Computational Text Analysis	12 C 2 WLH
Learning outcome, core skills: The students • are able to work on a complex research question from the field of textual studies with the help of digital technologies, e.g. to develop a procedure for the digitisation of historical documents; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Project *Course frequency:* each winter semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of linguistic research. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C
Course: Colloquium *Course frequency:* each winter semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jörg Wesche Dr. Anna Dorofeeva
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.21b: Project Computational Text Analysis	9 C 2 WLH
Learning outcome, core skills: The students • are able to work on a research question from the field of textual studies with the help of digital technologies, e.g. to analyse a text corpus or to visualise historical references of reception; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of textual research. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jörg Wesche Dr. Anna Dorofeeva
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.22a: Research Project Computational Literature Analysis**	12 C 2 WLH

Learning outcome, core skills: The students • are able to work on a complex research question from the field of literary studies with the help of digital technologies, e.g. to analyse a literary genre stylometrically; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into sub-tasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h

Course: Project *Course frequency:* each summer semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of research in literary studies. In doing so, they demonstrate that they can evaluate and modify the relevant methods and theories. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C

Course: Colloquium *Course frequency:* each summer semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jörg Wesche
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students:	

20	

Georg-August-Universität Göttingen Module M.DH.22b: Project Computational Literature Analysis	9 C 2 WLH
Learning outcome, core skills: The students • are able to work on a research question from the field of literary studies with the help of digital technologies, e.g. to analyse a literary corpus or to visualise historical references of reception; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of research in literary studies. In doing so, they demonstrate that they can evaluate and modify the relevant methods and theories. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium (Colloquium)	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Jörg Wesche
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.23a: Research Project Computational Image Analysis**	12 C 2 WLH

Learning outcome, core skills: The students • are able to work on a research question from the field of image science with the help of digital technologies, e.g. to analyse a genre of image or to reconstruct a historical image space; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h

Course: Project *Course frequency:* each winter semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that processes, evaluates and presents the results of research in image science. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C

Course: Colloquium *Course frequency:* each winter semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students:	

20	

Georg-August-Universität Göttingen Module M.DH.23b: Project Computational Image Analysis	9 C 2 WLH
Learning outcome, core skills: The students • are able to work on a research question from the field of image studies with the help of digital technologies, e.g. to analyse a group of images or to reconstruct historical references of the reception; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on language, text and literature asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** The students create digital content that digitally prepares, evaluates and presents the results of research in image science. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium (Colloquium)	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.DH.24a: Research Project Computational Artefact Analysis**	12 C 2 WLH
Learning outcome, core skills: The students • are able to work on a research question from the field of object science with the help of digital technologies, e.g. to analyse a genre of object or to reconstruct a historical pictorial space; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on visual and material culture asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Project *Course frequency:* each summer semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that prepares, evaluates and presents the results of object science research. In doing so, they demonstrate that they can evaluate relevant methods and theories and modify them to some extent. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C
Course: Colloquium *Course frequency:* each summer semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.24b: Project Computational Artefact Analysis	9 C 2 WLH

Learning outcome, core skills:	**Workload:**
The students • are able to work on a research question from the field of object science with the help of digital technologies, e.g. to analyse a group of objects or to reconstruct historical references of the reception; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on visual and material culture asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** The students create digital content that digitally prepares, evaluates and presents the results of object science research. In doing so, they demonstrate that they can evaluate and modify the relevant methods and theories. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.DH.25a: Research Project Computational Spatial Analysis	12 C 2 WLH

Learning outcome, core skills: The students • are able to work on a research question from the field of historical building recording, archaeology or geoscience with the help of digital technologies, e.g. to analyse urban structures or to reconstruct a historical living space; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on visual and material culture asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 332 h

Course: Project *Course frequency:* each winter semester	1 WLH
Examination: Project work (max. 10 pages of project documentation) **Examination requirements:** Students create digital content that processes, evaluates and presents the results of archaeological or geoscientific research. In doing so, they demonstrate that they can evaluate and modify the relevant methods and theories. The project work comprises 270 hours of self-study and concludes with a project documentation (max. 10 pages).	6 C

Course: Colloquium *Course frequency:* each winter semester	1 WLH
Examination: Oral Presentation (approx. 30 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students:	

20	

Georg-August-Universität Göttingen **Module M.DH.25b: Project Computational Spatial Analysis**	9 C 2 WLH
Learning outcome, core skills: The students • are able to work on a research question from the field of historical building recording, archaeology or geoscience with the help of digital technologies, e.g. to analyse urbanistic structures or to reconstruct a historical habitat; • have the ability to reflect on the possibilities and limitations of the methods used in the development of a digital solution; • are able to utilise digital technologies to enhance the critical discussion on visual and material culture asking new kinds of questions about traditional research topics; • have the ability to subdivide complex tasks into subtasks and to find multifaceted solutions (in a team).	**Workload:** Attendance time: 28 h Self-study time: 242 h

Course: Project	1 WLH
Examination: small project work (max. 5 pages of project documentation) **Examination requirements:** Students create digital content that digitally processes, evaluates and presents the results of archaeological or geoscientific research. In doing so, they demonstrate that they can evaluate and modify the relevant methods and theories. The project work comprises 180 hours of self-study and concludes with a project documentation (max. 5 pages).	6 C

Course: Colloquium	1 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination requirements:** Students demonstrate that they are capable of presenting a completed project in an appropriate manner to a broader audience and explain the research question and the relevance of the topic. They are also able to discuss and defend the theses that have been put forward.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.FES.111: Introduction to Ecological Modelling**	6 C 4 WLH

Learning outcome, core skills: Basic knowledge of classic and modern approaches for modelling dynamics of populations and communities. Skilled in analytical thinking, independent application of models for practical research questions, development of simple models, and critical assessment of the possibilities and limitations of different modeling approaches. Ability to develop an effective model concept.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Introduction to ecological modelling (Lecture,Exercise) *Contents*: Using examples from ecology in general and forest ecology in specific, we will cover the following modelling approaches and types: population growth (considering demographic and environmental noise, scramble and contest competition), metapopulation models, predator-prey models, forest growth models, patterns and dynamics of biodiversity, island biogeography, life tables, matrix models, individual-based models, and spatial models. We will also address how to develop a model concept. The course will consist of a mixture of lectures and hands-on work on the computer.	4 WLH
Examination: Term paper (max. 3 pages, 50%) and written examination (45 minutes, 50%)	6 C

Examination requirements: Term paper: Ability to develop an effective model concept. Written examination: Knowledge and understanding of essential characteristics of the modelling approaches covered in class. Ability to interpret model results. Knowledge of possibilities and limitations of the models.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Kerstin Wiegand
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.FES.113: Soil Hydrology	6 C 4 WLH
Learning outcome, core skills: The course consists of three interconnected parts. The theoretical background (1) describes the fundamental static and dynamic principles of soil water, starting with the special physical properties of water molecules continuing with the basic static traits of soil water, e.g. water content and the energy state. The latter is important for the understanding and calculation of soil water flow under saturated and unsaturated conditions. The water balance of the soils will be completed by the potential sinks of soil water in ecosystems, like e.g. drainage, evaporation, root water uptake, and transpiration. The theoretical lectures will be accompanied by experimental exercises (2): lab measurements of bulk density, water content, water potential, conductivity, pF-curve are important parameters describing the state of soil water. Additionally, automated soil lysimeters with or without plants will be provided to the students for self-initiated experiments. The self-measured hydrological and meteorological time series data are the basis for the third part (3), the modelling of soil water cycles. Based on the learned experimental and theoretical skills, the basic principles of soil water modelling are explained and practiced.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Soil Hydrology (Lecture,Exercise,Practical course)	4 WLH
Examination: Term Paper (max. 20 pages)	6 C
Examination requirements: Theoretical and experimental skills of soil hydrology	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Martin Jansen
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.114: Ecosystem - Atmosphere Processes**	6 C 4 WLH
Learning outcome, core skills: Understanding the carbon and water cycle of terrestrial ecosystems requires a solid understanding of biogeophysical and biogeochemical processes at the ecosystem – atmosphere interface. These processes are directly affected by human induced alterations of the climate system such as climate change and land use. In this course, the students will learn about ecosystem – atmosphere processes based on real datasets from forests and other terrestrial ecosystems. The student will be exposed to a quantitative analysis of the data and will gain basic insights into land surface modelling considering land use as well as climate change.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Ecosystem – Atmosphere Processes (Exercise)	2 WLH
Course: Ecosystem – Atmosphere Processes (Lecture,Seminar)	2 WLH
Examination: Presentation (approx. 20 minutes, 50%) and oral exam (approx. 20 minutes, 50%)	6 C
Examination requirements: The student will learn about biogeophysical and biogeochemical processes at the ecosystem – atmosphere interface. They will have the ability to formulate these processes in the programming language R and describe them quantitatively.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Nils Knohl
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.FES.115: Statistical Data Analysis with R	6 C 4 WLH
Learning outcome, core skills: Introduction to R as programming language for beginners, statistical data analysis including explorative data analysis, plotting, basic tests (t, F, non-parametric), ANOVA, simple linear regression, multiple regression, analysis of residuals, ANCOVA, non-linear regression, glms with focus on logistic regression, short introduction to tidyverse and ggplot; always including introduction to theory and to practical implementation in R.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Statistical Data Analysis with R (Lecture,Exercise)	4 WLH
Examination: Presentation (approx. 15 min.) with written outline (max. 10 pages)	6 C
Examination requirements: • Import data into a statistics software and perform an explorative data analysis • Display data graphically • Select appropriate statistical approaches or models for data analysis • Discuss the advantages and disadvantages of statistical approaches or models • Apply statistical approaches or models to given data • Explain and test assumptions of statistical approaches or models • Interpret the results of the data analysis • Suggest meaningful follow-up analyses • Present and explain the procedures involved in a statistical data analysis	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Katrin Mareike Meyer
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 30	

Additional notes and regulations: 30 students are only possible if a corresponding number of computers is available

Georg-August-Universität Göttingen **Module M.FES.121: Advanced Data Analysis with R**	6 C 4 WLH
Learning outcome, core skills: Advanced data analysis skills with program R. Topics of this module include data management and organization, working with spatio(temporal) data, visualization of data, and applying appropriate statistical modeling techniques. Modeling starts with a thorough review of the linear model. Subsequently situations where assumptions of the linear model are violated are shown and potential solutions are discussed.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Advanced Data Analysis with R (Exercise)	2 WLH
Course: Advanced Data Analysis with R (Lecture)	2 WLH
Examination: Oral examination (approx. 20 minutes)	6 C
Examination requirements: • Handle and organizing data sets (merging data from multiple sources, perform subsets and filter operations, calculate new variables) • Work with spatial data (vector and raster), perform basic operations. • Visualize data, choose appropriate models, validation and interpretation of models, and state potential caveats of models used.	

Admission requirements: M.Forest.1115: Statistcal Data Analysisi with R	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Johannes Signer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.FES.122: Ecological Simulation Modelling**	6 C 4 WLH

Learning outcome, core skills: • Knowledge of the modelling techniques covered; • Ability to find a suitable modeling technique for a given problem in the area of ecology and to apply it independently; • Knowledge of the current state of research in ecological modelling; • Critical appreciation and discussion of research results; • Refined presentation techniques; • Knowledge of constructive feedback techniques.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Simulation Modelling (Lecture,Exercise)	3 WLH
Course: Current Topics in Ecological Modelling (Seminar)	1 WLH
Examination: Presentation (approx. 15 min) with written outline (max. 10 pages) **Examination prerequisites:** Presentation (approx. 15 Minutes), ungraded	6 C

Examination requirements: • Know, explain, apply, analyse and assess model types that are applied in ecology • Know, explain, apply, analyse and assess the stages of model development along the modeling cycle • Present, explain and critically reflect a self developed simulation model • Understand and summarize published model studies and point out and discuss their possibilities and limitations	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Kerstin Wiegand
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 20	

Additional notes and regulations:

20 students are only possible if a corresponding number of computers is available.

Module is also applicable for other study programs, such as MSc "Biological Diversity and Ecology", MSc "Agriculture" (specialization Ressourcenmanagement).

Georg-August-Universität Göttingen Module M.FES.123: Functional-Structural Plant Models	6 C 4 WLH

Learning outcome, core skills: Basic knowledge and understanding of ecophysiological foundations for FSPM (functional-structural plant models) and of the corresponding frameworks from computer science (formal grammars, rule-based programming paradigm, software tools); assessment of the possibilities and limits of FSPMs; ability to analyse an FSPM and to parameterize it based on one's own data; acquaintance with methods of simulation and visualization.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Functional-Structural Plant Models (Lecture,Exercise) *Contents*: Overview about FSPMs; Lindenmayer systems, graph grammars and basic features of rule-based modelling and programming, e.g. in the language XL; software tools for FSPMs (e.g., the platform GroIMP – partially supported by eLearning units); basic knowledge about physiological processes, e.g., photosynthesis; approaches for modelling plant architecture, processes and the linkage of structure and function in plants; basics about data acquisition of morphological and physiological traits of woody plants; digital representation of measured branching systems and of selected processes; analysis, parameterization, modification and evaluation of an existing FSPM. *Form:* Lectures and exercises (weekly) and practical work (measurement campaign: block course).	4 WLH
Examination: Term Paper (max. 20 pages)	6 C

Examination requirements: To show basic knowledge and understanding of ecophysiological foundations for FSPM (functional-structural plant models) and of the corresponding frameworks from computer science (formal grammars, rule-based programming paradigm, software tools); assessment of the possibilities and limits of FSPMs; ability to analyse an FSPM and to parameterize it based on one's own data; acquaintance with methods of simulation and visualization.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.FES.131: Project: Ecosystem Analysis and Modelling**	12 C 2 WLH
Learning outcome, core skills: Usage of GIS and/or other software tools and modelling techniques to work on an interdisciplinary topic; autonomous acquisition of know-how and competencies for scientific problem solving; ability to interdisciplinary, strategic thinking; team work and organisation of tasks, scientific presentation and discussion; writing a final report in the style of a scientific article.	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Project: Ecosystem Analysis and Modelling *Contents*: Each topic will be proposed by a researcher from the Faculty of Forest Sciences and Forest Ecology who will then be the principal supervisor for this topic. To ensure the interdisciplinary character of the project, a second supervisor should come from a department different from that of the principal supervisor. A topic can be worked upon by a single student or (preferentially) by a team of two or three students. In the case of teamwork, the final report must contain sections which can be attributed to one individual author.	2 WLH
Examination: Presentation (approx. 20 minutes, 33 %) and term paper (max. 15 pages, 67%)	12 C
Examination requirements: Ability to use GIS and/or other software tools and modelling techniques to work on an interdisciplinary topic; autonomous acquisition of know-how and competencies for scientific problem solving; ability to interdisciplinary, strategic thinking; team work and organisation of tasks, scientific (oral) presentation and discussion; writing a final report in the style of a scientific article.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Additional notes and regulations:
Will be coordinated by W. Kurth in the winter semester and by M. Jansen in the summer term.

Georg-August-Universität Göttingen **Module M.FES.726: Ecological Modelling with C++**	6 C 4 WLH
Learning outcome, core skills: • Implementing ecological questions in model structures • Independently develop simulation models • Programming with C++ • Proficiency in the use of software dedicated to programming C++ • Commenting and documenting program code	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Ecological modelling with C++ (Lecture,Exercise) *Contents*: The module conveys advanced knowledge of modelling ecological questions. The focus is on the implementation of ecological models with the programming language C++. The module covers the fundamentals of C++ to the degree necessary for the implementation of models. Programming skills are applied in an independent modelling project implementing an own model question. The modelling project is documented in the term paper.	4 WLH
Examination: Term Paper (max. 20 pages)	6 C
Examination requirements: Develop ecological questions and translate them into model structures; Read and understand C++; implement model independently.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Kerstin Wiegand
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 14	

Georg-August-Universität Göttingen Module M.Forst.221: Remote Sensing and GIS	6 C 4 WLH
Learning outcome, core skills: Ziel der Veranstaltungen dieses Moduls ist es, den Studierenden einen umfassenden Einblick in die wesentlichen Arbeitsabläufe der fernerkundlichen digitalen Bildverarbeitung und -analyse zu geben. Die Veranstaltung ist in die aufeinander abgestimmten Teilmodule "Geografische Informationssysteme" und „Fernerkundung“ gegliedert. Beide Teile ermöglichen eine Erweiterung der im Bachelorstudium erworbenen, grundlegenden Kenntnisse. In praxisorientierten Kleinprojekten sollen die Studierenden Grundkenntnisse der Vektor- und Rasterdatenverarbeitung in Theorie und praktischer Anwendung kennenlernen und in einem GIS umsetzen. Die Studierenden sollen sich nach den Lehrveranstaltungen auf Basis der erworbenen Grundkenntnisse selbstständig spezielle Verarbeitungsfunktionen erschließen können und sollen auch die Möglichkeiten der Automatisierung von Geodaten-Verarbeitungsprozessen kennen. Die Lehrveranstaltungen versetzen die Studierenden in die Lage, selbstständig Projekte auf raumbezogener Datenbasis, ausgehend von der fernerkundlichen Informationsextraktion aus digitalen Bilddaten bis zur Analyse der generierten Geoobjekte, zu bearbeiten. Die Studierenden sollen befähigt werden, analytisch raumbezogene Fragestellungen zu lösen, Arbeitsprozesse zu strukturieren und zu gestalten sowie dafür im Team zu arbeiten und kooperativ zu agieren. Die in Vorlesungen und Übungen vermittelten Kenntnisse orientieren sich an den aktuellen Anforderungen raumbezogener interdisziplinärer Forschungsprojekte.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Fernerkundung (Lecture,Exercise) *Contents*: Grundlagen Rasterdaten, Prinzipien der digitalen Bildverarbeitung, Evaluation der Bildqualität auf Basis von Bildstatistiken, Prinzipien der Bildverbesserung, Vorstellung aktueller Sensoren und Plattformen zur Erdbeobachtung, Verwendung von überwachten Klassifikationsverfahren und maschinellen Lernen (ML) zur Erstellung thematischer Karten, Genauigkeitsanalyse thematischer Karte, Analyse von Drohnenbildern, multi-temporale Bildanalyse.	2 WLH
Examination: Written examination (60 minutes)	3 C
Course: Geografische Informationssysteme (Lecture,Exercise) *Contents*: Einführung in QGIS (Kennenlernen der Benutzungsoberfläche, Geodatenformate und -quellen, Hinzufügen von Layern), Umgang mit Vektorattributdaten, Vektordatengenerierung, Vektor- und Rasterdatenverarbeitung, Grundlagen zu Koordinatenbezugssystemen, Symbologie-Optionen für Vektor- und Rasterdaten, Erstellung von Drucklayouts.	2 WLH
Examination: Written examination (60 minutes)	3 C
Examination requirements: **Geografische Informationssysteme:**	

Kenntnis der Benutzungsoberfläche von QGIS und wichtiger QGIS-Funktionalitäten wie Projektanlage und -weitergabe, Umgang mit Geodatenformaten und -quellen, Umgang mit Koordinatenbezugssystemen, Symbologie-Optionen für Vektor- und Rasterdaten, Erstellung von Kartenlayouts. Fähigkeit zur Lösung raumbezogener Problemstellung unter Einsatz von Vektor- und Rasterdatenverarbeitungsfunktionen. **Fernerkundung:** • Grundlagen elektromagnetischer Strahlung und deren Interaktion mit der Atmosphäre und mit Landbedeckungsformen, • Grundlegende Techniken der Fernerkundungsbildvorbereitung, -bearbeitung, -verbesserung und -klassifikation, wie in den Übungen behandelt, • Anwendung der Software, die in den Übungen verwendet wird, • Beurteilung der Qualität von Fernerkundungs-Bildprodukten, einschließlich Genauigkeitsanalyse.	

Admission requirements: none	**Recommended previous knowledge:** Erforderlich sind Kenntnisse in der Kartografie, der Fernerkundung, deskriptiven Statistik und einfachen Stichprobenstatistik sowie GIS-Grundkenntnisse (entsprechend den üblichen Lehrveranstaltungen in Bachelorstudiengängen).
Language: German	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: 40	

Additional notes and regulations:

Sobald das Modul M.Forst.221 erfolgreich absolviert wurde, kann das Modul M.Forst.739 nicht mehr belegt werden.

Studierende des Schwerpunktes "Waldnaturschutz" können das Modul M.Forst.739 nicht belegen.

Georg-August-Universität Göttingen **Module M.Forst.765: Basics of Population Genetics**	6 C 4 WLH
Learning outcome, core skills: Kenntnisse in der Interpretation populationsgenetischer Prozesse.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Paarungssysteme (Lecture,Seminar) *Contents*: Im ersten Teil werden zunächst grundlegende Begriffe und Konzepte (Population, Fitness) behandelt sowie Paarungssysteme allgemein beschrieben und charakterisiert (Paarungsreferenzen, Paarungspräferenzen, Paarungsnorm). Es folgt dann die analytische Behandlung spezieller Paarungssysteme (Zufallspaarung, assortative Paarung, Inkompatibilitäten, Inzuchtsysteme usw.) mit den sich daraus ergebenden Veränderungen genetischer Strukturen.	2 WLH
Course: Selektionstheorie (Lecture,Seminar) *Contents*: Aufbauend auf dem ersten Teil der Populationsgenetik (Paarungssysteme) werden in diesem Semester die Auswirkungen von Selektion auf die Entwicklung genetischer Strukturen, insbesondere die Etablierung und Erhaltung genetischer Polymorphismen und auch die Entwicklung der Populationsfitness behandelt (Selektion und Paarungssystem, Formen der Selektion, Berechnung von Fitnesswerten, Selektion mit konstanten, häufigkeitsabhängigen bzw, dichteabhängigen genotypischen Fitnesswerten).	2 WLH
Examination: Term Paper (max. 20 pages)	6 C
Examination requirements: Kenntnisse populationsgenetischer Prozesse	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Oliver Gailing
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.Forst.778: Variation Measurements in Biology and Specifically in Genetics**	6 C 4 WLH
Learning outcome, core skills: Vertrautheit mit Methoden der Quantifizierung von Eigenschaften biologischer und speziell genetischer Variation.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Das Ausmaß von Variation (Lecture,Seminar) *Contents*: Es werden die Möglichkeiten dargestellt, das Ausmaß von Variation quantitativ zu erfassen und zu beschreiben. Dazu gehört auch die Behandlung entsprechender Konzepte (wie etwa für die Diversität oder Differenzierung). Die hier demonstrierten Anwendungen beziehen sich zwar zum Teil ganz allgemein auf Variation (wie sie auch in der Ökologie zu finden sind), verstärkt aber auf solche speziell aus dem Bereich der Genetik.	2 WLH
Course: Räumliche und andere Aspekte der Variation (Lecture,Seminar) *Contents*: In diesem Semester steht zunächst die Beschreibung der räumlichen Organisation und Verteilung von Variation (räumliche Charakterisierungen mit Ripley`s K, räumliche Autokorrelationen mit Moran`s I usw.) im Vordergrund. Anschließend werden weitere ausgewählte Themen behandelt, deren Auswahl sich auch an den speziellen Interessen der Zuhörer orientieren kann.	2 WLH
Examination: Hausarbeit (max. 20 Seiten)	6 C
Examination requirements: Kenntisse über: • Methoden der Quantifizierung von Eigenschaften biologischer Variation • Methoden der Quantifizierung von Eigenschaften genetischer Variation	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Oliver Gailing
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.Geg.02: Resource Utilisation Problems	6 C 4 WLH

Learning outcome, core skills: Die Studierenden können die Bedeutung der Ressourcen Boden und Wasser als Bestandteile von Ökosystemen und Lebensgrundlage des Menschen aufzeigen und das globale sowie regional differenzierte Ausmaß der Gefährdung und Degradation dieser Ressourcen benennen. Sie sind in der Lage, das DPSIR-Konzept, durch das die Beziehungen Drivers – Pressures – State – Impacts – Responses verdeutlicht werden können, auf verschiedene Ressourcennutzungsprobleme anzuwenden. Sie kennen die Reference Soil Groups der World Reference Base for Soil Resources, sowie die spezifischen Bodeneigenschaften und daraus resultierenden Nutzungsmöglichkeiten, –einschränkungen und Gefährdungen der verschiedenen Böden. **Modulinhalte:** Eigenschaften, Nutzungsmöglichkeiten und –probleme verschiedener Böden (mit Schwerpunkt auf feuchte Tropen und Subtropen sowie Trockengebiete), Boden-gefährdungen, Faktoren und Prozesse der Bodendegradation, Ursachen, Ausmaß und Arten der Bodendegradation in Europa, Desertifikation, regional differenzierte Auswirkungen des Klimawandels auf die Ressourcen Boden und Wasser, globale Verteilung von Wasserangebot und –nachfrage, Wasserverbrauch nach Sektoren, Wassermangel, Ursachen und Ausmaß von Problemen mangelnder Wasserqualität, regionale Unterschiede in der Versorgung mit sanitären Anlagen und sauberem Trinkwasser.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Ressourcennutzungsprobleme (Lecture)	2 WLH
Course: Ressourcennutzungsprobleme (Seminar) Inkl. Geländetage zur Bearbeitung einer Fragestellung im Rahmen eines kleinen Projekts.	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** Regelmäßige Teilnahme am Seminar; Referat mit schriftl. Ausarbeitung bzw. schriftlichem Beitrag zum Projektbericht oder Poster (ca. 30 Min., max. 20 S. bzw. 1 DIN A 0 Poster) **Examination requirements:** Die Studierenden erbringen den Nachweis, dass sie Probleme der Boden- und Wassernutzung überblicken und spezifische Degradationsursachen sowie -prozesse verstehen. Sie zeigen, dass sie geeignete situationsbezogene Verfahren des nachhaltigen Umgangs mit Böden und Wasser kennen. Die Erstellung des Beitrags zum Projektbericht oder die Postererstellung als Prüfungsvorleistung machen die Mitwirkung bei der Projektbearbeitung erforderlich.	6 C

Admission requirements: none	**Recommended previous knowledge:** Grundlagen der Bodengeographie

Language: German	**Person responsible for module:** Prof. Dr. Daniela Sauer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from 2
Maximum number of students: 42	

Georg-August-Universität Göttingen Module M.Geg.03: Global Environmental Change / Land Use Change / Land Cover Change	6 C 4 WLH

Learning outcome, core skills: Die Studierenden verfügen über ein Überblickswissen zur Forschung über Klimawandel und Global Change. Die Studierenden sind in der Lage: • Veränderungen der Umwelt unter dem Einfluss des Menschen zu analysieren, • typische Syndrome und Syndromkomplexe zu erkennen und zu verstehen, • Global Change als zentrales Thema der Geographie an der Schnittstelle von Natur- und Gesellschaftswissenschaften zu erkennen, • Adaptation- und Mitigation-Ansätze zu bewerten. **Modulinhalte der Vorlesung:** Das Modul bearbeitet in der Vorlesung folgende Themen: • Basiswissen Klimawandel – Summary der IPCC Reports, • Industrielle Revolution und ihre anhaltende Raumwirksamkeit, • Kippelemente mit direkter und indirekter Wirkung auf die zukünftige Menschheitsentwicklung, • Bevölkerungsentwicklung und Ernährungssicherung, • Globale und regionale Wasserressourcen, • Globaler Umweltwandel und Gesundheit der Menschheit (Global Health - One Health Ansatz), • Energieversorgung der Menschheit - Transformation der Energiesysteme. **Modulinhalte des Seminars:** Das Seminar nimmt aktuelle Themen des Globalen Umweltwandels auf. Die Studierenden sind in der Lage, Diskurse zu Klimawandel, Umweltveränderungen und Ressourcenverknappung, Entwaldung und Fragmentierung der Landschaft anhand von Fallbeispielen zu verstehen.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Globaler Umweltwandel (Global Change) (Lecture)	1 WLH
Course: Spezielle Fallbeispiele des Globalen Umweltwandels (Seminar)	3 WLH
Examination: Referat mit Ausarbeitung (ca. 30 Min., max. 20 S.) oder Projektbericht (max. 20 S.) mit Projektpräsentation (ca. 30 Min.) **Examination prerequisites:** Regelmäßige Teilnahme am Seminar	6 C

Examination requirements: Die Studierenden erbringen den Nachweis, dass sie das Grundlagenwissen im Bereich des globalen Klima- und Umweltwandels beherrschen und den Forschungsstand zu Klimawandel und Global Change überblicken. Ferner erbringen sie den Nachweis, dass sie die Veränderungen der Umwelt unter anthropogenen Einfluss analysieren, typische Syndrome und Syndromkomplexe erkennen und verstehen sowie Adaptions-	

und Mitigationsansätze bewerten können. Darüber hinaus erbringen die Studierneden den Nachweis, dass sie Diskurse zu Klimawandel, Umweltveränderungen und Ressourcenverknappung, Entwaldung und Fragmentierung der Landschaft, anhand von Fallbeispielen zu verstehen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Martin Kappas
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen Module M.Geg.04: Global Sociocultural and Economic Change	6 C 4 WLH
Learning outcome, core skills: Die Studierenden kennen die globalen Zusammenhänge des soziokulturellen und wirtschaftlichen Wandels. Sie verstehen Ursachen und Wirkungen der Veränderungsprozesse auf unterschiedlichen Maßstabsebenen aus der Perspektive der Bevölkerungs-, Siedlungs- und Wirtschaftsgeographie. Sie kennen den theoriegeleiteten kritischen Umgang mit aktuellen gesellschaftlichen, humanökologischen sowie politisch-ökologischen Fragestellungen. Die Studierenden sind in der Lage, Diskurse zu Bevölkerungsentwicklung und Ressourcenverknappung, Urbanisierung und Fragmentierung, Armutsentwicklung und räumliche Disparitäten sowie Regionalentwicklungen anhand von Fallbeispielen zu verstehen. **Modulinhalte:** Die Prozesse der Globalisierung werden anhand von Indikatoren und Akteuren für unterschiedliche Maßstabsebenen erläutert. Der Wandel wirtschaftlicher Märkte wird anhand von Theorien diskutiert und aktuelle Auswirkungen anhand von Regionen (z.B. Globaler Süden, Schwellenländer, Stadt-Land) reflektiert. Die gesellschaftlichen/kulturellen Dimensionen des Wandels werden theoriegeleitet diskutiert. Die Folgen der ökonomischen und soziokulturellen Globalisierungsprozesse werden anhand von „Global Governance“-Architekturen sowie politischen Steuerungs- und Regulationsmechanismen kritisch beleuchtet.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Globaler soziokultureller und ökonomischer Wandel (Lecture)	2 WLH
Course: Globaler soziokultureller und ökonomischer Wandel (Exercise)	2 WLH
Examination: Referat mit schriftl. Ausarbeitung (ca. 30 Min., max. 20 S.) **Examination prerequisites:** Regelmäßige Teilnahme an der Übung	6 C
Examination requirements: Die Studierenden erbringen den Nachweis, dass sie den theoriegeleiteten kritischen Umgang mit aktuellen gesellschaftlichen, humanökologischen sowie politisch-ökologischen Fragestellungen kennen und Diskurse zu Bevölkerungsentwicklung und Ressourcenverknappung, Urbanisierung und Fragmentierung, Armutsentwicklung und räumlichen Disparitäten sowie Regionalentwicklungen verstehen und einordnen können. Ferner erbringen sie den Nachweis, dass sie die globalen Zusammenhänge des soziokulturellen und wirtschaftlichen Wandels sowie Ursachen und Wirkungen der Veränderungsprozesse auf unterschiedlichen Maßstabsebenen aus der Perspektive der Bevölkerungs-, Siedlungs- und Wirtschaftsgeographie verstehen.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Christoph Michael Dittrich

Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen **Module M.Geg.05: GIS and Remote Sensing / Geographic Information Systems and Environmental Monitoring**	5 C 3 WLH
Learning outcome, core skills: Die Studierenden kennen die theoretischen und praktischen Grundlagen des Einsatzes von GIS/Fernerkundung für die Modellierung von Faktoren und der raum-zeitlichen Dynamik der Landoberfläche. Die Studierenden sind in der Lage: • grundlegende flächenhafte Informationsebenen (Indikatoren) in GIS zu erstellen bzw. aus Fernerkundungsdaten abzuleiten, • GIS-gestützte Modelle zur Umweltmodellierung anzuwenden, • selbständig GIS- und Fernerkundungsmethoden für angewandte Fragestellungen anzuwenden, • Grundlagen der Geostatistik zur Ressourcenanalyse und Umweltbewertung anzuwenden.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: GIS und Fernerkundung in der Ressourcenanalyse und -bewertung (Lecture)	1 WLH
Course: Übung mit Praktikum: GIS und Fernerkundung oder GIS und Umweltmonitoring (Exercise)	2 WLH
Examination: Projektarbeitsbericht (max. 15 pages) **Examination prerequisites:** Regelmäßige Teilnahme an der Übung	5 C
Examination requirements: Die Studierenden erbringen den Nachweis, dass sie für die Modellierung von Faktoren und der raum-zeitlichen Dynamik der Landoberfläche die theoretischen und praktischen Grundlagen des Einsatzes von GIS/Fernerkundung kennen, grundlegende flächenhafte Indikatoren in GIS erstellen bzw. aus Fernerkundungsdaten ableiten und GIS-Modelle zur Umweltmodellierung sowie die Geostatistik zur Ressourcenanalyse und Umweltbewertung anwenden können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Martin Kappas
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 25	

Georg-August-Universität Göttingen Module M.Geg.06: Quaternary Climate and Landscape Evolution	5 C 3 WLH
Learning outcome, core skills: Die Studierenden kennen die Grundzüge der quartären Klima- und Landschaftsentwicklung global und in Mitteleuropa. Sie verstehen die Wirkungsweisen verschiedener Steuergrößen auf die Klima- und Landschaftsentwicklung und deren Relevanz für gegenwärtige und künftige Dynamiken. Die Studierenden haben einen Überblick über Archive der Landschaftsentwicklung und darin enthaltene Proxies, die zur Rekonstruktion der Klima- und Landschaftsgeschichte herangezogen werden können. Sie sind mit den wichtigsten in der Quartärforschung zum Einsatz kommenden Untersuchungsmethoden und Datierungsverfahren vertraut.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Landschaftsentwicklung (Lecture)	1 WLH
Course: Archive und Proxies zur Rekonstruktion der Landschaftsentwicklung (Seminar)	2 WLH
Examination: Referat (ca. 30 Min.) mit schriftlicher Ausarbeitung (max. 20 S.) ODER Referat (ca. 30 Min.) mit mündlicher Prüfung (ca. 20 Min.) **Examination prerequisites:** Regelmäßige Teilnahme am Seminar	5 C
Examination requirements: Die Studierenden erbringen den Nachweis, dass sie die Bedeutung von Archiven und Proxies im Kontext der Rekonstruktion der Klima- und Landschaftsentwicklung verstanden haben und dass sie in der Lage sind, unter Einbindung englischsprachiger Primärliteratur die Relevanz der vergangenen Klima- und Landschaftsentwicklung wissenschaftlich adäquat darzustellen. Anhand eines selbst gewählten Archivs und eines selbst gewählten Proxies aus diesem Archiv erbringen sie weiterhin den Nachweis, dass sie in der Lage sind, anhand geeigneter Primärliteratur Stärken und Schwächen von Archiven und Proxies herauszuarbeiten und kritisch zu reflektieren.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Elisabeth Dietze
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from 1
Maximum number of students: 40	

Georg-August-Universität Göttingen **Module M.Geg.07: Perception, Evaluation and Management of Resources**	5 C 3 WLH
Learning outcome, core skills: Die Studierenden sind befähigt, die Umgehensweise mit natürlichen Ressourcen in einen gesellschaftlichen Kontext zu stellen und unterschiedliche Interessen und Bewertungen der Akteure zu verstehen. Sie erlernen anhand des Paradigmenwechsels im Umgang mit Ressourcen, dass auf verschiedenen Maßstabsebenen kulturelle, soziale, wirtschaftliche, und politischer Rahmenbedingungen konstruiert sind. Die nationalen, regionalen und lokalen Handlungsspielräume für die Ressourcenwahrnehmung und –bewertung werden durch sie bestimmt. Die Studierenden können Nutzungskonflikte sowie Steuerungsinstrumente (z.B. Schutz- und Nutzungskonzepte) des Ressourcenmanagements aus globaler bis lokaler Perspektive bewerten und eine Analyse von Hemmnissen und Chancen für eine nachhaltige Regionalentwicklung anhand von Fallbeispielen durchführen.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Ressourcenwahrnehmung, -bewertung und -management (Lecture)	1 WLH
Course: Ressourcenwahrnehmung, -bewertung und -management (Seminar)	2 WLH
Examination: Referat mit schriftl. Ausarbeitung (ca. 30 Min., max. 25 S.) oder Literatur-Kurzreview (max. 15 S.) **Examination prerequisites:** Regelmäßige Teilnahme am Seminar	5 C
Examination requirements: Die Studierenden erbringen den Nachweis, dass sie den Umgang mit natürlichen Ressourcen in einen gesellschaftlichen Kontext stellen und unterschiedliche Interessen und Bewertungen der Akteure verstehen können. Ferner erbringen sie den Nachweis, dass sie im Wissen um die Konstruktion soziokultureller, politischer und wirtschaftlicher Rahmenbedingungen Nutzungskonflikte sowie Schutzkonzepte des Ressourcenmanagements aus globaler bis lokaler Perspektive bewerten und eine Analyse von Hemmnissen und Chancen für eine nachhaltige Regionalentwicklung anhand von Fallbeispielen durchführen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Christoph Michael Dittrich
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Geg.12: GIS based Appraisal of Resources and Planning of Resource Use**	6 C 3 WLH

Learning outcome, core skills: Die Studierenden kennen die theoretischen Grundlagen sowie technischen Konzepte von GIS und Fernerkundung und können mit den erworbenen Kenntnissen eine eigenständige GIS-basierte Projektstudie erstellen. Sie wissen, welche grundlegende Funktionalität ihnen ein GIS bietet und können diese nutzen, um ein konkretes Ressourcennutzungsproblem zu lösen. Die Implementierung einer eigenständigen, GIS-gestützten Ressourcenanalyse und –bewertung ist der Kern der Projektarbeit. Die Studierenden verstehen den Nutzen eines fundierten theoretischen Hintergrundes in GIS / Fernerkundung auch im Bereich praktischer Ressourcennutzungsplanung einzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: GIS-Studienprojekt (Exercise)	3 WLH
Examination: Projektbericht (max. 15 Seiten) oder Präsentation (ca. 30 Min.) **Examination prerequisites:** Regelmäßige Teilnahme an der Übung	6 C

Examination requirements: Die Studierenden erbringen den Nachweis, dass sie eine eigenständige GIS-basierte Projektstudie erstellen können, die grundlegende Funktionalität eines GIS kennen und deren Nutzung beherrschen, um ein konkretes Ressourcennutzungsproblem zu lösen. Ferner erbringen sie den Nachweis, dass sie die Einsatzmöglichkeiten einer GIS-gestützten Ressourcenbewertung auch in der praktischen Ressourcennutzungsplanung verstehen.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Martin Kappas
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Geg.903: Project Internship in Geoinformatics**	8 C

Learning outcome, core skills: Die Studierenden erweitern Ihre technischen Grundkenntnisse über die Arbeit mit GIS und Geodaten indem Sie sich im Rahmen eines Projektpraktikums mit der Entwicklung einer eigenen GIS-Applikation (z. B. aus dem Bereich Web-GIS, Mobile-GIS, etc.) oder der Evaluierung / Weiterentwicklung bestehender Applikationen / Algorithmen beschäftigen. Das Praktikum findet grundsätzlich in der Organisationseinheit des betreuenden Dozenten statt, kann aber auf Anfrage auch in einem externen Betrieb bzw. einer Behörde durchgeführt werden.	**Workload:** Attendance time: 120 h Self-study time: 120 h

Course: Praktikum (mind. 120 Stunden)	
Examination: Praktikumsbericht (max. 25 pages)	8 C

Examination requirements: Die Studierenden erbringen den Nachweis, dass Sie sich eigenständig mit einer (GIS-) technischen Fragestellung auseinander setzen können und die Ergebnisse systematisch aufbereitet darlegen können.	

Admission requirements: none	**Recommended previous knowledge:** M.Geg.05, M.Geg.12
Language: German	**Person responsible for module:** Dr. Daniel Wyss Prof. Dr. Martin Kappas
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 5	

Georg-August-Universität Göttingen **Module M.Inf.1101: Practical Course on Modeling**	5 C 0,5 WLH

Learning outcome, core skills: Anwendung und Vertiefung von Wissen und Fähigkeiten aus der Informatik oder Angewandten Informatik in einem Anwendungsfach oder einem anderen Fachzweig der Informatik oder Angewandten Informatik mit dem Ziel, Systeme und Abläufe in diesem Fachzweig oder im Anwendungsfach zu modellieren oder zu simulieren.	**Workload:** Attendance time: 7 h Self-study time: 143 h

Course: Modellierungspraktikum (Internship) *Contents*: Typische implementierende Lehrveranstaltungen sind interdisziplinäre Projektseminare, die sich über ein Semester erstrecken, mit einer Projektwoche beginnen und einer Abschlusspräsentation enden. Möglich ist auch die Bearbeitung eines Pilotprojekts innerhalb einer Forschungsgruppe der Informatik oder der Angewandten Informatik in Vorbereitung auf das Forschungsbezogene Praktikum.	0,5 WLH
Examination: Vortrag (ca. 15 Min.) mit schriftlicher Ausarbeitung (max. 5 Seiten), not graded	5 C

Examination requirements: Wissen und Fähigkeiten zur Systementwicklung bei der Modellierung einer Aufgabenstellung aus der Kerninformatik, einem Anwendungsbereich oder aus der Angewandten Informatik.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen Module M.Inf.1102: Extended Practical Course on Modeling	9 C 1 WLH
Learning outcome, core skills: Anwendung und Vertiefung von Wissen und Fähigkeiten aus der Informatik oder Angewandten Informatik in einem Anwendungsfach oder einem anderen Fachzweig der Informatik oder Angewandten Informatik mit dem Ziel, Systeme und Abläufe in diesem Fachzweig oder im Anwendungsfach zu modellieren oder zu simulieren.	**Workload:** Attendance time: 14 h Self-study time: 256 h
Course: Großes Modellierungspraktikum (Internship) *Contents*: Typische implementierende Lehrveranstaltungen sind interdisziplinäre Projektseminare, die sich über ein Semester erstrecken, mit einer Projektwoche beginnen und einer Abschlusspräsentation enden. Möglich ist auch die Bearbeitung eines Pilotprojekts innerhalb einer Forschungsgruppe der Informatik oder der Angewandten Informatik in Vorbereitung auf das Forschungsbezogene Praktikum.	1 WLH
Examination: Vortrag (ca. 30 Min.) mit schriftlicher Ausarbeitung (max. 10 Seiten), not graded **Examination requirements:** Erweitertes Wissen und vertiefte Fähigkeiten zur Systementwicklung bei der Modellierung einer Aufgabenstellung aus der Kerninformatik, einem Anwendungsbereich oder aus der Angewandten Informatik.	9 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1111: Seminar on Theoretical Computer Science**	5 C 2 WLH

Learning outcome, core skills: Erwerb fortgeschrittener Kompetenzen in ausgewählten Gebieten der theoretischen Informatik und ihrer Anwendungen. Ausbau der Fähigkeiten zur Präsentation und Beurteilung wissenschaftlicher Ergebnisse und zur wissenschaftlichen Diskussion.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminar Theoretische Informatik (Seminar) *Contents*: Erarbeitung aktueller Themen anhand von relevanten Originalarbeiten aus dem Bereich der Theoretischen Informatik und ihrer Anwendungen oder auch gemeinsame systematische Erarbeitung eines fortgeschrittenen klassischen Themas im Hinblick auf Eignung für einen neuen Anwendungsbereich.	2 WLH
Examination: Vortrag (ca. 45 Min.) mit schriftlicher Ausarbeitung (max. 5 Seiten) **Examination requirements:** Kompetenzen bei der selbständigen Erarbeitung und Präsentation von fortgeschrittenen Themen zur Theoretischen Informatik.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: once a year; jedes 2. Semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 14	

Georg-August-Universität Göttingen Module M.Inf.1112: Efficient Algorithms	5 C 3 WLH
Learning outcome, core skills: Erwerb fortgeschrittener Kenntnisse und Fähigkeiten zur Entwicklung und Analyse effizienter Algorithmen und zur Untersuchung der Komplexität von Problemen in unterschiedlichen Anwendungsbereichen.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Vorlesung/Übung *Contents*: Zum Beispiel: Randomisierte und Approximationsalgorithmen, Graphalgorithmen, Onlinealgorithmen, Netzwerkalgorithmen, Neurocomputing, Pattern-Matching-Algorithmen.	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 25 Min.). **Examination requirements:** Fähigkeit zum Entwurf von effizienten Algorithmen für gegebene Probleme. Beurteilungskompetenz von deren inherenter Komplexität in den Bereichen der Kerninformatik und ggf. ihren Anwendungen.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1113: Specialisation Theoretical Computer Science**	5 C 3 WLH

Learning outcome, core skills: Erwerb fortgeschrittener Kompetenz im Umgang mit Konzepten der theoretischen Informatik und den damit verbundenen mathematischen Techniken wie z. B. NP Vollständigkeit und NP Äquivalenz, Interaktive Beweissysteme, PCP und die Komplexität von Approximationsproblemen, Komplexität von Blackbox-Problemen.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Vorlesung/Übung *Contents*: z. B. Vorlesung Komplexitätstheorie, Vorlesung Datenstrukturen für boolesche Funktionen, Vorlesung Informationstheorie.	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 25 Min.) **Examination requirements:** Fortgeschrittene Kompetenz im Umgang mit Konzepten der theoretischen Informatik z. B. der Komplexitätstheorie und den damit verbundenen mathematischen Techniken.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1114: Algorithms on Sequences**	5 C 4 WLH

Learning outcome, core skills: We expect that the participants will gain an understanding of classical string-processing tools. They are supposed to understand and be able to use in various situations: classical text algorithms (e.g., pattern matching algorithms, edit distance), classical text indexing data structures (e.g., suffix arrays / trees), and classical combinatorial results that are useful in this context (e.g., periodicity lemmas).	**Workload:** Attendance time: 56 h Self-study time: 94 h

Course: Algorithms on Sequences (Lecture,Exercise) *Contents*: This course is an introduction into the theory of stringology, or algorithms on sequences of symbols (also called words or strings). Our main intention is to present a series of basic algorithmic and combinatorial results, which can be used to develop efficient word-processing tools. While the emphasis of the course is on the theoretical side of stringology, we also present a series of applications of the presented concepts in areas like data-compression or computational biology The main topics our course will cover are: basic combinatorics on words, pattern matching algorithms, data structures for text indexing (suffix arrays, suffix trees), text compression (Huffman encoding, Lempel-Ziv method), detection of regularities in words, algorithms for words with don't care symbols (partial words), word distance algorithms, longest common subsequence algorithms, approximate pattern matching. The presentation of each theoretical topic from the above will be accompanied by a brief discussion on its possible applications. Literature • T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: Introduction to Algorithms (3rd Edition), MIT Press, 2009. • M. Crochemore, C. Hancart, T. Lecroq: Algorithms on Strings, Cambridge University Press, 2007. • M. Crochemore, W. Rytter: Jewels of Stringology, World Scientific, 2002. • D. Gusfield. Algorithms on strings, trees, and sequences: computer science and computational biology. Cambridge University Press, 1997.	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination requirements:** basic combinatorics on words, pattern matching algorithms, data structures for text indexing (suffix arrays, suffix trees), text compression (Huffman encoding, Lempel-Ziv method), detection of regularities in words, algorithms for words with don't care symbols (partial words), word distance algorithms, longest common subsequence algorithms, approximate pattern matching	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language:	**Person responsible for module:**

English	Prof. Dr. Florin-Silviu Manea
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1115: Advanced Topics on Algorithms**	5 C 4 WLH
Learning outcome, core skills: We expect that the students will become familiar with efficient sorting and searching methods, advanced data structures, dynamic data structures, as well as other efficient algorithmic methods, they will be able to estimate the complexity of those algorithms, and they will be able to apply those algorithms to particular programming problems (from practical or theoretical settings).	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Advanced Topics on Algorithms (Lecture,Exercise) *Contents*: In this course we present a series of selected results on data structures and efficient algorithms, and discuss a series of areas in which they can be applied successfully. The emphasis of the course is on the theory, we also approach the problem of a practical implementation of the presented algorithms. The main topics our course will cover are: efficient sorting and searching (non-comparison based methods, van Emde Boas trees, Radix Sort), advanced tree-structures (Fibonacci heaps, B-Trees, structures for working with disjoint sets), dynamic data structures (range minimum queries, lowest common ancestor, applications to string algorithms: suffix arrays, suffix trees), Hashing and Dictionaries, Young tableaux, geometric algorithms (convex hull), number theoretic algorithms. The presentation of each theoretical topic from the above will be accompanied by a brief discussion on its possible applications. Literature • T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein: Introduction to Algorithms (3rd Edition), MIT Press, 2009. • E. Demaine: Advanced Data Structures, MIT Course nr. 6.851, 2012. • Pawel Gawrychowski and Mayank Goswami and Patrick Nicholson: Efficient Data Structures, MPI Course, Summer 2014.	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination requirements:** efficient sorting and searching (non-comparison based methods, van Emde Boas trees, Radix Sort), advanced tree-structures (Fibonacci heaps, B-Trees, structures for working with disjoint sets), dynamic data structures (range minimum queries, lowest common ancestor, applications to string algorithms: suffix arrays, suffix trees), Hashing and Dictionaries, Young tableaux, geometric algorithms (convex hull), number theoretic algorithms	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency:	**Duration:**

irregular	1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen Module M.Inf.1120: Mobile Communication	5 C 3 WLH

Learning outcome, core skills:	**Workload:**
On completion of the module students should be able to: • explain the fundamentals of mobile communication including the use of frequencies, modulation, antennas and how mobility is managed • distinguish different multiple access schemes such as SDMA (Space Division Multiple Access), FDMA (Frequency Division Multiple Access), TDMA (Time Division Multiple Access), CDMA (Code Division Multiple Access) and their variations as used in cellular networks • describe the history of cellular network generations from the first generation (1G) up to now (4G), recall their different ways of functioning and compare them to complementary systems such as TETRA • explain the fundamental idea and functioning of satellite systems • classify different types of wireless networks including WLAN (IEEE 802.11), WPAN (IEEE 802.15) such as Bluetooth and ZigBee, WMAN (IEEE 802.16) such as WiMAX and recall their functioning • explain the challenges of routing in mobile ad hoc and wireless sensor networks • compare the transport layer of static systems to the transport layer in mobile systems and explain the approaches to improve the mobile transport layer performance • differentiate between the security concepts used in GSM and 802.11 security as well as describe the way tunnelling works	Attendance time: 42 h Self-study time: 108 h

Course: Mobile Communication (Lecture,Exercise)	3 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Fundamentals of mobile communication (frequencies, modulation, antennas, mobility management); multiple access schemes (SDMA, FDMA, TDMA, CDMA) and their variations; history of cellular network generations (first (1G) up to current generation (4G) and outlook to future generations); complementary systems (e.g. TETRA); fundamentals of satellite systems; wireless networks (WLAN (IEEE 802.11), WPAN (IEEE 802.15) such as Bluetooth and ZigBee, WMAN (IEEE 802.16) such as WiMAX); routing in MANETs and WSNs; transport layer for mobile systems; security challenges in mobile networks such as GSM and 802.11 and tunneling;	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in telematics and computer networks
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]

Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1121: Specialisation Mobile Communication**	5 C 3 WLH

Learning outcome, core skills: On completion of the module students should be able to: • recall the basic terms and definitions of wireless ad hoc networks, their history and name their basic application areas • describe the special characteristics of the physical layer of wireless ad hoc networks • differentiate the various media access control (MAC) schemes as used in wireless ad hoc networks; and name their challenges • explain the network protocols used in wireless ad hoc networks, reason the design decisions taken in this context as well as classifying and comparing the different existing routing protocol approaches • identify the energy management issues in wireless ad hoc networks and classify existing energy management schemes • describe security challenges in ad hoc networks, threats and attacks and corresponding security solutions such as cryptography schemes, key management, secure routing protocols and soft security mechanisms • discuss the challenges on the transport layer in wireless ad hoc and sensor networks, compare them to existing protocols, classify them and discuss enhancements of TCP for wireless ad hoc networks • describe the challenges of wireless sensor networks (WSN) and explain the differences to wireless ad hoc networks • memorize the WSN architecture and topology, the used operating systems and the existing hardware nodes • discuss the optimization goals in WSNs, the used MAC protocols as well as the utilised naming and addressing schemes; additionally, describe the used approaches for time synchronization, localization and routing	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Wireless Ad Hoc and Sensor Networks (Lecture,Exercise)	3 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Terms, definitions and characteristics of wireless ad hoc networks; Network Layer used in wireless ad hoc networks (Physical, MAC, Network Layer, Transport, Application); Energy Management; Security Challenges, threats and attacks in wireless ad hoc networks and their counter measures (cryptographic schemes, key management, secure routing, soft security); architecture, topologies and characteristics of wireless sensor networks (WSNs) and the differences to ad hoc networks; WSN specifics (naming and addressing, synchronization, localization and routing)	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in telematics and computer networks
Language:	**Person responsible for module:**

English	Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1122: Seminar on Advanced Topics in Telematics**	5 C 2 WLH

Learning outcome, core skills: On completion of the module students should be able to: • critically investigate current research topics from the area of telematics such as bio-inspired approaches in the area of wireless communication or security attacks and countermeasures for mobile wireless networks • collect, evaluate related work and reference them correctly • summarize the findings in a written report • prepare a scientific presentation of the chosen research topic	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Security of Self-organizing Networks (Seminar)	2 WLH
Course: Bio-inspired Networking (Seminar)	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 20 pages) **Examination requirements:** The students shall show that • they are able to become acquainted with an advanced topic in telematics by investigating up-to-date research publications. • they are able to present up-to-date research on an advanced topic in telematics. • they are able to assess up-to-date research on an advanced topic in telematics. • they are able to write a scientific report on an advanced topic in telematics according to good scientific practice.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in telematics and computer networks
Language: English	**Person responsible for module:** Dr. Parisa Memarmoshrefi
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1123: Computer Networks**	5 C 2 WLH

Learning outcome, core skills: The students • have gained a deeper knowledge in specific topics within the computer networks field • have improved their oral presentation skills • know how to methodically read and analyse scientific research papers • know how to write an analysis of a specific research field based on their analysis of state-of-the-art research • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Advanced Topics in AI, Computing, and Networking (Seminar)	2 WLH
Examination: Präsentation (ca. 30 Min.) und Hausarbeit (max. 15 Seiten) **Examination requirements:** Knowledge in a specific field of mobile communication; Ability to present the earned knowledge in a proper way both orally and in a written report	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1124: Seminar Computer Networks**	5 C 2 WLH

Learning outcome, core skills: The students • have gained a deeper knowledge in specific topics within the computer networks field • have improved their oral presentation skills • know how to methodically read and analyse scientific research papers • know how to write an analysis of a specific research field based on their analysis of state-of-the-art research • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminar on Internet Technology (Seminar)	2 WLH
Examination: Präsentation (ca. 30 Min.) und Hausarbeit (max. 15 Seiten) **Examination requirements:** Knowledge in a specific field of internet technology; ability to present the earned knowledge in a proper way both orally and in a written report	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1129: Social Networks and Big Data Methods**	5 C 2 WLH
Learning outcome, core skills: The students • are familiar with basic concepts of social networks • know how to methodically read and analyse scientific research papers • have enriched their practical skills in computer science with regards to analysis of big data applications • have improved their ability to work independently in a pre-defined context • have improved their ability to work in diverse teams	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Social Networks and Big Data Methods (Exercise,Seminar)	2 WLH
Examination: Term Paper (max. 20 pages) **Examination prerequisites:** Erreichen von mindestes 50% der Übungspunkte **Examination requirements:** Basic knowledge in social networks and data analysis; ability to transfer the theoretical knowledge to practical exercises; ability to present the earned knowledge in a proper written report	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures; advanced programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.Inf.1130: Software-defined Networks (SDN)	5 C 3 WLH
Learning outcome, core skills: The students • are familiar with the concepts of software defined networking (SDN) • know how to methodically read and analyse scientific research papers • have enriched their practical skills in computer networks with regards to SDN • know about practical deployability issues of SDN • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Software-defined Networking (Exercise,Seminar)	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** Achievement of at least 50% of the exercise points **Examination requirements:** Knowledge in software-defined networking; ability to transfer the theoretical knowledge to practical exercises; ability to present the earned knowledge	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures; advanced programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.Inf.1138: Usable Security and Privacy	5 C 4 WLH
Learning outcome, core skills: On completion of the module, students should be able to: • Understand the needs for usability in secure and privacy-preserving solutions and the associated challenges, • Present and discuss selected themes addressed in the research area of usable security and privacy, • Define and understand the principles and guidelines to apply when designing new solutions, • Describe and compare different methodologies to conduct user studies, • Plan user studies from their design to the processing and presentation of the results.	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Usable Security and Privacy (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (ca. 20 min.) **Examination requirements:** Introduction to usable security and privacy, selected topics in the research field of usable security and privacy, human-computer interaction principles and guidelines, methods to design and evaluate usable solutions in the area of security and privacy.	5 C

Admission requirements: none	**Recommended previous knowledge:** Backgrounds in Computer Security and Privacy
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.1139: Privacy-Enhancing Technologies**	5 C 4 WLH
Learning outcome, core skills: After successfully completing the module, students are able to: • Define and understand the basic concepts of privacy protection, • Identify and classify the different existing threats against privacy, • Define and understand the legal principles of data protection in Germany, the EU and worldwide, • Explain the principles of fundamental privacy-enhancing technologies as well as define and compare their protection goals, • Understand and analyze selected cutting-edge privacy-enhancing solutions.	**Workload:** Attendance time: 56 h Self-study time: 94 h

Course: Privacy-Enhancing Technologies (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min) or oral exam (approx. 20 min) **Examination requirements:** Privacy threats, data protection legal framework, anonymity, anonymization techniques and services, privacy-enhancing technologies, applied privacy protection.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in communication networks, databases, and data processing.
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1141: Semistructured Data and XML**	6 C 4 WLH

Learning outcome, core skills: Die Studierenden kennen die Konzepte semistrukturierter Datenmodelle und die Parallelen sowie Unterschiede zum "klassischen" strukturierten, relationalen Datenmodell. Sie können damit für eine Anwendung abschätzen, welche Technologien gegebenenfalls zu wählen und zu kombinieren sind. Die Studierenden verfügen über praktische Grundkenntnisse in den üblichen Sprachen dieses Bereiches. Sie haben einen Überblick über die historische Entwicklung von Modellen und Sprachen im Datenbankbereich und können daran wissenschaftliche Fragestellungen und Vorgehensweisen nachvollziehen.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Semistrukturierte Daten und XML (Lecture,Exercise)	
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 25 Min.) **Examination requirements:** Konzepte semistrukturierter Datenmodelle und die Parallelen sowie Unterschiede zum "klassischen" strukturierten, relationalen Datenmodell; Fähigkeit zur Beurteilung, welche Technologien in einer konkreten Anwendung zu wählen und zu kombinieren sind; praktische Grundkenntnisse in den üblichen Sprachen dieses Bereiches; Überblick über die historische Entwicklung von Modellen und Sprachen im Datenbankbereich; Fähigkeit zum Nachvollziehen wissenschaftlicher Fragestellungen und Vorgehensweisen.	6 C

Admission requirements: Datenbanken	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 100	

Additional notes and regulations: Das Modul wird auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren (in der Klausur können Text-Antworten auch auf deutsch gegeben werden).

Georg-August-Universität Göttingen Module M.Inf.1142: Semantic Web	6 C 4 WLH
Learning outcome, core skills: Die Studierenden kennen die theoretischen Grundlagen sowie technischen Konzepte des Semantic Web. Sie können den Nutzen und die Grenzen der verwendeten Technologien einschätzen und in realen Szenarien abwägen. Sie sehen an einigen Beispielen, wo aktuelle wissenschaftliche Fragestellungen ansetzen.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Semantic Web (Lecture,Exercise)	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 25 Min.) **Examination requirements:** Kenntnisse der theoretischen Grundlagen und technischen Konzepte des Semantic Web; Fähigkeit zum Abschätzen des Nutzens und der Grenzen der verwendeten Technologien; Fähigkeit zur Abwägung realer Szenarien; Fähigkeit zum Nachvollziehen wissenschaftlicher Fragestellungen und Vorgehensweisen.	6 C

Admission requirements: Datenbanken, Formale Systeme	**Recommended previous knowledge:** M.Inf.1243
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Additional notes and regulations:
Das Modul wird auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren.

Georg-August-Universität Göttingen **Module M.Inf.1150: Advanced Topics in Software Engineering**	5 C 3 WLH
Learning outcome, core skills: The students • gain knowledge about an advanced topic in software engineering. The advanced topic may be related to areas such as software development processes, software quality assurance, and software evolution • become acquainted with the status in industry and research of the advanced topic under investigation • gain knowledge about methods and tools needed to apply or investigate the advanced topic	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Construction of Reusable Software (Block course,Seminar) *Contents*: Topics which will be covered by lecture and associated seminar include • design patterns • frameworks • unit testing with the JUnit Framework • the Eclipse Framework • refactoring • design-by-Contract/Assertions • aspect-oriented programming (AOP)	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination requirements:** **Preliminary test** If the module is implemented by a lecture with exercises: • Development and presentation of the solution of at least one exercise (presentation and report) and active participation in the exercises If the module is implemented by a block lecture with an associated seminar: • Presentation of at least one topic in the associated seminar • Attendance in 80% of the seminar presentations **Exam** The students shall show knowledge about • the principles of the advanced topic under investigation • the status of the advanced topic under investigation in industry and research • the methods and tools for applying or investigating the advanced topic	5 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language:	**Person responsible for module:**

English	Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1152: Specialisation Softwareengineering: Quality Assurance**	5 C 3 WLH

Learning outcome, core skills: The students • can define the term software quality and acquire knowledge on the principles of software quality assurance • become acquainted with the general test process and know how it can be embedded into the overall software development process • gain knowledge about manual static analysis and about methods for applying manual static analysis • gain knowledge about computer-based static analysis and about methods for applying computer-based static analysis • gain knowledge about black-box testing and about the most important methods for deriving test cases for black-box testing • gain knowledge about glass-box testing and about the most important methods for deriving test cases for glass-box testing • acquire knowledge about the specialties of testing of object oriented software • acquire knowledge about tools that support software testing • gain knowledge about the principles of test management	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Software Testing (Lecture,Exercise)	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Develop and present the solution of at least one exercise (presentation and report) and active participation in the exercises. **Examination requirements:** The students have to show knowledge in software quality, principles of software quality assurance, general test process, static analysis, dynamic analysis, black-box testing, glass-box testing, testing of object-oriented systems, testing tools, and test management.	5 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1153: Specialisation Softwareengineering: Requirements Engineering**	5 C 3 WLH

Learning outcome, core skills: The students • can define the terms requirement and requirements engineering and acquire knowledge on the principles of requirements engineering • become acquainted with the general requirements engineering process and know how it can be embedded into the overall software development process • gain knowledge about the system context and context boundaries • gain knowledge about requirements elicitation techniques and the interpretation of elicitation results • gain knowledge about the negotiation of requirements with different stakeholders • gain knowledge about the structure of documents for the requirements documentation • gain knowledge about the requirements documentation in natural language and techniques for the use of structured natural language • gain knowledge about the requirements documentation with models and model-based techniques for requirements documentation • gain knowledge about the validation of requirements • gain knowledge about managing changes to requirements • gain knowledge about tracing requirements through a development process	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Requirements Engineering (Lecture,Exercise)	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Develop and present the solution of at least one excercise (presentation and report) and active participation in the exercise sessions. **Examination requirements:** Requirements, requirements engineering, general requirements engineering process, system context, system boundary, context boundary, requirements elicitation and interpretation, requirements negotiation, structure of requirements documentation, requirements documentation in natural language, model-based requirements documentation, requirements validation, requirements change management, requirements tracing.	5 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1154: Specialisation Softwareengineering: Software Evolution**	5 C 3 WLH

Learning outcome, core skills: The students • can define the term software evolution and acquire knowledge on the principles of software evolution and maintenance • become acquainted with general approaches for mining software repositories to understand, predict, and control the evolution of software • gain knowledge about typical data and data sources used in software evolution studies • gain knowledge about mining methods and tools for modeling, obtaining, and integrating data from software projects, including mining version control system data, mining issue tracking system data, mining static analysis data, mining clone detection data • gain knowledge about labelling and classification of artifacts and activities in software projects • gain knowledge about prediction, simulation, visualization, and other applications built upon mined software evolution data	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Software Evolution (Lecture,Exercise)	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Develop and present the solution of at least one exercise (presentation and report), active participation in the exercise sessions. **Examination requirements:** The students shall prove knowledge in the area of software evolution. This includes knowledge regarding principles of software evolution, software maintenance, software quality, mining software repositories, data mining, defect prediction, software clones, static analysis, dynamic analysis and human factors in software evolution.	5 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1155: Seminar: Advanced Topics in Software Engineering**	5 C 2 WLH
Learning outcome, core skills: The students • learn to become acquainted with an advanced topic in software engineering by studying up-to-date research papers. • gain knowledge about advanced topics in software engineering. The advanced topic may be related to areas such as software development processes, software quality assurance, and software evolution. • learn to present and discuss up-to-date research on advanced topics in software engineering. • learn to assess up-to-date research on advanced topics in software engineering.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar on Advanced Topics in Software-Engineering (Seminar) *Contents*: Topics which will be covered by this seminar can include • Usability and Usability-Engineering • User-oriented Usability Testing • Expert-oriented Usability Evaluation • Web-analytics • Information Architecture • SOA – Service-oriented Architecture • UML-Tools and Code Generation • Details of Specific Process Models • Model-driven Architecture • Usage-based Testing • Defect Prediction • Design Patterns • Agent-based Simulation • Reliability-Engineering for Cloud Systems	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 20 pages) **Examination prerequisites:** (1) Pitch Presentation (approx. 5 minutes); (2) Reviewable Draft of the Seminar Report (minimum 2 pages, maximum 5 pages); (3) Peer Review of a Fellow Student’s Work (maximum 1 page) **Examination requirements:** The students shall show that • they are able to become acquainted with an advanced topic in software engineering by investigating up-to-date research publications. • they are able to present up-to-date research on an advanced topic in software engineering.	5 C

• they are able to assess up-to-date research on an advanced topic in software engineering. • they are able to write a scientific report on an advanced topic in software engineering according to good scientific practice. Presentation of an advanced topic in software engineering and written report.	

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.Inf.1161: Image Analysis and Image Understanding	6 C 4 WLH
Learning outcome, core skills: Kompetenz, grundlegende Techniken der Bildverarbeitung sinnvoll zur Auswertung von Bilddaten einzusetzen; Verständnis für Probleme, Methoden und Begrenzungen der Bildanalyse mit elementaren Signalverarbeitungs- und höheren KI-Ansätzen.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Bildanalyse und Bildverstehen (Lecture,Exercise)	4 WLH
Examination: Klausur (120 Min.) oder mündliche Prüfung (ca. 25 Min.) **Examination prerequisites:** Aktive Teilnahme an den Übungen belegt durch die erfolgreiche Bearbeitung von 60 % der Übungszettel **Examination requirements:** Nachweis über den Erwerb vertiefter Kenntnisse und Fähigkeiten: Kompetenz, grundlegende Techniken der Bildverarbeitung sinnvoll zur Auswertung von Bilddaten einzusetzen; Verständnis für Probleme, Methoden und Begrenzungen der Bildanalyse mit elementaren Signalverarbeitungs- und höheren KI-Ansätzen.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 100	

Georg-August-Universität Göttingen Module M.Inf.1171: Cloud and Service Computing	5 C 3 WLH
Learning outcome, core skills: Successfully completing the module, students understand • hybrid clouds, consisting of private and public clouds • basic web technologies (transfer protocols, markup languages, markup processing, RESTful and SOAP web services) • virtualization technologies (server, storage, and network virtualization) • data services (sharing, management, and analysis) • continuous integration/continuous delivery • container and orchestration in clouds (e.g. Kubernetes, OpenStack Heat) • monitoring of cloud infrastructures • interoperability in clouds (e.g. Helm) • portability and security • microservices • cloud computing workloads On completion of this module students will have a good understanding of the fundamental and up-to-date concepts used in the context cloud computing. This basic knowledge can be leveraged by students to design, implement, and manage service-oriented cloud infrastructures by themselves.	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Cloud and Service Computing (Lecture,Exercise) *Contents*: Cloud Computing is a method of providing shared computing resources, such as applications, computing, storage, networking, development, and deployment platforms. In cloud computing these resources can be delivered as service to the user. Such Service-oriented infrastructures are the backbone of modern IT systems. They pool resources, enable collaboration between people, and provide complex services to end-users. Everybody who uses today's web applications implicitly relies on sophisticated service-oriented infrastructures. The same is true for users of mobile devices such as tablet computers and smart phones, which provide most of their benefits leveraging services. The key challenges of cloud computing infrastructures are related to scaling services. More specifically large cloud-computing infrastructures require scalability of IT management, programming models, and power consumption. The challenges to scale services lie in the inherent complexity of hardware, software, and the large amount of user requests, which large-scale services are expected to handle. This module teaches methods that address and solve those challenges in practice. Key aspects of the module are the management of IT infrastructures, the management of service landscapes, and programming models for distributed applications. The module covers the virtualization of computing, storage, and network resources as the fundament for scaling. IT management is covered by the discussion of deployment	3 WLH

models, service level agreements. Programming models are covered by discussing RESTful and SOAP web-services. Both, lectures and exercises, keep a close connection to the practical application of the discussed topics. The practical value of service-oriented infrastructures is highlighted in the context of enterprises as well as in the context of science. The methods taught in this module benefit from the lecturers' experiences at GWDG and thus provide exclusive insights into the topic. After successfully attending these modules students will understand the most important aspects to design, implement, and manage internet-scale cloud computing infrastructures.	
Examination: Written exam (90 min) or oral exam (approx. 30 min) **Examination requirements:** • Hybrid and Multi cloud infrastructures • RESTful and SOAP web services • Compute, storage, and network virtualisation • Infrastructure-as-a-service, platform-as-a-service, software-as-a-service • Characteristics of Cloud computing (NIST) • Service life cycle • Service level agreements • Cloud computing workloads (e.g. batch, SaaS, big data, back-end)	5 C

Admission requirements: none	**Recommended previous knowledge:** • Basic programming skills • Basic knowledge of Linux operating systems
Language: English	**Person responsible for module:** Prof. Dr. Ramin Yahyapour
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1172: Using Research Infrastructures**	5 C 3 WLH
Learning outcome, core skills: Successfully completing the module, students • understand what methods and services are available in state-of-the-art research infrastructures and direction of future development • understand the infrastructures for eScience and eResearch • know basics of data management and data analysis • know the fundamental of technologies like cloud computing and grids • understand the real-world problems from different domains (e.g., high energy physics, humanities, medical science, etc.) which are tackled by research infrastructures • understand certain aspects, methods and tools of these infrastructures for different use cases from different domains • will be motivated to take part in other related modules (e.g., Specialization in Distributed Systems, Parallel Computing, etc.)	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Using Research Infrastructures - Examples from Humanities and Sciences (Lecture,Exercise) *Contents*: Successfully completing the lecture, students • understand the role and importance of the research infrastructure and their general building blocks • know the basics of grid computing • know the basics of cloud computing • learn basics on system virtualization • learn fundamental ideas of data management and analysis • understand the real-world problems from different domains (e.g., high energy physics, humanities, medical science/life science, etc.) which are tackled by research infrastructures • understand certain aspects, methods and tools of these infrastructures for different use cases from different domains • will be motivated to take part in other related modules (e.g., Specialization in Distributed Systems, Parallel Computing, etc.) • get familiar with real-world challenges through talks from experts who will present their current research activities and the role of research infrastructures on their research	3 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Grid computing; cloud computing; system virtualization; data management; data analysis; application of eResearch infrastructure in high energy physics; eResearch in medicine and life science; eResearch in humanities	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Ramin Yahyapour
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.Inf.1185: Sensor Data Fusion	5 C 4 WLH

Learning outcome, core skills:	**Workload:**
This module is concerned with fundamental principles and algorithms for the processing and fusion of noisy (sensor) data. Applications in the context of navigation, object tracking, sensor networks, robotics, Internet-of-Things, and data science are discussed. After successful completion of the module, students are able to • define the notion of data fusion and distinguish different data fusion levels • formalize data fusion problems as state estimation problems • develop distributed and decentralized data fusion architectures • describe the basic concepts of linear estimation theory • explain the fundamental formulas for the fusion of noisy data • deal with unknown correlations in data fusion • understand the Bayesian approach to data fusion and estimation • formulate dynamic models for time-varying phenomena • describe the concept of a recursive Bayesian state estimator • explain and apply the Kalman filter for state estimation in dynamic systems • explain and apply basic nonlinear estimation techniques such as the Extended Kalman filter (EKF) and Unscented Kalman filter (UKF) • assess the properties, advantages, and disadvantages of the discussed (nonlinear) estimators • explain different approaches to deal with uncertainty such as probability theory, fuzzy theory, and Dempster–Shafer theory • identify data fusion applications and assess the benefits of data fusion	Attendance time: 56 h Self-study time: 94 h

Course: Sensor Data Fusion (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Definition of data fusion; data fusion levels; formalization of data fusion problems; distributed and decentralized fusion architectures; linear estimation theory; fundamental fusion formulas; dynamic state estimation; Kalman filter; Extended Kalman filter (EKF); Unscented Kalman filter (UKF), algorithms for dealing with unknown correlations; fuzzy theory; Dempster-Shafer theory	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Maximum number of students: 50	

Georg-August-Universität Göttingen Module M.Inf.1186: Seminar Hot Topics in Data Fusion and Analytics	5 C 2 WLH

Learning outcome, core skills:	**Workload:**
After successful completion of the modul students are able to • get acquainted with a specific research topic in the area of data fusion and data analytics • explain the considered problem in the chosen research topic • collect, evaluate, and summarize related work • describe solution approaches for the considered problem • discuss advantages and disadvantages of the proposed approaches • give an outlook to future research directions • prepare and give a presentation about the chosen research topic • write a scientific report about the chosen research topic • follow recent research in data fusion and data analytics	Attendance time: 28 h Self-study time: 122 h

Course: Hot Topics in Data Fusion and Analytics (Seminar)	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 20 pages) **Examination prerequisites:** Attendance in 80% of the seminar presentations **Examination requirements:** Advanced knowledge of a specific research topic in the field of data fusion and data analytics; written scientific report; oral presentation	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1188: Mobile Robotics**	5 C 4 WLH
Learning outcome, core skills: This module is concerned with fundamental principles and algorithms for mobile robot navigation and perception. After completion, the students are able to • model the locomotion of wheeled mobile robots • understand the concept of dead reckoning • describe the most common sensors for mobile robots, e.g., inertial sensors and beam-based sensors • employ probabilistic state estimation methods such as Kalman filters and sequential Monte Carlo methods (particle filters) for robot navigation and perception • describe and distinguish different concepts for localization such as trilateration and triangulation • implement and evaluate basic algorithms for localization • understand the robot mapping problem and explain different map representations such as occupancy grids • describe the problem of Simultaneous Localization and Mapping (SLAM) • implement and evaluate basic algorithms for SLAM such as graph-based approaches and Rao-Blackwellized particle filters • implement and evaluate basic feature extraction methods such as Random Sample Consensus (RANSAC) • design basic planning algorithms for mobile robots using, e.g., a Markov Decision Process (MDP)	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Mobile Robotics (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Motion models for wheeled robots; dead reckoning; mobile robot sensors; Kalman filter; particle filter; localization concepts and algorithms; robot mapping; Simultaneous Localization and Mapping (SLAM); feature extraction methods; planning algorithms	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.Inf.1191: Privacy in Ubiquitous Computing	5 C 4 WLH
Learning outcome, core skills: After successful completion of the module, students are able to: • Define and understand the key concepts of privacy and ubiquitous computing, • Identify and classify threats to privacy in ubiquitous computing, • Describe, compare, and choose fundamental techniques to protect privacy, • Understand and analyze cutting-edge solutions.	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Privacy in Ubiquitous Computing (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination prerequisites:** Active participation during the exercises. **Examination requirements:** Introduction to privacy and ubiquitous computing, privacy threats, privacy-enhancing technologies, wireless sensor networks, smart meters, participatory sensing, RFIDs, Internet-of-Things.	5 C

Admission requirements: none	**Recommended previous knowledge:** M.Inf.1120, M.Inf.1121
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen Module M.Inf.1192: Seminar on Privacy in Ubiquitous Computing	5 C 2 WLH
Learning outcome, core skills: On completion of the module, students should be able to: • Investigate selected topics in privacy in ubiquitous computing, • Identify existing solutions in the area to be investigated, • Explain, compare, and discuss these solutions, • Develop new ideas to improve the existing solutions, • Summarize their findings in a written report, • Give a presentation about the chosen area.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminar on Privacy in Ubiquitous Computing (Seminar)	2 WLH
Examination: Presentation (approx. 30 minutes) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research on a topic in the area of privacy in ubiquitous computing, • They are able to explain selected solutions related to the chosen topic, • They are able to compare these solutions by analyzing their potential advantages and limitations, • They are able to write a structured scientific report on their findings by respecting the rules of good scientific practice, • They are able to present and to critically discuss their findings in a presentation. The examination includes a **seminar work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in privacy
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1193: Seminar on Usable Security and Privacy**	5 C 2 WLH
Learning outcome, core skills: On completion of the module, students should be able to: • Investigate a selected topic related to usability in the field of security and privacy, • Identify relevant publications to address this topic and survey the state-of-the-art, • Understand, present, and explain issues encountered by the users, • Develop and describe new ideas to address these issues, • Summarize their findings in a written report, • Give a presentation about their chosen topic.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar Usable Security and Privacy (Seminar)	2 WLH
Examination: Presentation (approx. 30 min.) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research on a topic in the area of usable security and privacy, • They are able to identify, understand, and explain usability issues encountered in this area, • They are able to propose novel solutions to these issues and discuss their potential advantages and limitations, • They are able to write a structured scientific report on their findings by respecting the rules of good scientific practice, • They are able to present and critically discuss their findings in a presentation. The examination includes a **seminar work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of privacy and usability obtained, e.g., in the recommended lecture “Usable Security and Privacy”
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1194: Seminar on Privacy in Data Science**	5 C 2 WLH
Learning outcome, core skills: On completion of the module, students should be able to: • Investigate selected topics on privacy in data science, • Identify existing solutions in the area to be investigated, • Explain, compare, and discuss these solutions, • Develop new ideas to improve the current state-of-the-art, • Summarize their findings in a written report, • Give a presentation about the chosen area.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar Privacy in Data Science (Seminar)	2 WLH
Examination: Presentation (approx. 30 min.) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research on a topic in the area of privacy in data science, • They are able to explain selected solutions related to the chosen topic, • They are able to compare these solutions by analyzing their potential advantages and limitations, • They are able to write a structured scientific report on their findings by respecting the rules of good scientific practice, • They are able to present and critically discuss their findings in a presentation. The examination includes a **seminar work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of privacy obtained, e.g., in one of the recommended lectures “Privacy-Enhancing Technologies”, “Privacy in Ubiquitous Computing”, “Usable Security and Privacy”, or “Ethical, Social, and Legal Foundations of Data Science”.
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1195: Seminar Human in the Age of Artificial Intelligence**	5 C 2 WLH
Learning outcome, core skills: This seminar investigates the relationship between Artificial Intelligence and automation and the human, the future of humanity, and ethical decision-making. This will be achieved by research and review of literature about the topic. On completion of this module students : • are familiar with the main concepts of the designed course and develop a greater awareness of the benefits and limitations of AI applications. • understand the role of artificial intelligence on Self and in Society. • are able to write a report demonstrating their understanding of the topic. • have improved their presentation skills on the selected topic. • have improved their ability to work independently in a pre-defined context.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Human in the Age of Artificial Intelligence (Seminar)	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 15 pages) **Examination requirements:** The students shall show that: • they are able to become acquainted with the topic of the designed course by investigating research publications • they are able to assess and analyze the research on the chosen topic • they are able to present and discuss their finding in a presentation • they are able to write a scientific report according to good scientific practice	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Parisa Memarmoshrefi
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1196: Object Tracking**	5 C 4 WLH
Learning outcome, core skills: This module introduces fundamental methods for the detection and tracking of (multiple) moving objects using environment sensors such as camera, lidar or radar devices. After completion of the course, the students are able to • describe different tracking concepts such as tracking-by-detection • extract object detections from visual, lidar and radar data • model the motion and measurement of moving objects • model the creation and termination of object tracks • apply vision-based and point cloud-based (multiple) object tracking algorithms • compare (multiple) object tracking methods based on scores such as Intersection-over-Union and MOTA/MOTP • solve data association problems, e.g. with the Hungarian or Auction algorithms • apply deep learning-based (multiple) object tracking methods, e.g., using transformers • apply probabilistic (multiple) object tracking algorithms such as the Multiple Hypotheses Tracker (MHT)	**Workload:** Attendance time: 56 h Self-study time: 94 h
Course: Object Tracking (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Students need to achieve the learning goals	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1200: Advanced Research Training (small scale) - Scientific Computing**	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements, ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen. Überblick über die Modulinhalte: Die kleine forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zum Wissenschaftlichen Rechnen gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	**Workload:** Attendance time: 7 h Self-study time: 173 h
Course: Kleine forschungsbezogene Projektarbeit *Contents*: Die kleine forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zum Wissenschaftlichen Rechnen gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded	
Examination requirements: Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt des Wissenschaftlichen Rechnens.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Gert Lube
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1201: Advanced Research Training - Applied System Development**	12 C 1 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements, ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 14 h Self-study time: 346 h
Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Systementwicklung gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 24 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Systemorientierten Informatik.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1202: Advanced Research Training - Bioinformatics**	12 C 1 WLH

Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen. Überblick über die Modulinhalte: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Bioinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	**Workload:** Attendance time: 14 h Self-study time: 346 h

Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Bioinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 24 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Bioinformatik.	12 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Burkhard Morgenstern
Course frequency: not specified	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1203: Advanced Research Training (small scale) - Computational Neuroscience**	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 7 h Self-study time: 173 h
Course: Kleine forschungsbezogene Projektarbeit *Contents*: Die kleine forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Neuroinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Neuroinformatik.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1204: Advanced Research Training - Ecological Informatics**	12 C 1 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 14 h Self-study time: 346 h
Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Ökoinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 24 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Informatik der Ökosysteme.	12 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1205: Advanced Research Training (small scale) - Health Informatics**	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 7 h Self-study time: 173 h
Course: Kleine forschungsbezogene Projektarbeit *Contents*: Die kleine forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Medizinischen Informatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Medizinischen Informatik.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. rer. nat. Dagmar Krefting
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1208: Advanced Research Training - Scientific Computing**	12 C 1 WLH

Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 14 h Self-study time: 346 h

Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zum Wissenschaftlichen Rechnen gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 24 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt des Wissenschaftlichen Rechnens.	12 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Gert Lube
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1209: Advanced Research Training - Computational Neuroscience**	10 C 1 WLH

Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 14 h Self-study time: 286 h

Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Neuroinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 20 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Neuroinformatik.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1215: Error Correcting Codes**	6 C 4 WLH

Learning outcome, core skills: Die Studierenden • kennen den schematischen Aufbau von Kommunikationssystemen und verstehen ihre stochastischen/algorithmischen Beschreibungen • kennen einfache Kanalcodes und können ihre Parameter bestimmen • kennen verschiedene Decodierprinzipien, können sie im Rahmen der statistischen Schätztheorie interpretieren und ihre algorithmische Komplexität analysieren • verstehen im Detail die Grundzüge der Theorie linearer Codes und effiziente Decodierverfahren für spezielle Codes • kennen und verstehen kombinatorische und asymptotische untere und obere Schranken für die Existenz von Codes • beherrschen allgemeine Konstruktionsverfahren für Fehlerkorrektur-Codes bzw. Codecs und können sie mit geeigneter Software implementieren • kennen die Grundzüge der Informationstheorie und den Kanalcodierungssatz und können bekannte Codefamilien diesbezüglich bewerten • verstehen die algebraische Theorie zyklischer Codes und können sie für die Konstruktion von Codes mit speziellen Eigenschaften anwenden • kennen Reed-Solomon-Codes und ihre Eigenschaften und Anwendungen, können sie im Vergleich zu allgemeinen algebraischen Codes bewerten • beherrschen verschiedene Decodierverfahren für RS-Codes und können sie analysieren	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Fehlerkorrigierende Codes (Lecture,Exercise)	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Bearbeitung von 50% aller Übungsblätter, Vorführung mindestens einer Aufgabe während der Übung, kontinuierliche Teilnahme an den Übungen **Examination requirements:** In der Prüfung wird die aktive Beherrschung der vermittelten Inhalte und Techniken nachgewiesen, z.B. • Verständnis der Zusammenhänge durch Umschreibung in eigenen Worten nachweisen • Konstruktion von Codes nach Vorgabe kombinatorischer Parameter • Parameter gegebener Codes bestimmen • Decodierung gestörter Empfangswörter • Codier-/Decodierverfahren nach Korrektheit und Komplexität analysieren • begründete Auswahl von Codierungsverfahren in hypothetischer Anwendungssituation • (teilweise) programmtechnische Umsetzung von Kanal-(De-)codierern	6 C

Admission requirements: none	**Recommended previous knowledge:**

	Beherrschung einer Programmiersprache, Grundkenntnisse der Theorie endlicher Körper
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.Inf.1216: Data Compression and Information Theory	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Die Studierenden • kennen den schematischen Aufbau von Kommunikationssystemen und verstehen ihre stochastischen/algorithmischen Beschreibungen • kennen die Grundbegriffe und Sätze der Shannonschen und der algorithmischen Informationstheorie und können sie in konkreten Situationen anwenden • kennen grundlegende verlustfreie Quellencodes (Huffman, Shannon, Lauflängen) und Erweiterungen sowie arithmetische Codes und können ihre Eignung in Anwendungssituationen bewerten • verstehen das Prinzip der Codeadaptionen und seine Implementierung anhand ausgewählter Codes • kennen allgemeine Entwurfsprinzipien für Quellencodes und verstehen ihre Umsetzung in konkreten Implementierungen • kennen die Schritte der verlustbehafteten Datenkompression und können ihre Leistungsparameter analysieren • kennen die Grundzüge der Ratenverzerrungstheorie und können sie in konkreten Situationen anwenden • kennen wichtige Beispiele verlustbehafteter Datenkompression, können sie analysieren und in Anwendungssituationen bewerten	Attendance time: 56 h Self-study time: 124 h

Course: Datenkompression und Informationstheorie (Lecture,Exercise)	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Bearbeitung von 50% aller Übungsblätter, Vorführung mindestens einer Aufgabe während der Übung, kontinuierliche Teilnahme an den Übungen **Examination requirements:** In der Prüfung wird die aktive Beherrschung der vermittelten Inhalte und Techniken nachgewiesen, z.B. • Verständnis der Zusammenhänge durch Umschreibung in eigenen Worten nachweisen • Konstruktion von Codes nach Vorgabe stochastischer Parameter • Schätzung stochastischer Parameter von Quellen und Kanälen • begründete Auswahl von Codierungsverfahren in hypothetischer Anwendungssituation • Codeparameter, Kanalkapazität etc. berechnen • (teilweise) programmtechnische Umsetzung von Quellen (de-)codierern • modulare Beschreibung konkreter Kommunikationssysteme darlegen • Leistungsparameter konkreter Quellencodierverfahren analysieren	6 C

Admission requirements:	**Recommended previous knowledge:**
none	Beherrschung einer Programmiersprache

Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1217: Cryptography**	6 C 4 WLH
Learning outcome, core skills: Die Studierenden • kennen den schematischen Aufbau kryptographischer Systeme und Protokolle, unterscheiden symmetrische und asymmetrische Verfahren und können ihre Nachteile und Vorzüge erklären • kennen klassische Kryptosysteme und können sie in Bezug auf Sicherheit, Korrektheit und Komplexität analysieren • beherrschen statistische Kryptoanalyseverfahren für klassische Systeme und können sie implementieren, verstehen die Unizitätstheorie klassischer Systeme • kennen Entwurfsprinzipien für moderne Block- sowie Stromchiffren und beherrschen fortgeschrittene Angriffsverfahren auf schwache Implementationen • kennen die Grundzüge der Theorie der one-way- bzw. trapdoor-Funktionen und ihre Zusammenhänge zur Komplexitätstheorie, können diese für den Entwurf kryptographischer Hashfunktionen bzw. Protokolle anwenden • kennen zahlentheoretische Grundlagen und verstehen ihre Bedeutung für verschiedene Public-Key-Verfahren • kennen Public-Key-Verfahren und darauf basierende Signaturverfahren und können sie mit Hilfe geeigneter Software implementieren • kennen fortgeschrittene kryptographische Protokolle auf der Basis von Public-Key-Verfahren, können ihre Korrektheit nachweisen und ihre Sicherheit grundsätzlich bewerten	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Kryptographie (Lecture,Exercise)	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination prerequisites:** Bearbeitung von 50% aller Übungsblätter, Vorführung mindestens einer Aufgabe während der Übung, kontinuierliche Teilnahme an den Übungen **Examination requirements:** In der Prüfung wird die aktive Beherrschung der vermittelten Inhalte und Techniken nachgewiesen, z.B. • Verständnis der Zusammenhänge durch Umschreibung in eigenen Worten nachweisen • Konstruktion einfachster Protokolle nach Situationsvorgabe • Kryptoanalyse klassischer Systeme durch statistische Angriffsverfahren • prinzipielle Sicherheitsanalyse vorgegebener einfacher Protokolle • prinzipielle Analyse gewisser Block- bzw. Stromchiffren • Komplexitätsanalyse zahlentheoretischer Kryptoverfahren • (teilweise) programmtechnische Umsetzung von Kryptoverfahren • Auswahl und Realisierung geeigneter Betriebsmodi für Blockchiffren	6 C

Admission requirements: none	**Recommended previous knowledge:**

	Beherrschung einer Programmiersprache, Grundkenntnisse der Zahlentheorie
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.Inf.1222: Specialisation Computer Networks	5 C 2 WLH
Learning outcome, core skills: The students • have gained a deeper knowledge in specific topics within the computer networks field • have improved their oral presentation skills • know how to methodically read and analyse scientific research papers • know how to write an analysis of a specific research field based on their analysis of state-of-the-art research • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Advanced Topics in Computer Networks (Seminar)	2 WLH
Examination: Präsentation (ca. 30 min.) und Hausarbeit (max. 15 Seiten) **Examination requirements:** Knowledge in a specific field of advanced computer networks technology; ability to present the earned knowledge in a proper way both orally and in a written report	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unrregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.Inf.1223: Advanced Topics in Computer Networks	5 C 3 WLH
Learning outcome, core skills: The students • know the principles of existing and emerging advanced networking technologies • know the details of Peer-to-Peer networks • are capable to describe the principles of cloud computing • have a basic understanding of information centric networking • are able to analyze social networks • have been introduced to state-of-the-art research in the computer networks field	**Workload:** Attendance time: 42 h Self-study time: 108 h
Course: Advanced Topics in Computer Networks (Lecture,Exercise)	3 WLH
Examination: Oral exam (approx. 30 minutes) or written exam (90 minutes) **Examination requirements:** advanced networking technologies, Peer-to-Peer networks, cloud computing, information centric networking, social networks, state-of-the-art research in the computer networks field	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures; basic programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 100	

Georg-August-Universität Göttingen **Module M.Inf.1226: Security and Cooperation in Wireless Networks**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
On completion of the module students should be able to: • recall cryptographic algorithms and protocols such as encryption, hash functions, message authentication codes, digital signatures and session key establishment • explain security requirements and vulnerabilities of existing wireless networks • discuss upcoming wireless networks and new security challenges that are arising • name trust assumptions and adversary models in the era of ubiquitous computing • show how naming and addressing schemes will be used in the future of the Internet and how these schemes can be protected against attacks • explain how security associations can be established via key establishment, exploiting physical contact, mobility, properties of vicinity and radio link • define secure neighbour discovery and explain the wormhole attack and its detection mechanisms • describe secure routing in multi-hop wireless networks by explaining existing routing protocols, attacks on them and the security mechanisms that can help to achieve secure routing • discuss how privacy protection can be achieved in MANETs in several contexts, such as location privacy and privacy in routing, and recall privacy related notions and metrics • recall selfish and malicious node behaviour on the MAC layer CSMA/CA, in packet forwarding and the impact on wireless operators and the shared spectrum; as countermeasure secure protocols for behaviour enforcement should be known • differentiate between different game theory strategies that can be used in wireless networks	Attendance time: 56 h Self-study time: 124 h

Course: Security and Cooperation in Wireless Networks (Lecture,Exercise)	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination requirements:** Cryptographic algorithms and protocols, hash functions, message authentication codes, digital signatures, session keys; security requirements, challenges and vulnerabilities in wireless networks; trust assumptions and adversary models in ubiquitous computing; naming and addressing schemes in the future internet; establishment of secure associations (key establishment, exploiting physical contact, mobility, properties of vicinity and radio link); secure neighbourhood discovery and wormhole attack detection mechanisms; secure routing in multi-hop wireless networks; privacy protection in MANETs (location privacy, routing privacy); enforcement of cooperative behaviour in MANETs; game theory strategies used in wireless networks	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in telematics and computer networks
Language:	**Person responsible for module:**

English	Dr. Parisa Memarmoshrefi
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1230: Specialisation Software-defined Networks (SDN)**	5 C 2 WLH

Learning outcome, core skills: The students • are familiar with advanced concepts of software defined networking (SDN) • know how to methodically read, analyse and discuss scientific research papers • have enriched their practical skills in computer networks with regards to SDN and its applications • know about practical deployability issues of SDN • have improved their ability to work independently in a pre-defined context • have improved their ability to work in diverse teams	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Specialization in Software-defined Networking (Exercise,Seminar)	2 WLH
Examination: Term Paper (max. 20 pages) **Examination prerequisites:** Erreichen von mindestes 50% der Übungspunkte **Examination requirements:** Advanced knowledge in software-defined networking; ability to transfer the theoretical knowledge to practical exercises; ability to present the earned knowledge in a proper written report	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures; advanced programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1232: Parallel Computing**	6 C 4 WLH
Learning outcome, core skills: Successfully completing the module, students are able to: • define and describe the benefit of parallel computing • specify the classification of parallel computers (Flyn classification) • analytically evaluate the performance of parallel computing approaches (scaling/ performance models) • know the parallel hardware and performance improvement approaches (cache coherence, pipeline, etc.) • know the interconnects and networks and their role in parallel computing • understand and develop sample parallel programs using different paradigms and development environments (e.g., shared memory and distributed models) • expose to some applications of Parallel Computing through hands-on exercises	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Parallel Computing (Lecture,Exercise) *Contents*: Successfully completing the lecture, students are able to: • define and describe the benefit of parallel computing and identify the role of software and hardware in parallel computing • specify the Flynn classification of parallel computers (SISD, SIMD, MIMD) • analytically evaluate the performance of parallel computing approaches (Scaling/ Performance models) • understand the different architecture of parallel hardware and performance improvement approaches (e.g., caching and cache coherence issues, pipeline, etc.) • define Interconnects and networks for parallel computing • architecture of parallel computing (MPP, Vector, Shared memory, GPU, Many-Core, Clusters, Grid, Cloud) • design and develop parallel software using a systematic approach • parallel computing algorithms and development environments (i.e. shared memory and distributed memory parallel programming) • write parallel algorithms/programs using different paradigms and environments (e.g., POSIX Multi-threaded programming, OpenMP, MPI, OpenCL/CUDA, MapReduce, etc.) • get exposed to some applications of Parallel Computing through exercises References • An Introduction to Parallel Programming, Peter S. Pacheco, Morgan Kaufmann (MK), 2011, ISBN: 978-0-12-374260-5. • Designing and Building Parallel Programs, Ian Foster, Addison-Waesley, 1995, ISBN 0-201-57594-9 (Available online).	4 WLH

• Advanced Computer Architecture: Parallelism, Scalability, Programmability, Kai Hwang, Int. Edition, McGraw Hill, 1993, ISBN: 0-07-113342-9. • In addition to the mentioned text book, tutorial and survey papers will be distributed in some lectures as extra reading material.	
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min.) **Examination requirements:** Parallel programming; Shared Memory Parallelism; Distributed Memory Parallelism, Single Instruction Multiple Data (SIMD); Multiple Instruction Multiple Data (MIMD); Hypercube; Parallel interconnects and networks; Pipelining; Cache Coherence; Parallel Architectures; Parallel Algorithms; OpenMP; MPI; Multi-Threading (pthreads); Heterogeneous Parallelism (GPGPU, OpenCL/CUDA)	6 C

Admission requirements: • Data structures and algorithms • Programming in C/C++	**Recommended previous knowledge:** • Computer architecture • Basic knowledge of computer networks and topologies
Language: English	**Person responsible for module:** Prof. Dr. Ramin Yahyapour
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1234: Emerging Topics in Advanced Computer Networks**	6 C 4 WLH
Learning outcome, core skills: This course covers the principles of existing and emerging advanced networking technologies and services e.g., ICN, SDN, Smart City, IoT, Advanced Networking. In general, students will study computer networks, future Internet architectures and data science related topics. The students will • know the principles of existing and emerging advanced networking technologies and services • have a basic understanding of computer networks • have been introduced to the state-of-the-art research in the relevant field • build a practical system based on the study material covered in the course	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Emerging Topics in Advanced Computer Networks (Lecture,Exercise)	4 WLH
Examination: Oral exam (approx. 30 min) or written exam (90 min) **Examination requirements:** Advanced networking technologies, Peer-to-Peer networks, Data science, state-of-the-art research in the computer networks field	5 C

Admission requirements: none	**Recommended previous knowledge:** • Basic knowledge in computer networks and data science • Basics knowledge of algorithms and data structures • Basic programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen Module M.Inf.1235: Bio-Inspired Artificial Intelligence	6 C 4 WLH
Learning outcome, core skills: This course is an introduction to bio-inspired artificial intelligence, explaining its relevant theories and methods that are derived from biological processes. It covers important applications and discusses how to apply biologically inspired algorithms for solving problems. The course will cover concepts and computational models inspired by the area of biology, such as evolutionary systems, cellular systems, neural systems, immune systems, swarm intelligence. On completion of this module, students : • are familiar with the main concepts and methods inspired by biological systems • understand the relevant types of algorithms designed for bio-inspired computing • get knowledge about solving real-world problems with bio-inspired approaches • develop their skills in biologically inspired algorithm design	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Bio-Inspired Artificial Intelligence (Lecture,Exercise) Literature: • Floreano, Dario., and Claudio. Mattiussi. Bio-Inspired Artificial Intelligence Theories, Methods, and Technologies. • Stephan Olariu and Albert Y. Zomaya. Handbook of Bioinspired Algorithms and Applications.	4 WLH
Examination: Written exam (90 min.) or oral exam (approx. 20 min.) **Examination prerequisites:** At least 50% of homework exercises solved. **Examination requirements:** Knowledge of principles of biologically inspired models and computing algorithms, the advantages and limitations of bio-inspired approaches, the value of their application to real world problems, ability to design and implement bio-inspired algorithms.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Parisa Memarmoshrefi
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

<table>
<tr><td>Georg-August-Universität Göttingen
Module M.Inf.1236: High-Performance Data Analytics</td><td>6 C
4 WLH</td></tr>
<tr><td>Learning outcome, core skills:
Successfully completing the module, students understand
• the motivation and use-case for large-scale data analytics
• performance implications of hardware and software system for large-scale data workloads
• the usage of industry-standard tools to solve data analytics problems
• algorithms, data structures, data models, tools, and infrastructure for efficient processing of data</td><td>Workload:
Attendance time:
56 h
Self-study time:
124 h</td></tr>
<tr><td>Course: High-Performance Data Analytics (Lecture,Exercise)
Contents:
Data-driven science requires the handling of large volumes of data in a quick period of time. Executing efficient workflows is challenging for users but also for systems. This module introduces concepts, principles, tools, system architectures, techniques, and algorithms toward large-scale data analytics using distributed and parallel computing. We will investigate the state-of-the-art of processing data of workloads using solutions in High-Performance Computing and Big Data Analytics.

Topics cover:
• Challenges in high-performance data analytics
• Use-cases for large-scale data analytics
• Performance models for parallel systems and workload execution
• Data models to organize data and (No)SQL solutions for data management
• Industry relevant processing models with tools like Hadoop, Spark, and Paraview
• System architectures for processing large data volumes
• Relevant algorithms and data structures
• Visual Analytics
• Parallel and distributed file systems

Guest talks from academia and industry will be incorporated in teaching that demonstrates the applicability of this topic.

Weekly laboratory practicals and tutorials will guide students to learn the concepts and tools. In the process of learning, students will form a learning community and integrate peer learning into the practicals. Students will have opportunities to present their solutions to the challenging tasks in the class. Students will develop presentation skills and gain confidence in the topics.</td><td>4 WLH</td></tr>
<tr><td>Examination: Written exam (90 min) or oral exam (approx. 30 min)
Examination requirements:
• Challenges in high-performance data analytics
• Use-cases for large-scale data analytics
• Performance models for parallel systems and workload execution
• Data models to organize data and (No)SQL solutions for data management
• Industry relevant processing models with tools like Hadoop, Spark, and Paraview</td><td>6 C</td></tr>
</table>

• System architectures for processing large data volumes • Relevant algorithms and data structures • Visual Analytics • Parallel and distributed file systems	

Admission requirements: none	**Recommended previous knowledge:** Basic programming skills, Basic knowledge of Linux operating systems, Python
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 4
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1237: Seminar Newest Trends in High-Performance Data Analytics**	5 C 2 WLH
Learning outcome, core skills: The students will be able to • Appraise research in the area of high-performance data analytics • Compose a presentation covering their selected topic in depth • Evaluate findings (tools or theory) of other researchers • Explain theory and application covering their topic	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar Newest Trends in High-Performance Data Analytics (NTHPDA) (Seminar) *Contents*: High-Performance Data Analytics is a vehicle to extract findings from large data sets. It is an indispensable tool in science and business but a rapidly changing field. *Teaching und learning methods:* As part of this seminar, you will create a presentation and report revolving around a selected hot topic in German or English. You will learn to research literature and may conduct small experiments to provide a holistic view of the selected topic. You will meet regularly with an assigned supervisor and work towards the presentation and report. *Remark:* If you like to prepare for the topic early, we can hand out a topic during the lecture free time before the term - just contact us.	2 WLH
Examination: Presentation (approx. 35 min.) and report (max. 15 pages) **Examination prerequisites:** Participation in the seminar **Examination requirements:** Presentation (50%) and report (50%)	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen **Module M.Inf.1238: Scalable Computing Systems and Applications in AI, BigData and HPC**	5 C 3 WLH

Learning outcome, core skills: The students will be able to • Describe approaches for the development of scalable systems and applications • Sketch efficient algorithms and concepts • Analyze and summarize state-of-the-art concepts, tools and research papers • Deliver a technical presentation for a professional audience • Explore and apply concepts or tools to improve scalability for a selected use case • Quantify efficiency and scalability of selected use cases	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Scalable Computing Systems and Applications in AI, BigData and HPC (SCAP) (Seminar) *Contents*: Performance is an important feature for large-scale data analysis. *Teaching und learning methods:* The module can be considered to consist of a seminar and small-scale practical that are connected by a specific topic. Students will first select a topic and use case, for instance, scalable AI, lock-free data structures, concept or tool. Then, during the term they will prepare a presentation and introduce the topic considering state of the art. Next, a student will realize an individual project by practically working on their topic. They have to evaluate performance and scalability, and then analyze and quantify the contribution of the respective tool. Students can choose on a big variety of topics, some involve concepts and tools. Typically, the evaluation requires some application and programming. More information is provided on the webpage. The results are presented in a final meeting. *Remark:* If you like to prepare for the topic early, we can hand out a topic during the lecture free time before the term - just contact us.	3 WLH
Examination: Presentation (15 min) and report (max 15 pages) on student project **Examination requirements:** Report (70%) and final presentation (30%) The examination can be taken individually or as group work (max. 3 persons).	5 C

Admission requirements: none	**Recommended previous knowledge:** • Linux Basics (you have used Linux and the Bash shell). We will provide a short crash course at the beginning of the course and link supplementary training material.
Language:	**Person responsible for module:**

English	Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.1242: Seminar Databases**	5 C 2 WLH

Learning outcome, core skills: Die Studierenden können sich in ein Spezialgebiet moderner Datenbank- und Informationssysteme einarbeiten, Quellen im Web suchen und in Beziehung zu dem behandelten Gebiet setzen, sowie in einer Diskussion darstellen und bewerten. Überblick über die Modulinhalte: Aktuelle Original-Arbeiten aus dem Bereich Datenbanken.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminar Datenbanken (Seminar)	2 WLH
Examination: Vortrag (ca. 60 Min.) mit schriftlicher Ausarbeitung (max. 15 Seiten) **Examination requirements:** Einarbeitung in ein Spezialgebiet moderner Datenbank- und Informationssysteme; Fähigkeit, Quellen im Web suchen und in Beziehung zu dem behandelten Gebiet zu setzen, sowie in einer Diskussion darzustellen und zu bewerten	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Additional notes and regulations: Das Modul wird in der Regel auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren.

Georg-August-Universität Göttingen **Module M.Inf.1243: Deductive Databases**	6 C 4 WLH

Learning outcome, core skills: Die Studierenden verfügen über vertiefte Kenntnisse der im Datenbankbereich zugrundeliegenden Theorie. Sie haben einen Einblick in die Möglichkeiten, die logikbasierte Ansätze und entsprechende deklarative Programmiersprachen über reine Datenverwaltung hinaus bieten, um Wissen zu repräsentieren und in intelligenten Anwendungen Schlüsse daraus zu ziehen (z.B. Answer Set Programming).	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Deduktive Datenbanken (Lecture,Exercise) *Contents*: Relationaler Kalkül, Datalog, Negation in Closed World, Disjunktives Reasoning, Stabile Modelle, Answer Set Programming.	4 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 25 Min.). **Examination requirements:** Vertiefte Kenntnisse der dem Datenbankbereich zugrundeliegenden Theorie. Praktische Anwendung logikbasierter Programmiersprachen.	6 C

Admission requirements: Datenbanken, Formale Systeme	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Additional notes and regulations: Das Modul wird auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren.

Georg-August-Universität Göttingen Module M.Inf.1244: Seminar on optimal transport	5 C 2 WLH
Learning outcome, core skills: By using original references students will familiarize themselves with advanced aspects of optimal transport theory or its applications in modern data analysis and machine learning and present their findings to the other participants. • read and understand original research papers or graduate-level textbooks • collect background material on a given topic and its context • order and prioritize this material for a presentation • prepare a structured presentation with a corresponding handout • give an accessible presentation • answer questions from the audience that may go slightly beyond the presentation material • leading and participating in a scientific discussion	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar on optimal transport (Seminar)	2 WLH
Examination: Presentation (approx. 45 min.), follow-up discussion, and handout (max. 5 pages) **Examination requirements:** Advanced knowledge on a specific topic in optimal transport research; structured presentation; handout	5 C

Admission requirements: none	**Recommended previous knowledge:** Lecture “Computational optimal transport” or some course on optimization are strongly recommended.
Language: English	**Person responsible for module:** Prof. Dr. Bernhard Schmitzer
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.Inf.1250: Seminar: Software Quality Assurance	5 C 2 WLH
Learning outcome, core skills: The students • learn to become acquainted with an advanced topic in software quality assurance by studying up-to-date research papers • gain knowledge about advanced topics in software quality assurance. The advanced topic may be related to areas such as test processes, software metrics, black-box testing,white-box testing, test automation, test generation and testing languages • learn to present and discuss up-to-date research on advanced topics in software quality assurance. • learn to assess up-to-date research on advanced topics in software quality assurance	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Randomness and Software Testing (Seminar) *Contents*: Since exhaustive testing of software is almost never possible, different approaches towards the determination of appropriate test suites have been proposed throughout the years. One direction is to randomize the generation of software tests. This does not necessarily mean that there is no underlying strategy, the opposite is the case. The inputs and/or execution paths of software are created using probability distributions with the aim to optimize certain quality aspects of software. This seminar addresses topics from randomized software testing, including randomized selection of execution paths (e.g., through usage-based testing) and randomized generation of test data (e.g., using fuzzing). In addition to the techniques themselves, we also address how randomized approaches differ from traditional approaches based on coverage criteria and/or heuristics.	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 20 pages) **Examination prerequisites:** (1) Pitch Presentation (approx. 5 minutes); (2) Reviewable Draft of the Seminar Report (minimum 2 pages, maximum 5 pages); (3) Peer Review of a Fellow Student’s Work (maximum 1 page) **Examination requirements:** The students shall show that • they are able to become acquainted with an advanced topic in software quality assurance by investigating up-to-date research publications • they are able to present up-to-date research on an advanced topic in software quality assurance • they are able to assess up-to-date research on an advanced topic in software quality assurance • they are able to write a scientific report on an advanced topic in software quality asssurance according to good scientific practice	5 C

Presentation of an advanced topic in software engineering and written report.	

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

<table>
<tr><td>Georg-August-Universität Göttingen
Module M.Inf.1251: Seminar: Software Evolution</td><td>5 C
2 WLH</td></tr>
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<table>
<tr><td>Learning outcome, core skills:
The students
learn to become acquainted with an advanced topic in software evolution by studying up-to-date research papers
gain knowledge about advanced topics in software evolution. The advanced topic may be related to areas such as comparison of software projects, defect analysis and prediction, version control and infrastructure, changes and clones, impact analysis, practical applications and experiments, patterns and models, as well as integration and collaboration (process-related and social aspects)
learn to present and discuss up-to-date research on advanced topics in software evolution
learn to assess up-to-date research on advanced topics in software evolution</td><td>Workload:
Attendance time:
28 h
Self-study time:
122 h</td></tr>
</table>

<table>
<tr><td>Course: Mining Software Repositories (Seminar)
Contents:
The topics in this seminar on software evolution will include the following areas:
comparison of projects
defect analysis and prediction
version control and infrastructure
beyond source code - text analysis
search and recommendation
changes and clones
impact analysis
practical applications and experiments
available resources
visualization and presentation of results
patterns and models
integration and collaboration (process-related and social aspects)</td><td>2 WLH</td></tr>
<tr><td>Examination: Presentation (approx.45 minutes) and written report (max. 20 pages)
Examination prerequisites:
(1) Pitch Presentation (approx. 5 minutes); (2) Reviewable Draft of the Seminar Report (minimum 2 pages, maximum 5 pages); (3) Peer Review of a Fellow Student’s Work (maximum 1 page)
Examination requirements:
The students shall show that
they are able to become acquainted with an advanced topic in software evolution by investigating up-to-date research publications
they are able to present up-to-date research on an advanced topic in software evolution
they are able to assess up-to-date research on an advanced topic in software evolution</td><td>5 C</td></tr>
</table>

• they are able to write a scientific report on an advanced topic in software evolution according to good scientific practice Presentation of an advanced topic in software engineering (approx.45 minutes) and written seminar report (max. 20 pages)	

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1252: Specialisation Practical Computer Science**	6 C 4 WLH

Learning outcome, core skills: Students will acquire in-depth knowledge in one of the following areas. • Software Engineering • Operating Systems • Compilers and Programming Languages • Embedded Systems • Mobile Edge Computing • Pervasive Computing	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Specialisation Practical Computer Science (Lecture) *Contents*: Place holder for a course of the professorship of practical computer science.	
Examination: Written examination (90 minutes)	6 C

Course: Seminar Practical Computer Science (Seminar) *Contents*: Place holder for a course of the professorship of practical computer science.	
Examination: Oral report with written elaboration (max. 20 pages)	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Studiendekan Informatik
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 100	

Georg-August-Universität Göttingen **Module M.Inf.1258: Advanced Research Training (small scale) - Data Science**	6 C 0,5 WLH

Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 7 h Self-study time: 173 h

Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben aus dem Bereich Data Science gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt aus dem Bereich Data Science.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1259: Advanced Research Training - Data Science**	12 C 1 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 14 h Self-study time: 346 h
Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben aus dem Bereich Data Science gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	1 WLH
Examination: Term Paper (max. 24 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt aus dem Bereich Data Science.	12 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1260: Advanced Research Training (small scale) - Ecological Informatics**	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen.	**Workload:** Attendance time: 7 h Self-study time: 173 h
Course: Forschungsbezogene Projektarbeit *Contents*: Die forschungsbezogene Projektarbeit ist an ein aktuelles Forschungsvorhaben zur Ökoinformatik gekoppelt. Die Tätigkeit des Studierenden liegt im Kernbereich dieses Vorhabens. Sie reicht vom Studium projektrelevanter wissenschaftlicher Literatur über die Mitarbeit zu Lösungsvorschlägen bis hin zur praktischen Umsetzung der auf diese Weise erworbenen Kenntnisse und Einsichten.	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Kompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements ggf. Erwerb von Fähigkeiten beim Umsetzen theoretischer Konzepte in praktische Lösungen in einem Forschungsprojekt der Informatik der Ökosysteme.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1261: Seminar Graphic Data Processing**	5 C 2 WLH

Learning outcome, core skills: Die Studierenden sollen lernen, sich anhand von Originalarbeiten selbständig in aktuelle Themen der Grafischen Datenverarbeitung einzuarbeiten und den erarbeiteten Stoff vor einem kritischen Publikum vorzutragen. Hierzu gehört das gründliche Durcharbeiten und Beurteilen der betreffenden Originalarbeit sowie die Erarbeitung von Grundlagen, die für das Verstehen der Arbeit notwendig sind, dort aber aus Platzgründen nicht ausgeführt sind. Dabei sind im Allgemeinen weitere Originalarbeiten oder Lehrbücher heranzuziehen, die notwendig sind, um die gewählte Originalarbeit vollständig zu verstehen. Da im Vortrag nur ein Teil des erarbeiteten Stoffes dargestellt werden kann, ist eine sinnvolle Auswahl zu treffen. Die Unterscheidung zwischen wichtigen und weniger wichtigen Bestandteilen des erlernten Stoffes gehört zu den Aufgaben des Vortragenden. Es wird erwartet, dass der Vortragende nicht nur den vorgetragenen Stoff beherrscht, sondern auch Grundlagen dieses Stoffes, die im Vortrag aus Zeitgründen nicht behandelt werden konnten. Schließlich ist eine schriftliche Ausarbeitung des Vortrags zu erstellen.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminare beispielsweise zu den Themen Computergrafik, Bildanalyse, Auswertung von 3D-Daten, Mustererkennung, Modellierung und Rendering natürlicher Objekte. (Seminar) *Contents*: Aktuelle Forschungsarbeiten der Grafischen Datenverarbeitung (Computergrafik, Bildanalyse, Mustererkennung, Analyse von 3D-Daten)	
Examination: Vortrag (ca. 60 Min.) mit schriftlicher Ausarbeitung (max. 20 Seiten). **Examination requirements:** Selbständige Einarbeitung anhand von Originalarbeiten in aktuelle Themen der Grafischen Datenverarbeitung und Präsentation des erarbeiteten Stoffes einschließlich der Grundlagen die zum Verstehen des eigentlichen Themas notwendig sind.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Winfried Kurth
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Additional notes and regulations:

Vortrag und Hausarbeit sind in englischer und in deutscher Sprache möglich

Georg-August-Universität Göttingen **Module M.Inf.1291: Seminar Advanced Topics in Computer Security and Privacy**	5 C 2 WLH

Learning outcome, core skills: On completion of the module, students should be able to: • Investigate selected research topics in computer security and privacy, • Identify existing solutions in the area to be investigated, • Explain, compare, and discuss these solutions, • Develop new ideas to improve the existing solutions, • Summarize their findings in a written report, • Give a presentation about the chosen area.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Seminar on Advanced Topics in Computer Security and Privacy (Seminar)	2 WLH
Examination: Presentation (approx. 30 minutes) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research on an advanced topic in computer security and privacy, • They are able to explain selected solutions related to the chosen topic, • They are able to compare these solutions by analyzing their potential advantages and limitations, • They are able to write a structured scientific report on their findings by respecting the rules of good scientific practice, • They are able to present and to critically discuss their findings in a presentation. The examination includes a **seminar work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	5 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer security and privacy
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Additional notes and regulations:

On completion of the module, students should be able to:

- Investigate selected topics in privacy in ubiquitous computing,
- Identify existing solutions in the area to be investigated,

- Explain, compare, and discuss these solutions,
- Develop new ideas to improve the existing solutions,
- Summarize their findings in a written report,
- Give a presentation about the chosen area.

Georg-August-Universität Göttingen Module M.Inf.1292: Seminar Neuromorphic Computing	5 C 2 WLH
Learning outcome, core skills: The seminar shall provide an understanding of the fundamental concepts of neuromorphic computing, relating to machine learning, computational neuroscience, and hardware development. After successful completion of this module, students are able to: • discuss latest research results. • critically evaluate the benefits and drawbacks of different hardware systems and algorithms. The seminar aims to convey competences in the area of neuromorphic computing and to improve the students‘ skills to present and evaluate scientific literature as well as to lead scientific discussions.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar Neuromorphic Computing (Seminar)	2 WLH
Examination: Presentation (30-45 min) with written report (2-5 pages) **Examination prerequisites:** Active participation in at least 5 discussion sessions throughout the semester. **Examination requirements:** Independent preparation and presentation of a topic from the area of neuromorphic computing (from a given list of topics).	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Dr. Jannik Luboeinski Prof. Dr. Christian Tetzlaff
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen Module M.Inf.1304: E-Health	6 C 4 WLH
Learning outcome, core skills: Die Studierenden können die verschiedenen Kommunikationsstandards im Gesundheitswesen beschreiben und bewerten. Sie können die bisherige Entwicklung dieser Standards beschreiben und zukünftige Herausforderungen und Potentiale von Standards darlegen. Die Studierenden können die Bedeutung der Standards in der aktuellen Forschung beschreiben. Die Studierenden können die wesentlichen rechtlichen Rahmenbedingungen der E-Health benennen. Sie können die Bedeutung der nationalen und internationalen Verordnungen und Gesetze erläutern und geeignete Beispiele nennen. Die Studierenden können die Auswirkungen der E-Health auf die traditionelle Organisationsform des deutschen Gesundheitswesens beschreiben und Chancen und Herausforderungen der digitalen Transformation erläutern.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: E-Health (Block course) *Contents*: Kommunikationsstandards im Gesundheitswesen und deren bisherige und zukünftige Entwicklung; Bedeutung der Standards in der aktuellen Forschung; rechtliche Rahmenbedingungen der E-Health (nationale und internationale Verordnungen und Gesetze); Auswirkungen der E-Health auf das deutsche Gesundheitswesen; Chancen und Herausforderungen der digitalen Transformation; weitere Inhalte nach aktueller Entwicklung. Literaturempfehlungen werden zu Beginn des Semesters ausgegeben. *Course frequency:* once a year	4 WLH
Examination: Klausur bzw. E-Prüfung (90 Min.) oder mündliche Prüfung (ca. 20 Min.) (50%); Seminararbeit (min. 10 bis max. 20 Seiten) (25%) und Seminarvortrag (30 bis max. 45 Minuten) (25%). **Examination prerequisites:** Teilnahme an den Blockseminarterminen.	6 C
Examination requirements: In der Prüfung wird neben dem theoretischen Verständnis zentraler Begriffe und Methoden deren Auswahl, Einsatz und Überprüfung anhand von Fallbeispielen nachgewiesen. Lernziele werden zu jeder Lehreinheit ausgegeben. Prüfungsanforderungen werden in der Lehrveranstaltung durch geeignete Übungsaufgaben und/oder Repetitorien vermittelt. In Klausuren bzw. E-Prüfungen sind grundsätzlich offene Fragen in Textform zu bearbeiten, weitere Fragetypen (z. B. MC) sind in geringem Umfang möglich. Prüfungsanforderungen in Seminarvorträgen und Hausarbeiten sind einer schriftlichen Aufgabenstellung zu entnehmen, Bewertungskriterien werden zu Beginn des jeweiligen Semesters ausgegeben.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language:	**Person responsible for module:**

German, English	Prof. Dr. rer. nat. Dagmar Krefting Prof. Dr. Ulrich Sax
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1306: Market Analysis**	9 C 6 WLH

Learning outcome, core skills: The students • describe the benefit, the essential terms and methods of requirements engineering and explain them by means of a chosen example. • plan and execute an actual market analysis (trade fair excursion resp.) in context of their chosen example. • explain and conduct a benefit analysis in context of their chosen example.	**Workload:** Attendance time: 84 h Self-study time: 186 h

Course: Market Analysis (Lecture,Excursion,Exercise,Seminar) *Contents*: Market Analysis of an IT-Market: Requirements Engineering, Requirements and Product Specifications, Market Analysis (Excursion), Benefit Analysis. The contents are adjusted to current developments of the field. Sources are recommended at the beginning of each term.	6 WLH
Examination: **Examination prerequisites:** Regular participation at seminar dates.	9 C

Examination requirements: In a team, the students prepare and partially implement an approach to a complex, practical decision. They make use of suitable literature and acquire further sources. They document their results continuously in seminar papers and present their intermediate results in the seminar. Their thus compiled solution (recommended decision resp.) is graded on the basis of the documented and presented results. Requirements of seminar presentations and papers are specified in each assignment and grading criteria are conveyed at the start of each semester.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. rer. nat. Dagmar Krefting Prof. Dr. Ulrich Sax
Course frequency: once a year; Starts only in Winter Terms.	**Duration:** 2 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1307: Current Topics in Medical Informatics**	6 C 4 WLH
Learning outcome, core skills: The students • name and describe topics in medical informatics, which are of major importance for the future development of the field. • explain, discuss, and substantiate said importance. • reflect on a topic and analyze it by means of literature research. • conduct topic-related assignments and case examples. • present and discuss their results.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Current Topics in Medical Informatics (Block course,Lecture,Exercise,Seminar) *Contents*: The contents are adjusted to current developments of the field. Examples: clinical decision support, assistive health care technologies, advanced technologies and methods of data analysis and data quality management, machine learning, semantic analysis of medical data models. The seminar can be conducted as an online course. *Course frequency:* once a year	4 WLH
Examination: Seminar paper (max. 20 pages) (60%) and presentation (ca. 20 minutes) (40%) or e-assessment in the online-course (100 %) **Examination prerequisites:** Regular participation in the seminar.	6 C
Examination requirements: Detailed coverage of a current topic in medical informatics in accordance with the learning aims. Requirements of seminar presentations and papers are specified in assignments, as are requirements in the e-assessment. Grading criteria are conveyed at the start of each semester.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. rer. nat. Dagmar Krefting Prof. Dr. Ulrich Sax
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1308: Journal Club**	3 C 2 WLH

Learning outcome, core skills: The students • conduct their own research of current scientific journal publications in a given area of medical informatics. • choose relevant publications and justify their choice. • research background information on publication sources and authors and put it into the scientific context of the given area of the field. • read, present, assess, and discuss scientific publications.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Journal Club (Seminar) *Contents*: Contents are adjusted to the current development of the field.	2 WLH
Examination: Two seminar presentations (ca. 30 minutes each) (40% each) and active participation in the discussions of papers presented by other candidates (20%). **Examination prerequisites:** Evidence of active participation in at least 12 seminar dates.	3 C

Examination requirements: Evidence of acquired, field-specific competencies through critical examination of relevant publications. Requirements of seminar presentations are specified in assignments. Grading criteria are conveyed at the start of each semester.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. rer. nat. Dagmar Krefting Prof. Dr. Ulrich Sax
Course frequency: each semester	**Duration:** 2 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 25	

Georg-August-Universität Göttingen Module M.Inf.1309: Biomedical Signal and Image Processing	6 C 4 WLH
Learning outcome, core skills: The students • name and describe aims and typical tasks in biomedical signal and image processing. • name the relevant signal and imaging techniques in biomedicine and explain their essential characteristics. • describe essential mathematical and physical contexts – on an appropriate level - which are the basis for the introduced techniques. • explain concepts overarching the fields of signal and image processing, e.g. signal-to-noise ratio, sampling, quantization, system theory. • explain the fundamentals of signal and image processing in time, frequency and time-frequency domain. • explain typical use-cases, e.g. signal delineation and image segmentation, and explain encountered challenges • explain fundamentals of multiscale signal and image analysis. • apply each of the theoretical fundamentals in practical use cases with established software tools.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Biomedical Signal and Image Processing (Lecture,Seminar) *Contents*: Electrical biosignals in biomedicine and their digital representation; typical processing chain starting with signal acquisition, followed by filtering and feature extraction; sampling theorem, aliasing; Linear-time invariant systems and their properties; Time and frequency domain representations of signals, uncertainty principle on time-frequency transforms: Short-time Fourier Transform, Discrete Wavelet Transform, Continuous Wavelet Transform; Convolution Theorem. Radiological, nuclear-medicine, and optical procedures in medicine; digital image representation, processing chain, resolution and contrast, contrast enhancement, noise reduction, filter techniques; detection of points, lines, edges, and segments, threshold and area-oriented operations, feature extraction. Use of tools such as Python, Numpy, Scipy, Matplotlib. The contents are adjusted to current developments. Literature is indicated at the start of each semester.	4 WLH
Examination: Practical exam ("praktische Prüfung") (80%) and presentation of results (ca. 30 min.) (20%) in the seminar. **Examination requirements:** By means of a practical examination, the students continuously work on programming assignments that form a larger seminar project. The practical examination can be conducted in groups. The regular assignment results have to be submitted, and presented in the seminar.	6 C

Grading criteria will be presented to the students at the start of the module. Detailed requirements are incorporated in the assignments.	

Admission requirements: none	**Recommended previous knowledge:** Students are expected to have sound knowledge in fundamentals of mathematics. They are expected to have programming experience.
Language: English	**Person responsible for module:** Prof. Dr. rer. nat. Dagmar Krefting Prof. Dr. rer. nat. Ulrich Sax
Course frequency: each summer semester	**Duration:** 1 Semester
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1351: Work Methods in Health Research**	5 C 3 WLH
Learning outcome, core skills: The students... • name and explain methods, structures, and aims of collaborative research organizations and explain their impact on global health research and health care. • explain collaborative work methods in academic projects. • explain the role of individual actors in collaborative research. • describe the structure and organization of German and European scientific community in societies and associations and explain the benefit of said organization for (international) research as well as their own personal benefits. • demonstrate said competencies in a seminar assignment.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Mögliche Lehrformen: Vorlesung, Übung, Seminar, Blockseminar *Contents*: Clinical Research Units, Collaborative Research Centers, German Centers for Health Research, TMF, GMDS, EFMI, IMIA. Tools for collaborative work, team-building, maintaining a team, self-assessment. The contents are continuously adjusted to current developments of the field. Sources are recommended at the beginning of each term. *Course frequency:* once a year	3 WLH
Examination: Seminar paper (max. 10 pages) and seminar presentation (approx. 20 minutes) **Examination prerequisites:** regelmäßige Teilnahme bei Blockseminaren und bei Seminaren **Examination requirements:** The students describe, explain, and assess selected aspects of collaborative health research in detail. This may be based on literature or individual research. The student work may address a specific aspect of collaborative research or analyze actual collaborative work designs. Students may work in teams. They make use of suitable literature and acquire further sources. They document their results in a seminar paper (ten pages maximum) and present their results in the seminar (20 minutes). Requirements are specified in an assignment sheet. Detailed grading criteria are conveyed at the start of each semester.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** UnivProf. Dr. rer. nat. Ulrich Sax Prof. Dr. Dagmar Krefting
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2

Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1355: IT-Management Techniques in Health Care**	10 C 8 WLH

Learning outcome, core skills: The students… • describe methods as well as technical, organizational and human aspects of knowledge management. • explain the importance of knowledge management for productivity and competition in life sciences and health care. • discuss the fundamentals of business administration with respect to the employment of IT in health care. • explain the potentials of usage and development of IT in health care. • build on their acquired competencies to analyze practical challenges of project management in a specialized area or use case. They assess the impact of said aspects on the potential success of projects.	**Workload:** Attendance time: 112 h Self-study time: 188 h

Course: IT-Management-Techniques in Health Care (Block course,Lecture,Seminar) *Contents*: • Economic Aspects of IT-Investments in Health Care: Fundamentals of Business Administration, Sustainability, TCO, ROI, Clinical Pathways, outpatient management, and health care IT. • Knowledge Management: History of knowledge management, forms and dimensions of knowledge, SECI- and circular models, tools for knowledge management, personal knowledge management, knowledge management and content management, knowledge management in medical informatics and from a physician’s viewpoint, impact of knowledge management on health care. • Special Aspects of Project Management in Health Care: Models, tools, and phases of project management, risks, challenges, stakeholders, communication, and quality management in project management. The contents are continuously adjusted to current developments of the field. Sources are recommended at the beginning of each term.	8 WLH
Examination: Written exam (Klausur), online-exam respectively (90 minutes) or oral exam (approx. 20 minutes), seminar paper (max. 15 pages), seminar presentation (approx. 30 minutes). **Examination prerequisites:** none	10 C

Examination requirements: The students demonstrate their command and grasp of fundamental terms and methods in IT-management. They can describe and explain the choice, use, and assessment of management methods. They discuss said methods and their employment in the context of exemplary use cases. Requirements for seminar papers and presentations are specified in assignment sheets. Detailed grading criteria are conveyed at the start of each semester. In written evaluations and online tests, mostly open questions will	

be posed that are to be answered in free text. Other question types, such as Multiple Choice, are possible to a lesser extent.	

Admission requirements: none	**Recommended previous knowledge:** Prior successful attendance of module B.Inf.1304 is recommended, or an equivalent of prerequisite knowledge in fundamentals of project management.
Language: English, German	**Person responsible for module:** UnivProf. Dr. rer. nat. Ulrich Sax Prof. Dr. Dagmar Krefting
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1356: Infrastructures for Clinical Research**	9 C 8 WLH

Learning outcome, core skills: Die Studierenden kennen die Grundlagen der Bioinformatik und Biostatistik. Sie kennen die wichtigsten Methoden und Werkzeuge in der Analyse von Hochdurchsatzdaten. Die Studierenden lernen die Grundlagen und Prinzipien der Planung, Durchführung und Analyse klinischer Studien kennen. Sie sind vertraut mit Planungssoftware für klinische Studien. Sie lernen, wie Metaanalysen mit geeigneter Software auszuführen sind. Die Studierenden kennen die Ziele, Methoden, Anwendungen und Entwicklungen einer personalisierten Medizin. Sie können diese in Bezug auf exemplarische Felder in Forschung und Versorgung erläutern. Die Studierenden lernen die interdisziplinäre Bedeutung der Bioinformatik, Biostatistik und Medizininformatik kennen und können diese im Kontext von Forschung und Versorgung darstellen.	**Workload:** Attendance time: 112 h Self-study time: 158 h

Course: Personalisierte Medizin (Lecture) *Contents*: Die Studierenden kennen die Ziele, Methoden, Anwendungen und Entwicklungen einer personalisierten Medizin. Sie können diese in Bezug auf exemplarische Felder in Forschung und Versorgung erläutern.	2 WLH
Course: Grundlagen der Biostatistik und Bioinformatik (Block course) *Contents*: Die Studierenden kennen die Grundlagen der Bioinformatik und Biostatistik. Sie kennen die wichtigsten Methoden und Werkzeuge in der Analyse von Hochdurchsatzdaten.	2 WLH
Course: Klinische Studien (Lecture,Exercise) *Contents*: Die Studierenden lernen die Grundlagen und Prinzipien der Planung, Durchführung und Analyse klinischer Studien kennen. Sie sind vertraut mit Planungssoftware für klinische Studien. Sie lernen, wie Metaanalysen mit geeigneter Software auszuführen sind.	4 WLH
Examination: 2 Klausuren bzw. E-Prüfungen (je 90 Minuten, je 50% der Modulnote) oder mündliche Prüfung (ca. 45 Minuten)	9 C

Examination requirements: Die Studierenden zeigen ihr Verständnis der Planung, Durchführung und Analyse klinischer Studien. Sie können die Vor- und Nachteile verschiedener Studiendesigns in einem gegebenen Kontext kritisch bewerten. Sie können eine Studienplanung mit geeigneter Software durchführen. Sie beherrschen die Metaanalyse einer randomisierten, kontrollierten Studie in Bezug auf deren Biases und Heterogenität und können die Ergebnisse interpretieren. Die Studierenden beschreiben die Ziele, Methoden, Anwendungen und Entwicklungen einer personalisierten Medizin. Sie können die interdisziplinäre Bedeutung des Themas darstellen und Anwendungsfelder der personalisierten Medizin in Forschung und Versorgung exemplarisch erläutern. Die Studierenden können die Potentiale und	

Herausforderungen des behandelten interdisziplinären Forschungsgebietes kritisch bewerten.	

Admission requirements: none	**Recommended previous knowledge:** Der vorherige Besuch des Moduls B.Inf.1351: Grundlagen der Biomedizin oder einer vergleichbaren Lehrveranstaltung wird dringend empfohlen. Der vorherige Besuch des Moduls B.Mat.0804: Diskrete Stochastik bzw. des Moduls B.Mat.1420: Grundlagen der Stochastik oder einer vergleichbaren Lehrveranstaltung wird dringend empfohlen.
Language: English, German	**Person responsible for module:** Prof. Dr. Tim Friede Prof. Dr. Ulrich Sax, Prof. Dr. Dagmar Krefting
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 25	

Georg-August-Universität Göttingen Module M.Inf.1501: Data Mining in Bioinformatics	6 C 4 WLH
Learning outcome, core skills: After successful completion of the module, students • know the principles, paradigms, and challenges of data mining methods for multivariate statistical analysis in computational biology and bioinformatics • understand and recognize properties and potential problems of high-dimensional data spaces • know and implement methods for dimensionality reduction using concepts from statistics and linear algebra • can evaluate linear and non-linear dimensionality reduction with the ability to critically assess and interpret the results • apply vector and matrix computation techniques for the analysis of multidimensional data	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Data Mining in Bioinformatics (Lecture,Exercise)	2 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** Participation in the exercises and successful completion of three exercise sheets. **Examination requirements:** Students should be able to understand, specify, use, implement and evaluate methods for analysis of high-dimensional biological data and critically assess the limits of their applicability.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of molecular biology, linear algebra and statistics, scientific programming in Python.
Language: English	**Person responsible for module:** Peter Meinicke
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.Inf.1505: Models and Algorithms in Bioinformatics	6 C 4 WLH
Learning outcome, core skills: After successful completion of the module, students • know the principles, paradigms, and challenges of models and algorithms for statistical data analysis in bioinformatics • understand and apply principles of scientific programming using concepts from statistics and linear algebra • can implement, train and evaluate probabilistic models for sequence analysis • know and apply algorithms for cluster analysis and visualization of multidimensional data • understand, recognize and solve numerical problems in the implementation of algorithms for model training and inference	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Models and Algorithms in Bioinformatics (Lecture,Exercise)	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination prerequisites:** Participation in the exercises and successful completion of three exercise sheets. **Examination requirements:** Students should be able to understand, specify, use, implement and evaluate models and algorithms for biological data analysis and critically assess the limits of their applicability.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of molecular biology, algorithms and statistics; programming in Python.
Language: English	**Person responsible for module:** Peter Meinicke
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1800: Practical Course Advanced Networking**	6 C 4 WLH

Learning outcome, core skills: The students • know the principles of one existing or emerging advanced networking technology • are able to implement these technologies in useful mobile applications • ideally have advanced in their researching ability • have improved their programming skills • have improved their oral presentation skills • have improved their scientific writing skills • have improved their teamwork	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical Course Advanced Networking Lab (Practical course)	4 WLH
Examination: Präsentation (ca. 30 min.) und Hausarbeit (max. 15 Seiten) **Examination requirements:** advanced networking technology, mobile applications, programming, oral presentation, scientific writing, teamwork	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in computer networks; basics of algorithms and data structures; basic programming skills
Language: English	**Person responsible for module:** Prof. Dr. Xiaoming Fu
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.Inf.1802: Practical Course on XML**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Die Studierenden verfügen über vertiefte Kenntnisse und Erfahrungen mit Konzepten und Sprachen aus dem Bereich XML. Sie wissen, welche Sprachen und Werkzeuge ggf. bei Problemstellungen anwendbar sind und können Projekte in diesem Bereich umsetzen. Sie sind mit der Grundidee der W3C-Standards vertraut und können sich selber benötigte Informationen im Web zusammensuchen. Vermittlung von praktischen Fähigkeiten aus dem Bereich XML, XPath, XQuery, XSLT, Web Services und weiteren Sprachen und Werkzeugen.	Attendance time: 56 h Self-study time: 124 h

Course: Praktikum XML (Internship)	
Examination: Praktische Prüfung (ca. 4 Übungs- und Programmieraufgaben) und mündliche Prüfung (ca. 20 Min.) **Examination requirements:** Vertiefte Kenntnisse und Erfahrungen in Sprachen aus dem Bereich XML. Kenntnisse darüber, welche Sprachen und Werkzeuge ggf. bei Problemstellungen anwendbar sind; Fähigkeit zum Umsetzen von Projekten in diesem Bereich; Kenntnisse der W3C-Standards.	6 C

Admission requirements: none	**Recommended previous knowledge:** M.Inf.1141
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Additional notes and regulations:
Das Modul wird auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren.

Georg-August-Universität Göttingen Module M.Inf.1803: Practical Course in Software Engineering	6 C 4 WLH
Learning outcome, core skills: The students • learn to become acquainted with up-to-date methods and software tools • learn to select methods and tools for given practical problems in software engineering • learn to apply methods and tools for given practical problems in software engineering • learn to assess methods and tools for given practical problems in software engineering by performing experiments	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical Course on Parallel Computing (Practical course) *Contents*: This practical course includes practical exercises on: Distributed memory architectures • Cluster computing with Torque PBS • Grid Computing with Globus Toolkit • Message Passing Interface (MPI) • MapReduce Shared Memory architectures • OpenMP • Pthreads Heterogeneous parallelism (GPU, CUDA, etc.) • CUDA	4 WLH
Examination: Practical exercises in small groups (approx. 4-12 exercises) and oral examinations for the exercises (approx. 15 minutes each), not graded **Examination prerequisites:** Attendance in 90% of the classes **Examination requirements:** The students shall show that • they are able to become acquainted with up-to-date methods and software tools • they are able to select methods and tools for given practical problems in software engineering • they are able to apply methods and tools for given practical problems in software engineering • they are able to assess methods and tools for given practical problems by performing experiments	6 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.

Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1804: Practical Course in Software Quality Assurance**	6 C 4 WLH

Learning outcome, core skills: The students • learn to become acquainted with up-to-date methods and software tools for software quality assurance • learn to select methods and tools for given practical problems in software quality assurance • learn to apply methods and tools for given practical problems in software quality assurance • learn to assess methods and tools for given practical problems in software quality assurance by performing experiments	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical Course on Software Evolution: Origin Analysis (Practical course) *Contents*: Changes in the usage requirements and the technological landscape, among others, drive a continuous necessity for changes in software systems in order to sustain their existence and operability in changing environments. Origin analysis aims to determine the location of points of interest through time. For example, origin analysis aids on the one hand projecting the location of past changes into the current state of the code base, and on the other hand determining previous locations and origins of detected issues. In this course, we will build and extend an existing infrastructure for performing origin analysis and use it to perform studies on large software systems, such as Google Chrome, Mozilla Firefox, Amarok, and others.	4 WLH
Examination: Practical exercises in small groups (approx. 4-6 exercises) and oral examinations for the exercises (approx. 15 minutes each), not graded **Examination prerequisites:** Attendance in 90% of the classes **Examination requirements:** The students shall show that • they are able to become acquainted with with up-to-date methods and software tools for software quality assurance • they are able to select methods and tools for given practical problems in software quality assurance • they are able to to apply methods and tools for given practical problems in software quality assurance • they are able to to assess methods and tools for given practical problems in software quality assurance by performing experiments	6 C

Admission requirements: none	**Recommended previous knowledge:** Foundations of software engineering.
Language: English	**Person responsible for module:** Prof. Dr. Jens Grabowski

Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 12	

Georg-August-Universität Göttingen Module M.Inf.1806: Seminar and Project Databases	6 C 2 WLH
Learning outcome, core skills: Die Studierenden können sich in ein Spezialgebiet moderner Datenbank- und Informationssysteme einarbeiten, Quellen und Dokumentationen im Web suchen und in Beziehung zu dem behandelten Gebiet setzen, Werkzeuge evaluieren sowie in einer Diskussion darstellen und bewerten.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Projektseminar Datenbanken und Informationssysteme	
Examination: Vortrag (ca. 60 Min.) mit schriftlicher Ausarbeitung (max. 25 Seiten) **Examination requirements:** Nachweis über den Erwerb vertiefter Kenntnisse und Fähigkeiten in einem Spezialgebiet moderner Datenbank- und Informationssysteme. Insbesondere zur Darstellung und Bewertung von Quellen, Dokumentationen und Werkzeugen. Der Vortrag umfasst eine Präsentation einer Fallstudie.	6 C

Admission requirements: Datenbanken	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 16	

Georg-August-Universität Göttingen Module M.Inf.1807: Extended Seminar and Project Databases	12 C 4 WLH
Learning outcome, core skills: Die Studierenden können sich in ein komplexes Spezialgebiet moderner Datenbank- und Informationssysteme einarbeiten, Quellen und Dokumentationen im Web suchen und in Beziehung zu dem behandelten Gebiet setzen, Werkzeuge evaluieren sowie in einer Diskussion darstellen und bewerten.	**Workload:** Attendance time: 56 h Self-study time: 304 h

Course: Großes Projektseminar Datenbanken und Informationssysteme	
Examination: Vortrag (ca. 60 Min.) mit schriftlicher Ausarbeitung (max. 25 Seiten) **Examination requirements:** Nachweis über den Erwerb vertiefter und spezialisierter Kenntnisse und Fähigkeiten in einem Spezialgebiet moderner Datenbank- und Informationssysteme. Insbesondere zur Darstellung und Bewertung von Quellen, Dokumentationen und Werkzeugen. Im Rahmen des Vortrag ist ein Fallstudie zu präsentieren.	12 C

Admission requirements: Datenbanken	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.1808: Practical Course on Parallel Computing**	6 C 4 WLH
Learning outcome, core skills: Successfully completing the module, students are able to: • practically work with a cluster of computers (e.g., using a batch system) • practically utilize grid computing infrastructures and manage their jobs (e.g., Globus toolkit) • apply distributed memory architectures for parallelism through practical problem solving (MPI programming) • utilize shared memory architectures for parallelism (e.g., OpenMP and pthreads) • utilize heterogenous parallelism (e.g., OpenCL, CUDA and general GPU programming concepts) • utilize their previous knowledge in data structures and algorithms to solve problems using their devised (or enhanced) parallel algorithms	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Practical Course on Parallel Computing (Practical course) *Contents*: As a practical course, the focus will be on the hands-on session and problem solving. Students will get a brief introduction to the topic and then will use the laboratory equipment to solve assignments of each section of the course.	4 WLH
Examination: Oral examination (approx. 20 minutes), not graded **Examination requirements:** • understand how to manage computing jobs using a cluster of computers or using grid computing facilities • understand the configuration of a PBS cluster through practical assignments • practically use LRM clusters and POVRay examples • understand cluster computing related topics (error handling, performance management, security) in more depth and using hands-on experience and practically using Globus toolkit • design and implement solutions for parallel programs using distributed memory architectures (using MPI) • design and implement solutions for parallel programs using shared memory parallelism (using OpenMP, pthreads) • practically work with MapReduce programming framework and problem solving using MapReduce • practically work with heterogenous parallelism environment (GPGPU, OpenCL, CUDA, etc.)	6 C

Admission requirements: • Data structures and algorithms • Programming in C(/C++)	**Recommended previous knowledge:** • Parallel Computing • Computer architecture • Basic knowledge of computer networks • Basic know-how of computing clusters

Language: English	**Person responsible for module:** Prof. Dr. Ramin Yahyapour
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.1809: Advanced Research Training - Key Competency**	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von berufsspezifischen Schlüsselkompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements im Rahmen eines forschungsbezogenen Projekts.	**Workload:** Attendance time: 7 h Self-study time: 173 h

Course: Forschungsbezogene Projektarbeit	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Berufsspezifische Schlüsselkompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements im Rahmen eines forschungsbezogenen Projekts.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen Module M.Inf.1810: Extended Advanced Research Training - Key Competency	6 C 0,5 WLH
Learning outcome, core skills: Erwerb von erweiterten berufsspezifischen Schlüsselkompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements im Rahmen eines forschungsbezogenen Projekts.	**Workload:** Attendance time: 7 h Self-study time: 173 h
Course: Forschungsbezogene Projektarbeit	0,5 WLH
Examination: Term Paper (max. 12 pages), not graded **Examination requirements:** Erweiterte berufsspezifische Schlüsselkompetenzen im Bereich der projektbezogenen und forschungsorientierten Teamarbeit und des Projektmanagements im Rahmen eines forschungsbezogenen Projekts.	

Admission requirements: M.Inf.1809	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Jens Grabowski
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module M.Inf.1822: Practical Course in Data Fusion**	6 C 4 WLH

Learning outcome, core skills: After successful completion of the module, students are able to • become acquainted with software tools and frameworks for data fusion • work with modern sensors • collect, process and analyze (sensor) data • implement data fusion algorithms • experimentally evaluate and compare data fusion algorithms • apply data fusion algorithms in the context of localization, navigation, tracking, sensor networks and robotics	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical Course in Data Fusion (Practical course)	4 WLH
Examination: Practical project in small groups, oral presentation of results (approx. 15 minutes each), scientific report (max. 6 pages each), not graded **Examination prerequisites:** All practical exercises must be passed with at least 40% of the achievable points. If there is a total of five or fewer exercises, this condition must be fulfilled for all but one exercise; in all other cases, this condition must be fulfilled for all but two exercises. **Examination requirements:** Implementation and evaluation of data fusion algorithms, oral presentation, scientific writing and teamwork.	6 C

Admission requirements: none	**Recommended previous knowledge:** M.Inf.1185 or M.Inf.1188
Language: English	**Person responsible for module:** Prof. Dr. Marcus Baum
Course frequency: non-periodic	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.1824: Practical Course on Computer Security and Privacy**	6 C 4 WLH
Learning outcome, core skills: On completion of the module, students should be able to: • Identify and understand existing solutions in the area to be investigated, • Design and implement a new approach to improve the investigated existing solutions, • Present their chosen approach in a written report justifying their design decisions and implementation choices as well as clearly document their implementation, • Give a presentation about their implemented approach.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Lab Computer Security and Privacy (Practical course)	4 WLH
Examination: Presentation (approx. 30 minutes) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research and analyse the design space of a chosen topic, • They are able to make design decisions based on this analysis, • They are able to design and implement an approach improving the current state-of-the-art, • They are able to write a structured scientific report on their design decisions and the resulting solution by respecting the rules of good scientific practice, • They are able to present and to critically discuss their implemented solution in a presentation. The examination includes a **project work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	6 C

Admission requirements: none	**Recommended previous knowledge:** Backgrounds in Computer Security and Privacy
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.1827: Practical Course on Linked Data and Semantic Web**	6 C 4 WLH
Learning outcome, core skills: Die Studierenden verfügen über vertiefte Kenntnisse und Erfahrungen mit Konzepten und Sprachen aus dem Bereich RDF, OWL und Linked Data. Sie wissen, welche Sprachen und Werkzeuge ggf. bei Problemstellungen anwendbar sind und können Projekte in diesem Bereich umsetzen. Vermittlung von praktischen Fähigkeiten aus dem Bereich RDF, OWL, LOD, SPARQL, Web Services und weiteren Sprachen und Werkzeugen.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Praktikum Linked Data und Semantic Web (Internship)	
Examination: Praktische Prüfung (ca. 4 Übungs- und Programmieraufgaben) und mündliche Prüfung (ca. 20 Min.) **Examination requirements:** Vertiefte Kenntnisse und Erfahrungen in Sprachen aus dem Bereich des Semantic Web. Kenntnisse darüber, welche Sprachen und Werkzeuge ggf. bei Problemstellungen anwendbar sind; Fähigkeit zum Umsetzen von Projekten in diesem Bereich.	6 C

Admission requirements: none	**Recommended previous knowledge:** M.Inf.1142
Language: English, German	**Person responsible for module:** Prof. Dr. Wolfgang May
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Additional notes and regulations:
Das Modul wird auf English angeboten. Es besteht die Möglichkeit, die Prüfungsleistung auf Deutsch zu absolvieren.

Georg-August-Universität Göttingen **Module M.Inf.1828: Lab Usable Security and Privacy**	6 C 4 WLH

Learning outcome, core skills: On completion of the module, students should be able to: • Identify, understand, and analyze usability issues in the field of security and privacy, • Design, plan, and conduct a user study to explore a selected issue by following the data protection regulations and taking into account ethical aspects, • Document, analyze, and critically discuss the obtained results, • Propose future improvements or directions based on the obtained results, • Present the study design, methodology, results, and consequences in a written report, • Give a presentation about their study and the associated findings.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Lab Usable Security and Privacy (Practical course)	4 WLH
Examination: Presentation (approx. 20 min.) und written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research and analyse the issues related to the usability of security and privacy solutions, • They are able plan and conduct a user study from its design to the processing and presentation of the results, • They are able to write a structured scientific report on their study including its design and the obtained results by respecting the rules of good scientific practice and data protection regulations, • They are able to present both their study and the associated results as well as critically discuss them in a presentation. The examination includes a **project work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of privacy and usability obtained, e.g., in the recommended lecture “Usable Security and Privacy”
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students:	

20	

Georg-August-Universität Göttingen **Module M.Inf.1829: Practical course in High-Performance Computing**	6 C 4 WLH

Learning outcome, core skills: The students will be able to • Construct parallel processing schemes from sequential code using MPI and OpenMP • Justify performance expectations for code snippets • Sketch a typical cluster system and the execution of an application • Characterize the scalability of a parallel application based on observed performance numbers • Analyze the performance of a parallel application using performance analysis tools • Describe the development and executions models of MPI and OpenMP • Construct small parallel applications that demonstrate features of parallel applications • Demonstrate the usage of an HPC system to load existing software packages and to execute parallel applications and workflows • Demonstrate the application of software engineering concepts	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical course in High-Performance Computing (PCHPC) (Block course) *Contents*: High-Performance Computing is the field that allows us to utilize the combined resources of 1000's of computers. Applications can utilize this compute power to solve research questions at the frontier of science but also solve important questions for our daily lives such as a weather forecast. *Teaching und learning methods:* This practical course is comprised of two parts: firstly, a crash course on the basics of High-Performance Computing is delivered during a one-week tutorial. In a hands-on experience, it covers the theoretical knowledge regarding parallel computing, high-performance computing, supercomputers, and the development and performance analysis of parallel applications. Practical demonstrations encourage you to utilize the GWDG cluster system to execute existing parallel applications, to start developing your own parallel application using MPI and OpenMP, and to analyze the performance of these applications to ensure they run efficiently. During this week, we will use group works and small exercises to foster the training. We will start forming a learning community that will blend into the second part of the course. Equipped with this experience, in the second part, you will team up in groups of two and parallelize a non-trivial problem of your choice. Firstly, you will decide upon a problem you like to solve, then you create a sequential solution to this problem, and lastly, you apply the experience of the block course to parallelize and analyze the scalability of the application.	4 WLH

The results will be shared with the peers in a presentation at the end of the term, and documented in a report - these components will be assessed and marked. *Remark:* If you like to prepare for the topic early, we can hand out a topic during the lecture free time before the term - just contact us.	
Examination: Presentation (15 min) and report (max 15 pages) for student project **Examination prerequisites:** Participation in the block seminar **Examination requirements:** Report (70%) and final presentation (30%)	6 C

Admission requirements: none	**Recommended previous knowledge:** • Programming experience in C++, C or Python • Parallel programming concepts • Linux
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen **Module M.Inf.1830: FPV Quadcopter - Basics**	6 C 4 WLH
Learning outcome, core skills: Nach Abschluss des Praktikums sollen die Teilnehmer*innen sind in der Lage sein, Quadcopter zu: • Entwerfen • Programmieren • Konstruieren • Tunen • Fliegen	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: FPV Quadcopter - Grundlagen (Internship) *Contents*: • Funktionsweise von Quadcoptern (Theorie und Praxis) • Konstruktion und Realisierung • Entwurf (auch mittels CAD Software) • Fertigung des Entwurfs (inkl. Löten, 3D-Druck etc.) • Programmierung des FC (flight controller) • PID Tuning und Ähnliches • Steuerung im ANGLE & ACRO Mode • Fliegen am Simulator und in der Realität auf einem anspruchsvollen Track Weitere Themen werden nach Bedarf der jeweiligen Quadcopterprojekte behandelt, etwa autonomes Fliegen, KI-gestützte Bildverarbeitung, long-range Flugtechnik, Löttechnik, spezielle 3D-Druck Techniken, Entwicklung Autopilot, betaflight Firmware etc. Weitere Details sowie ein Kursvideo finden Sie auf der Webseite zum Praktikum: www.gipplab.org/teaching.	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination requirements:** Die folgenden Themen werden in einer mündlichen Prüfung abgeprüft: • Funktionsweise von Quadcoptern (Theorie und Praxis) • Konstruktion und Realisierung • Entwurf (auch mittels CAD Software) • Fertigung des Entwurfs (inkl. Löten, 3D-Druck etc.) • Programmierung des FC (flight controller) • PID Tuning und Ähnliches • Steuerung im ANGLE & ACRO Mode • Fliegen am Simulator und in der Realität auf einem anspruchsvollen Track	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Béla Gipp

Course frequency: each winter semester	Duration: 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 8	

Additional notes and regulations:

Teilnehmer*innen können neben vorgegebenen Projekten auch ihre eigenen Ideen mit fachkundiger Unterstützung umsetzen. Die benötigten Bauteile, Geräte und Materialien werden vom Lehrstuhl bzw. der Universität gestellt.

Für Absolvent*innen dieses Grundlagenkurses und Teilnehmer*innen mit anderweitig erworbenen gleichwertigen Kenntnissen bietet der Lehrstuhl jeweils im Sommersemester auch einen Fortgeschrittenenkurs (M.Inf.1833) an.

Georg-August-Universität Göttingen **Module M.Inf.1831: High-Performance Computing System Administration**	6 C 4 WLH

Learning outcome, core skills: The students will be able to • Discuss theoretic facts related to networking, compute and storage ressources • Integrate cluster hardware consisting of multiple compute and storage nodes into a “supercomputer“ • Configure system services that allow the efficient management of the cluster hardware and software including network services such as DHCP, DNS, NFS, IPMI, SSHD • Install software and provide it to multiple users • Compile end-user applications and execute it on multiple nodes • Analyze system and application performance using benchmarks and tools • Formulate security policies and good practice for administrators • Apply tools for hardening the system such as firewalls and intrusion detection • Describe and document the system configuration	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Practical Course on HPC System Administration (HPCSA) (Practical course) *Contents*: The administration of computer systems enables us to manage large-scale clusters and distributed systems efficiently. It enables for various roles in industry and data centers but also makes you more proficient in managing your own computer system and hobby projects. *Teaching und learning methods:* Students will learn in a one week block course the basics of system administration and create a small cluster system using provided hardware. They will work on individual projects while being encouraged to collaborate with fellow students to setup, evaluate or expand services or tools and present their results. *Remark:* If you like to prepare for the topic early, we can hand out a topic during the lecture free time before the term - just contact us.	4 WLH
Examination: written report (max. 15 pages; without appendix) **Examination requirements:** Report (100%) The examination can be taken individually or as group work (max. 3 persons).	6 C

Admission requirements: none	**Recommended previous knowledge:** • Linux Basics (you have used Linux and the Bash shell).

	We will provide a short crash course at the beginning of the course and link supplementary training material.
Language: English, German	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen **Module M.Inf.1832: Lab Privacy and Security in Robotics and AI Systems**	6 C 4 WLH

Learning outcome, core skills: On completion of the module, students should be able to: • Identify and understand existing privacy-preserving or security solutions in the area of robotics and/or artificial intelligence. • Design and implement a new approach to improve the investigated existing solutions, • Present their chosen approach in a written report justifying their design decisions and implementation choices as well as clearly document their implementation, • Give a presentation about their implemented approach.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Lab Privacy and Security in Robotics and AI Systems (Practical course)	4 WLH
Examination: Presentation (approx. 30 min.) and written report (max. 8 pages) **Examination requirements:** The students shall show that: • They are able to conduct literature research and analyze the design space of their chosen topic, • They are able to make design decisions based on this analysis, • They are able to design and implement an approach improving the current state-of-the-art, • They are able to write a structured scientific report including their design decisions and the resulting solution by respecting the rules of good scientific practice, • They are able to present and critically discuss their implemented solution in a presentation, while respecting the given timeframe. The examination includes a **project work** over the semester, **presentation** (approx. 30 min.), and **written report** (max. 8 pages in IEEE double-column template). The exam can be taken **individually or as group work**.	6 C

Admission requirements: none	**Recommended previous knowledge:** Backgrounds in security and privacy obtained in one or several of our offered lectures.
Language: English	**Person responsible for module:** Prof. Dr. Delphine Reinhardt
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.1833: FPV Quadcopter - Advanced**	6 C 4 WLH

Learning outcome, core skills: Nach Abschluss des Praktikums sollen die Teilnehmer sind in der Lage sein, Quadcopter auf fortgeschrittenem Niveau zu: • Entwerfen (per CAD) • Programmieren • Konstruieren • Tunen • Fliegen	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: FPV Quadcopter - Fortgeschrittenenkurs (Internship) *Contents*: Der Fokus des Fortgeschrittenenkurses liegt auf der Umsetzung selbst gewählter Projekte der Teilnehmer mit fachkundiger Unterstützung der Dozenten in den Themenbereichen: • Funktionsweise von Quadcoptern (Theorie und Praxis) • Konstruktion und Realisierung • Entwurf (auch mittels CAD-Software) • Fertigung des Entwurfs (inkl. Löten, 3D-Druck etc.) • Programmierung des FC (flight controller) • PID-Tuning und Ähnliches • Steuerung im ANGLE & ACRO Mode • Fliegen am Simulator und in der Realität auf einem anspruchsvollen Track Weitere Themen werden nach Bedarf der jeweiligen Quadcopterprojekte behandelt, etwa autonomes Fliegen, KI-gestützte Bildverarbeitung, long-range Flugtechnik, Löttechnik, spezielle 3D-Druck Techniken, Entwicklung Autopilot, betaflight Firmware etc. Weitere Details sowie ein Kursvideo finden Sie auf der Webseite zum Kurs: www.gipplab.org/teaching	4 WLH
Examination: Oral examination (approx. 20 minutes) **Examination requirements:** Die folgenden Themen werden in einer mündlichen Prüfung abgeprüft: • Funktionsweise von Quadcoptern (Theorie und Praxis) • Konstruktion und Realisierung • Entwurf (auch mittels CAD-Software) • Fertigung des Entwurfs (inkl. Löten, 3D-Druck etc.) • Programmierung des FC (flight controller) • PID-Tuning und Ähnliches • Steuerung im ANGLE & ACRO Mode • Fliegen am Simulator und in der Realität auf einem anspruchsvollen Track	6 C

Admission requirements:	**Recommended previous knowledge:**

Erfolgreiche Teilnahme am Grundlagenkurs (M.Inf.1830) im Wintersemester oder anderweitig erworbene gleichwertige Kenntnisse, welche in einem Fachgespräch mit Prof. Gipp nachzuweisen sind.	none
Language: German	**Person responsible for module:** Prof. Dr. Béla Gipp
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 8	

Additional notes and regulations:

Teilnehmer*innen können neben vorgegebenen Projekten auch ihre eigenen Ideen mit fachkundiger Unterstützung umsetzen. Die benötigten Bauteile, Geräte und Materialien werden vom Lehrstuhl bzw. der Universität gestellt.

Als Vorbereitung auf diesen Fortgeschrittenenkurs bietet der Lehrstuhl jeweils im Wintersemester einen Grundlagenkurs (M.Inf.1830) an.

Georg-August-Universität Göttingen **Module M.Inf.1834: Extension High-Performance Computing (EHPC)**	3 C 0,5 WLH

Learning outcome, core skills: Gain additional understanding of high-performance computing systems through an extended project work focused on developing and/or evaluating software for HPC systems. This module serves as an extension of our courses, in particular the Practical Course on High-Performance Computing (PCHPC) and Practical Course on HPC System Administration (HPCSA) such that students who want to spend extra effort on their project work for one of these courses can receive additional credits. In order to receive the extra credits, register to this module examination in FlexNow in addition to the regular module for the course and discuss this with the module organizer.	**Workload:** Attendance time: 7 h Self-study time: 83 h

Course: Practical Course on HPC (PCHPC) (Practical course) see M.Inf.1829	0,5 WLH
Course: High-Performance Computing System Administration (HPCSA) (Practical course) *Contents*: see M.Inf.1831	0,5 WLH
Examination: Additional 5 pages to the report of the extended module **Examination prerequisites:** Participation in the extended module **Examination requirements:** Similar to the extended module	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 40	

Georg-August-Universität Göttingen Module M.Inf.1835: Practical Course: Swarm – Sensor Lab	6 C 4 WLH
Learning outcome, core skills: Swarm intelligence is a field of AI focused on collective behavior in decentralized systems. Inspired by nature (including ant colonies and flocks of birds), it enables simple agents to work together to solve complex problems. When combined with sensor data, these algorithms can enable robust solutions to real-world problems in diverse fields. On completion of the module, students should be able to: • Understand the main principles of swarm intelligence (SI) • Learning swarm algorithms to create adaptive and resilient behaviors in multi-agent systems • Develop and test algorithms in simulation environments • Analyse and evaluate the performance of swarm intelligence models • Apply the swarm intelligence to address real-world problems	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Practical Course: Swarm – Sensor Lab (Practical course)	4 WLH
Examination: Written report (max. 15 pages) and presentation (approx. 25 min.) **Examination requirements:** Both theoretical and practical aspects of swarm intelligence. Theoretical aspects include: • Core concepts of swarm intelligence, fundamental swarm algorithms, the role of exploration and exploitation parameters, performance metrics and statistical analysis. Practical aspects include: • Coding of the algorithms, experimenting with parameters, modifying algorithms, benchmarking. • Design, planning, simulation/implementation, and testing of individual application (final project)	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in programming
Language: English	**Person responsible for module:** Dr. Parisa Memarmoshrefi
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 12	

Additional notes and regulations:
The module M.Inf.1835 may not be taken if the module M.Inf.1820 has already been completed.

Georg-August-Universität Göttingen **Module M.Inf.1905: Advanced Topics in Language and Text Processing**	3 C 2 WLH
Learning outcome, core skills: A successful completion of the module enables the participants to: • describe the problem area that the course focusses on • name, illustrate and analyse the algorithms covered • evaluate and compare different analysis methods • select suitable algorithms for specific application scenarios	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Advanced Topics in Language and Text Processing (Seminar) *Contents*: This course covers advanced topics in computational linguistics and natural language processing, for example processing creative language, processing non-standard language varieties, language processing for low-resource languages, argumentation mining, ethics and algorithmic bias, obtaining and incorporating world knowledge, multi-modal language processing, opinion mining, text generation etc. The students will learn about different sub-tasks for the given topic and become acquainted with state-of-the-art algorithms for tackling them. They will learn to understand how these algorithms work and will be able to critically assess them (i.e., what are the underlying assumptions an algorithm makes, in which circumstances they perform well or not so well, and how do they compare to other approaches). Students will also be enabled to understand and critically evaluate research papers in the field.	2 WLH
Examination: Presentation (max. 20 minutes) and term paper (max. 10 pages) **Examination prerequisites:** Participation in the exercise **Examination requirements:** The students can describe the problem area covered in the course, are able to illustrate and reflect on the current research literature and evaluate advantages and disadvantages for specific application scenarios of the methods covered in the course. **In case of groupwork**, the exam is taken as **collective examination**: Presentation (max. 20 minutes per examinee) and term paper (max. 10 pages per examinee).	3 C

Admission requirements:	**Recommended previous knowledge:** Knowledge of basic language analysis tasks (tokenisation, part-of-speech tagging, syntactic parsing) and basic computational methods for performing them. Basic knowledge of probability theory (how to compute probabilities, conditional and joint probability, statistical in-/dependence, Bayes' theorem). Basic knowledge of linguistics (parts-of-speech, syntactic structure, word senses). The recommended knowledge can be obtained by taking an introductory course in computational linguistics/

	natural language processing or working through a relevant reference book.
Language: English, German	**Person responsible for module:** Prof. Dr. Caroline Sporleder
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.1906: Computational Semantics and Discourse Processing**	6 C 4 WLH

Learning outcome, core skills: A successful completion of the module enables the participants to: • describe the problem area • name, describe and analyse the algorithms covered in the course • evaluate and compare different methods • select suitable algorithms for specific application scenarios	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Computational Semantics and Discourse Processing (Exercise,Seminar) *Contents*: This course covers selected topics in computational semantics and discourse processing, for example lexical semantics and word sense disambiguation, distributional semantics, compositionality and sentence semantics, semantic representations, semantic parsing, co-reference resolution, generating referring expressions, named entity recognition and disambiguation, modelling discourse coherence, temporal analysis, sentiment and emotion analysis, detecting discourse relations and discourse parsing, text generation etc. Students will learn basic semantic and pragmatic constructs and the challenges they pose to language processing. They will become aquainted with different approaches for analysing semantic and discourse phenomena and will be able to critically assess these.	4 WLH
Examination: Presentation (max. 30 minutes) and term paper (max. 12 pages) **Examination prerequisites:** Participation in the exercise **Examination requirements:** The students demonstrate knowledge of challenges and processing methods in the area of computational semantics and discourse processing and are able to explain and evaluate methods and theories in this area. They are able to: • describe the problem area • name, explain and analyse the algorithms covered in the course • evaluate and compare different methods • select suitable algorithms for specific application scenarios	6 C

Admission requirements: none	**Recommended previous knowledge:** Knowledge of basic language analysis tasks (tokenisation, part-of-speech tagging, syntactic parsing) and basic computational methods for performing them. The recommended knowledge can be obtained by taking an introductory course in computational linguistics/natural language processing or working through a relevant reference book.

Language: English, German	**Person responsible for module:** Prof. Dr. Caroline Sporleder
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module M.Inf.2102: Advanced Statistical Learning for Data Science**	6 C 4 WLH

Learning outcome, core skills: Students will • learn concepts of advanced statistical methods and their scope of applications. These methods comprise the EM algorithm, Markov models, Hidden Markov Models, Markov chain Monte Carlo. • gain a solid understanding of ensemble learning algorithms. In particular, we will address additive tree approaches like boosting and Random Forest algorithms, as well as methods for ensemble optimization • learn strategies for model assessment and selection such as nested cross-validation, Monte Carlo validation, or permutation tests. Moreover, this will comprise measures of model quality and robustness. • acquire practical experience in the interpretation of machine learning models and learn required methods for feature selection, importance, stability, and robustness • learn techniques of statistical network inference, their implementation as well as their application to high-dimensional data.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Advanced Statistical Learning for Data Science (Lecture) Hastie, et al. Elements of Statistical Learning https://web.stanford.edu/~hastie/ElemStatLearn/ Bishop: Pattern Recognition and Machine Learning. https://cs.ugoe.de/prml	2 WLH
Examination: Written exam (90 min) or oral exam (approx. 20 min) **Examination prerequisites:** M.Inf.2102.Ex: At least 50% of homework exercises solved. **Examination requirements:** Knowledge of advanced statistical methods, ensemble learning, model assessment, and interpretation as well as statistical network inference. Evaluate their advantages and disadvantages and the ability to implement and interpret the results of these techniques.	6 C

Course: Statistical Learning in Data Science Exercise (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of linear algebra and probability Completion of B.Inf.1236 Machine Learning or equivalent
Language: English	**Person responsible for module:** Jun.-Prof. Dr. Anne Christin Hauschild Prof. Dr. Michael Altenbuchinger
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3

Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.Inf.2103: Statistical Network Inference and Analysis	6 C 4 WLH
Learning outcome, core skills: Students will • Learn the concepts of different network inference methods for observational data, such as probabilistic graphical models, e.g., Gaussian and Mixed Graphical Models or the Markov Random Field • Gain a solid understanding about regularization strategies to deal with large feature spaces, e.g., graphical lasso and covariance shrinkage • Learn state-of-the-art optimization strategies and use them to the implement networks inference methods • Acquire practical experience in network inference using diverse data types, e.g., demographic or biomedical data • Understand the concept of Directed Acyclic Graphs (DAGs) and learn to estimate lower bounds for causal effects from observational data • Understand and apply network inference methods for time-course data • Understand and apply analysis strategies for networks, e.g., community detection methods	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Statistical Network Inference and Analysis (Lecture,Exercise) Literature: Hastie, et al. Elements of Statistical Learning https://web.stanford.edu/~hastie/ElemStatLearn/	4 WLH
Examination: Written exam (90 min) or oral exam (30 min) **Examination prerequisites:** M.Inf.2103.Ex: At least 50% of homework exercises solved. **Examination requirements:** Knowledge about probabilistic graphical models, DAGs, Regularization strategies, Implementation strategies.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge about statistical learning
Language: English	**Person responsible for module:** Prof. Dr. Michael Altenbuchinger
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.2201: Probabilistic Machine Learning**	9 C 6 WLH
Learning outcome, core skills: After successful completion of the module, students • know the principles, paradigms, and challenges of probabilistic reasoning • apply basis principles and tools to perform probabilistic reasoning • manipulate distributions and densities of random variables • apply different methods for inference in probabilistic models (direct solving, sampling, variational inference, Laplace approximation) • apply latent variable models for given problems • perform inference in various forms of Gaussian models using closure properties of the Gaussian family • use graphical models to describe and reason about multivariate distributions of random variables • apply and implement learning algorithms in probabilistic models • can choose from a toolbox of basic algorithms for probabilistic inference on given problems • can implement and debug probabilistic algorithms and inference techniques • apply state of the art deep probabilistic models such as variational autoencoders or normalizing flows	**Workload:** Attendance time: 84 h Self-study time: 186 h
Course: Probabilistic Machine Learning (Lecture)	4 WLH
Examination: Written exam (120 min.) or oral exam (approx. 30 min.) **Examination requirements:** • Ability to use principles and tools of probabilistic reasoning on given problems • Ability to extend and modify existing algorithms of probabilistic inference • Ability to diagnose problems in algorithms of probabilistic reasoning • Ability to mathematically derive results in probabilistic models • Ability to use graphical models to simplify problems of probabilistic reasoning • Knowledge of common models and algorithms of probabilistic inference (Gaussian, Bayesian logistic regression, autoencoders, normalizing flows, and others). • Knowledge of common sampling algorithms (importance sampling, MCMC)	9 C
Course: Probabilistic Machine Learning – Exercise (Exercise) Bonus % for the final exam can be gathered by successfully solving exercise sheets and defending them to a tutor.	2 WLH

Admission requirements: none	**Recommended previous knowledge:** • Basic knowledge of linear algebra • Basic knowledge of multivariate calculus • Python, in particular numpy • Basic knowledge of probability
Language: English	**Person responsible for module:** Prof. Dr. Fabian Sinz

	Dr. Johannes Söding
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 50	

Additional notes and regulations: The course can be taken in parallel to B.Inf.1237 Deep Learning.

Georg-August-Universität Göttingen **Module M.Inf.2203: Interpretability and Bias of Machine Learning Models**	6 C 4 WLH

Learning outcome, core skills: After completion of this module, students can • explain the concepts underlying interpretability research and use the respective terminology appropriately • apply interpretability methods to better understand machine learning models • interpret and discuss the output of interpretability methods and their limitations • identify sources of bias for machine learning models and discuss their implications	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Interpretability and Bias of Machine Learning Models (Lecture)	2 WLH
Examination: Written exam (90 minutes) or oral exam (approx. 20 minutes) **Examination prerequisites:** successful completion of exercise projects **Examination requirements:** Students need to achieve the learning goals	6 C

Course: Interpretability and Bias of Machine Learning Models - Exercise (Exercise)	2 WLH

Admission requirements: none	**Recommended previous knowledge:** Python programming skills **and** B.Inf.1236 or equivalent **or** B.Inf.1237 or equivalent **or** M.Inf.2202 or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.Inf.2204: Introduction to Graph Machine Learning**	5 C 2 WLH
Learning outcome, core skills: Upon completion of the module, students will • Understand the fundamental concepts and principles of graph machine learning • Understand the significance of graph data for machine learning as well as its challenges • Be able to apply various graph-based machine learning algorithms such as Message-Passing Graph Neural Networks (MPGNNs), Graph Kernels, and Graph Transformers • Learn to preprocess data, including handling of discrete numerical features such as the atomic number in molecular data • Implement graph machine learning algorithms such as message-passing GNNs and Graph Transformers based on machine learning libraries for graph learning • Be able to apply supervised and unsupervised learning strategies on graph data • Investigate practical data science problems using graph machine learning	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Introduction to Graph Machine Learning (Lecture,Exercise) *Contents*: • Core Characteristics of Graph data • Methods: Graph Kernels, Message-Passing GNNs, Graph Transformer • Unsupervised node embeddings • Dense and sparse implementations of GNNs • Positional and Structural Embeddings • Machine learning workflow from dataset to prediction • Expressivity of GNNs and the Weisfeiler-Leman hierarchy	2 WLH
Examination: Oral exam (approx. 20 minutes) or written exam (90 minutes) **Examination prerequisites:** At least 50% of homework exercises solved and N-1 exercise sheets submitted. **Examination requirements:** Knowledge of basic Graph Learning paradigms with their advantages and disadvantages as well as possible application areas. Being able to implement those techniques.	5 C

Admission requirements: none	**Recommended previous knowledge:** General knowledge from Machine Learning and/or deep learning as well as basic python
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**

Maximum number of students: 24	

Georg-August-Universität Göttingen **Module M.Inf.2241: Current Topics in Machine Learning**	5 C 2 WLH
Learning outcome, core skills: After successful completion of the module, students • have gained a deeper knowledge in specific topics within the field of machine learning • have improved their oral presentation skills • know how to methodically read and analyse scientific research papers • know how to write an analysis of a specific research field based on their analysis of state-of-the-art research • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Current Topics in Machine Learning (Seminar)	2 WLH
Examination: Oral presentation (approx. 30 min.) and term paper (max. 5000 words) **Examination requirements:** Knowledge in a specific field of machine learning; ability to present the acquired knowledge in a both orally and in a written report.	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1236 Machine Learning B.Inf.1237 Deep Learning (the seminar can accompany lecture in the same term)
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Inf.2242: Journal Club Machine Learning and Computational Neuroscience**	5 C 2 WLH
Learning outcome, core skills: After successful completion of the module, students • have gained a deeper knowledge in specific topics within the fields of machine learning and computational neuroscience • have improved their oral presentation and discussion skills • know how to methodically read and critically analyse original scientific research papers • are able to lead a scientific discussion on an original research paper	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Journal Club Machine Learning and Computational Neuroscience	2 WLH
Examination: Two Oral Presentations (approx. 20 minutes each), not graded **Examination prerequisites:** Regular participation **Examination requirements:** Knowledge of current topics in machine learning and computational neuroscience; ability to present the acquired knowledge orally and lead a discussion on the topic.	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1236 and B.Inf.1237 or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4
Maximum number of students: 10	

Additional notes and regulations:
For students who are writing their thesis in the Neural Data Science or Machine Learning Group.

Georg-August-Universität Göttingen **Module M.Inf.2243: Selected Topics in Data Science**	5 C 3 WLH

Learning outcome, core skills: After completing the module, students should be able to: • Investigate a specific topic in the Data Science field in depth • Identify research trends and existing solutions in the area to be investigated • Explain, compare, and discuss these solutions • Develop ideas to improve the current state of the art • Work independently in a pre-defined context • Gather, organize, read, analyze, and discuss scientific research papers • Write an academic paper • Give an academic presentation about their topic	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Selected Topics in Data Science (Seminar) *Contents*: Please visit www.gipplab.org/teaching for details on this course.	3 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination prerequisites:** Completion of intermediate milestones **Examination requirements:** The students shall demonstrate their ability to: • Conduct literature research on a current Data Science topic • Identify, understand, and explain state-of-the-art approaches in the chosen area • Propose novel solutions to improve the current state-of-the-art methods • Either implement their ideas in software or write a structured scientific paper on their findings • Present and critically discuss their software project or scientific paper in a presentation	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Béla Gipp
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Additional notes and regulations:
This course provides a good foundation for a bachelor's or master's thesis in our group. Visit www.gipplab.org/students-corner/graduation-projects for our current theses proposals.

Georg-August-Universität Göttingen Module M.Inf.2244: Seminar Deep Learning in Biology and Medicine	5 C 2 WLH
Learning outcome, core skills: Deep learning is already one of the most important data analysis methods in biological and medical research and is increasingly also used in clinical practice. Its applications range from protein folding and molecule design for drug discovery to gene sequence analysis to image analysis for microscopy data and medical imaging. As part of the seminar students will pick a specific application, learn how to perform literature research and prepare a presentation on the topic. After successful completion of the modul students will be able to • Appraise research in the area of deep learning in biology and medicine. • Compose a presentation covering their selected topic in depth. • Evaluate methods and findings of other researchers. • Understand and explain the methods and domain knowledge fundamental to their topic.	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Deep Learning in Biology and Medicine (Seminar)	2 WLH
Examination: Presentation (approx. 45 minutes) and written report (max. 20 pages) **Examination prerequisites:** Attendance in 80% of the seminar presentations **Examination requirements:** Advanced knowledge of a specific research topic in the field of deep learning applied in biology or medicine; written scientific report; oral presentation	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1236; B.Inf.1237
Language: English	**Person responsible for module:** Prof. Dr. Constantin Pape
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 15	

Georg-August-Universität Göttingen Module M.Inf.2245: Journal club optimal transport for data analysis	5 C 2 WLH
Learning outcome, core skills: After successful completion of the module, students • have gained a deeper knowledge in specific topics of optimal transport based data analysis • have improved their oral presentation and discussion skills • know how to methodically read and critically analyse original scientific research papers • are able to lead a scientific discussion on an original research paper	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Journal club optimal transport for data analysis	2 WLH
Examination: Oral Presentation (approx. 30 minutes), not graded **Examination prerequisites:** Regular participation **Examination requirements:** Knowledge of current topics in optimal transport and data analysis; ability to present the acquired knowledge orally and lead a discussion on the topic.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Bernhard Schmitzer
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 10	

Additional notes and regulations:
For students who are writing their thesis in the Optimal Transport Group.

Georg-August-Universität Göttingen Module M.Inf.2246: Advanced NLP	5 C 2 WLH
Learning outcome, core skills: After completion of this module, students can • Discuss state-of-the-art approaches for a selected field of advanced NLP using the appropriate terminology • Evaluate and interpret benchmark results for the selected task • Discuss the potential and limitations of existing methods and their societal implications Examples for selected fields are multilingual NLP, cognitive plausibility in NLP, interpretability, advanced language modeling	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Advanced NLP (Seminar)	2 WLH
Examination: Oral presentation (approx. 20 min.) and written report (2500 - 4500 words) **Examination prerequisites:** Successful participation in course **Examination requirements:** Students need to achieve the learning goals	5 C

Admission requirements: none	**Recommended previous knowledge:** M.Inf.2202 or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.2247: Data Science with Cognitive Signals**	5 C 2 WLH

Learning outcome, core skills: After completion of this module, students can • describe the characteristics of different types of cognitive signals using appropriate terminology • explain different methods for integrating cognitive signals into data science models and discuss their strengths and weaknesses • apply processing methods on cognitive data and interpret the results	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Data Science with Cognitive Signals (Seminar)	2 WLH
Examination: Oral presentation (approx. 20 min.) and/or written report (2500 - 4500 words) **Examination prerequisites:** Successful participation in course **Examination requirements:** Students need to achieve the learning goals	5 C

Admission requirements: none	**Recommended previous knowledge:** Python programming skills
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.2248: Seminar Math Information Retrieval**	5 C 3 WLH

Learning outcome, core skills: After completing the module, students should be able to: • Investigate a specific topic in Math Information Retrieval in depth • Identify research trends and existing solutions in the area to be investigated • Explain, compare, and discuss these solutions • Develop ideas to improve the current state of the art • Work independently in a pre-defined context • Gather, organize, read, analyze, and discuss scientific research papers • Write an academic paper • Give an academic presentation about their topic	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Seminar Math Information Retrieval (Seminar) *Contents*: Please visit www.gipplab.org/teaching for details on this course.	3 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination prerequisites:** Completion of intermediate milestones **Examination requirements:** The students shall demonstrate their ability to: • Conduct literature research on a current Math Information Retrieval topic • Identify, understand, and explain state-of-the-art approaches in the chosen area • Propose novel solutions to improve the current state-of-the-art methods • Either implement their ideas in software or write a structured scientific paper on their findings. • Present and critically discuss their software project or scientific paper in a presentation	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Béla Gipp
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Additional notes and regulations: This course provides a good foundation for a bachelor's or master's thesis in our group. Visit www.gipplab.org/students-corner/graduation-projects for our current theses proposals.

Georg-August-Universität Göttingen **Module M.Inf.2249: Seminar Digital Humanities and Information Science**	5 C 3 WLH

Learning outcome, core skills: After completing the module, students should be able to: • Investigate a specific topic in the fields of Digital Humanities or Information Science in depth • Identify research trends and existing solutions in the area to be investigated • Explain, compare, and discuss these solutions • Develop ideas to improve the current state of the art • Work independently in a pre-defined context • Gather, organize, read, analyze, and discuss scientific research papers • Write an academic paper • Give an academic presentation about their topic	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Seminar Digital Humanities and Information Science (Seminar) *Contents*: Please visit www.gipplab.org/teaching for details on this course.	3 WLH
Examination: Oral Presentation (approx. 20 minutes) **Examination prerequisites:** Completion of intermediate milestones **Examination requirements:** The students shall demonstrate their ability to: • Conduct literature research on a current topic in the fields of Digital Humanities or Information Science • Identify, understand, and explain state-of-the-art approaches in the chosen area • Propose novel solutions to improve the current state-of-the-art methods • Either implement their ideas in software or write a structured scientific paper on their findings. • Present and critically discuss their software project or scientific paper in a presentation	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Béla Gipp
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 30	

Additional notes and regulations: This course provides a good foundation for a bachelor's or master's thesis in our group. Visit www.gipplab.org/students-corner/graduation-projects for our current theses proposals.

Georg-August-Universität Göttingen **Module M.Inf.2250: Educational Language Technology**	5 C 2 WLH
Learning outcome, core skills: After completion of this module, students can • describe methods and application scenarios for educational language technology using appropriate terminology • Evaluate and interpret benchmark results for the selected task • Discuss the potential and limitations of existing methods and their societal implications Examples for educational technology are: essay scoring, simplification, exercise generation, learner modeling.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Educational Language Technology (Seminar)	2 WLH
Examination: Oral presentation (approx. 20 min.) and/or written report (2500 - 4500 words) **Examination prerequisites:** Successful participation in course **Examination requirements:** Students need to achieve the learning goals	5 C

Admission requirements: none	**Recommended previous knowledge:** Python programming skills, B.Inf.1248 or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.2251: Language Modeling Research and Evaluation**	6 C 4 WLH
Learning outcome, core skills: After completion of this module, students can: • critically assess evaluation results of language modeling research • determine the strengths and weaknesses of an evaluation dataset both conceptually and practically • apply computational analysis methods for determining annotation quality, and for identifying dataset gaps and biases	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Language Modeling Research and Evaluation (Seminar) *Contents*: New language models are released almost every month these days. In the technical reports, the quality of these models is evaluated on hundreds of datasets and languages. But what do these averaged numbers mean? And what can we infer about the strengths and weaknesses of the model? This course mixes theoretical discussions on evaluation concepts, practical sessions focused on data and model analysis, and invited talks by guest researchers sharing their perspectives on what language models can and cannot (yet) do and how to measure it. For this course, you do not need to know the technical details of language modeling architectures but need to bring a general interest in language modeling research and the willingness to do finegrained data analysis.	4 WLH
Examination: Oral presentation (approx. 20 min.) and written report of a practical project (2500 - 4500 words) **Examination prerequisites:** Participation in the seminar	6 C

Admission requirements: none	**Recommended previous knowledge:** Python programming skills B.Inf.1248 or equivalent
Language: English	**Person responsible for module:** Prof. Dr. Lisa Beinborn
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.Inf.2501: Challenges and Perspectives in Neural Data Science**	3 C 2 WLH

Learning outcome, core skills: After successful completion of the module, students have gained • an overview of recent fundamental research questions and future perspectives in systems and computational neuroscience • an understanding of the neuroscientific background and the data science problems addressed by the relevant research groups • the capabilities to make an informed choice about how to design their further curriculum and where and how to conduct their Master's project	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Challenges and Perspectives in Neural Data Science (Lecture) *Contents*: In each lecture, one research group at the Göttingen campus introduces their research questions, neuroscience background and data science methods used.	2 WLH
Examination: Term paper (max. 1000 words), not graded **Examination requirements:** Based on the content of the lecture series and their own additional research, students formulate a short pitch for a potential Master's thesis project in a neuroscience lab at the Göttingen Campus. The pitch describes the motivation and background of the project, the gap in knowledge, the approach and expected results, as well as the significance of the project. It should be based on at least one published research paper of the group of interest.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker Prof. Dr. Fabian Sinz
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Bachelor: 5 - 6; Master: 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.Inf.2541: Current Topics in Computational Neuroscience**	5 C 2 WLH

Learning outcome, core skills: After successful completion of the module, students • have gained a deeper knowledge in specific topics within the field of computational neuroscience • have improved their oral presentation skills • know how to methodically read, critically analyse and discuss original scientific research papers • know how to write an analysis of a specific research field based on their analysis of state-of-the-art research • have improved their ability to work independently in a pre-defined context	**Workload:** Attendance time: 28 h Self-study time: 122 h

Course: Current Topics in Computational Neuroscience (Seminar)	2 WLH
Examination: Oral presentation (approx. 30 min) and term paper (max. 5000 words) **Examination prerequisites:** Regular participation **Examination requirements:** Knowledge of a current topic in computational neuroscience; ability to present the acquired knowledge in a both orally and in a written report.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Alexander Ecker
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 15	

Georg-August-Universität Göttingen **Module M.Mat.4639: Aspects of scientific computing / applied mathematics**	6 C 4 WLH

Learning outcome, core skills: **Learning outcome:** The successful completion of modules of the cycle "Scientific computing / Applied mathematics" enables students to learn and apply methods, concepts, theories and applications in the area of "Scientific computing / Applied mathematics". During the course of the cycle students will be successively introduced to current research topics and able to carry out independent contributions to research (e. g. within the scope of a practical course in scientific computing or a Master's thesis). Depending on the current course offer the following content-related competencies may be pursued. Students • are familiar with the theory of basic mathematical models of the corresponding subject area, especially about the existence and uniqueness of solutions; • know basic methods for the numerical solution of these models; • analyse stability, convergence and efficiency of numerical solution strategies; • apply available software for the solution of the corresponding numerical methods and evaluate the results sceptically; • evaluate different numerical methods on the basis of the quality of the solutions, the complexity and their computing time; • are informed about current developments of scientific computing, like e. g. GPU computing and use available soft- and hardware; • use methods of scientific computing for solving application problems, like e. g. of natural and business sciences. **Core skills:** After having successfully completed the module, students will be able to • conduct scholarly debates about problems of the area "Scientific computing / Applied mathematics"; • carry out scientific work under supervision in the area "Scientific computing / Applied mathematics".	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Lecture course (4 WLH); alternatively lecture course (2 WLH) with exercises/seminar (2 WLH)	4 WLH
Examination: Oral examination (approx. 20 minutes)	6 C

Examination requirements: Proof of the acquisition of special skills and the mastery of advanced competencies in the area "Scientific computing / applied mathematics"	

Admission requirements: none	**Recommended previous knowledge:** B.Mat.3339
Language:	**Person responsible for module:**

English	Dean of studies
Course frequency: Usually subsequent to the module M.Mat.4539 "Specialisation in scientific computing / applied mathematics"	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Master: 1 - 3
Maximum number of students: not limited	

Additional notes and regulations: **Instructor:** Lecturers at the Institute of Numerical and Applied Mathematics

Georg-August-Universität Göttingen **Module M.Phy.5601: Seminar Computational Neuroscience/Neuro-informatics**	4 C 2 WLH
Learning outcome, core skills: After successful completion of the module, students ... • have deepened their knowledge of computational neuroscience / neuroinformatics by an independent elaboration of a topic; • have learned methods of presentation of topics from computer science; • are able to deal with (English-language) literature; • are able to present an informatic topic; • are able to lead a scientific discussion.	**Workload:** Attendance time: 28 h Self-study time: 92 h
Course: Seminar (Seminar) *Course frequency:* each semester	
Examination: Presentation (approx. 45 Min.) with written report (max. 7 S.) **Examination prerequisites:** regular participation **Examination requirements:** Independent preparation and presentation of research-related topics from the area of computational neuroscience / neuroinformatics as well as biophysics of neuronal systems.	4 C

Admission requirements: none	**Recommended previous knowledge:** B.Phy.5614
Language: English	**Person responsible for module:** Prof. Dr. Florentin Andreas Wörgötter
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** Master: 1 - 3
Maximum number of students: 14	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0001: Sustainable Finance**	6 C 4 WLH

Learning outcome, core skills: After a successful completion of the course students should be able to: • provide a well-founded overview of the field of sustainable finance and show where parallels and differences to traditional finance exist, • understand and critically reflect on theory-based arguments for and against the explicit consideration of sustainability as a corporate objective, • understand, critically reflect on and apply approaches for integrating sustainability into portfolio selection, • understand, critically reflect on and apply models for the market valuation of securities extended to include the aspect of sustainability and assess their ability to explain empirical phenomena, • understand instruments of sustainable debt financing with regard to their possible applications and can analyze them in the context of asymmetric information and incentive effects, • are able to assess theories on the integration of sustainability in capital structure decisions with regard to their practical implications and their ability to explain empirical phenomena.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Sustainable Finance (Lecture) *Contents*: 1. Foundations: What is sustainable finance? 2. Sustainability as a corporate objective? 3. Integration of sustainability into portfolio selection. 4. Integration of sustainability into asset pricing. 5. Sustainable debt financiang. 6. Sustainability and capital structure decisions.	2 WLH
Course: Sustainable Finance (Exercise) *Contents*: In the accompanying practice sessions students deepen and broaden their knowledge from the lectures.	2 WLH
Examination: Written examination (60 minutes)	6 C

Examination requirements: • Demonstrate an overarching understanding of the field of sustainable finance, • demonstrate the ability to build meaningful arguments for and against the consideration of sustainability as a business objective in the context of theoretical considerations, • ability to evaluate important financial concepts such as net present value and shareholder value in the context of sustainability, • demonstrate an understanding of different approaches to integrating sustainability into the portfolio section,	

• demonstrate an understanding of different models for integrating sustainability into asset pricing, • ability to analyze instruments of sustainable debt financing, • demonstrate an understanding of the relationship between capital structure decisions and sustainability.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge from Bachelor courses in finance
Language: German	**Person responsible for module:** Prof. Dr. Olaf Korn
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0004: Financial Risk Management**	6 C 4 WLH

Learning outcome, core skills: After a successful completion of the course students are able to: • understand and explain how risk management is related to other issues in corporate finance, • critically assess different motivations for corporate risk management, • understand and critically assess different risk measures and how they are applied in practice, • understand and explain how international risks can be managed and how the management of international risks is related to various economic parity conditions, • understand, analyze and critically apply measures and methods to manage interest rate risk, • understand, analyze and critically apply measures and methods to manage credit risk, • understand, analyze and critically apply hedging strategies for commodity price risk.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Financial Risk Management (Lecture) *Contents*: 1. Introduction 2. Risk Management: Motivation and Strategies 3. Managing Interest Rate Risk 4. Managing Credit Risk 5. Managing International Risks 6. Managing Commodity Price Risk Parts of the material covered by the lectures will be transmitted via recordings that students have to work through on their own. Parts of the contact hours during lectures will be used by the students to discuss open issues and to work on specific cases and applications of the main concepts.	2 WLH
Course: Financial Risk Management (Tutorial) *Contents*: In the accompanying practice sessions students deepen and broaden their knowledge from the lectures.	2 WLH
Examination: Written examination (60 minutes)	6 C

Examination requirements: • Demonstrate a profound knowledge of how risk management is related to other issues in corporate finance, • document an understanding of viable reasons for corporate risk management and how corporate risk management can create value, • demonstrate the ability to analyze and apply different risk measures,	

• show a profound understanding of methods and techniques used to manage international risks, interest rate risk, credit risk, and commodity price risk.	

Admission requirements: none	**Recommended previous knowledge:** M.WIWI-BWL.0001 Sustainable Finance
Language: English	**Person responsible for module:** Prof. Dr. Olaf Korn
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.WIWI-BWL.0023: Performance Management	6 C 4 WLH
Learning outcome, core skills: The course participants should gain insight into the conceptual principles of metrics for a value-based Management system. By combining scientific results with practical examples participants should develop an understanding of positive and negative consequences of the elements of value-based management. Moreover, students should gain knowledge of approaches to measuring sustainability in corporate management.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Performance Management (Lecture) *Contents*: This course covers performance management principles of corporate activities with a focus on a value-based perspective extended by a sustainability perspective. The course is divided into five main chapters. First, principles of management accounting and value-based management are introduced. Second, the course presents market- and accounting based performance measures and illustrates its limits. Third, the conceptual fundament of a holistic value-based management and the corresponding dimensions of a consistent implementation are presented. Fourth, sustainability-oriented metrics are discussed. Fifth, the value-based approaches are embedded in the design of performance management systems.	2 WLH
Course: Performance Management (Exercise) *Contents*: The tutorial serves to apply the introduced concepts of Value-based management by solving exercises and discussing cases. First, the tutorial introduces the distinct stakeholder groups. Second, focusing on shareholders the tutorial deals with corporate valuation methods and its qualification for a value-based steering. Third, the concepts and weaknesses of traditional key performance indicators are discussed. Fourth, the tutorial elucidates the methodological concepts of value-based metrics and their potential. Fifth, the tutorial includes the stakeholder orientation and discusses sustainability-oriented metrics. Sixth, based on value-based metrics, the tutorial explains the dimensions of a holistic value-based management and concludes with a discussion of the appropriateness of a value-based management implementation.	2 WLH
Examination: Written examination (60 minutes)	6 C
Examination requirements: Proofing the knowledge of market- and accounting-based performance measures, the elements of value-based management as well as sustainability-oriented metrics by naming, calculating and explaining in relevant exercises. Moreover, the application of the gained knowledge in practically relevant exam questions.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Management Accounting
Language: German	**Person responsible for module:** Prof. Dr. Michael Wolff

Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.WIWI-BWL.0024: Corporate Planning	6 C 3 WLH

Learning outcome, core skills:	**Workload:**
The students know important location factors and associated problems, can handle location and transport questions using various algorithms (e.g. Triple, Kruskal or Dijkstra algorithm), and know the basics of Industry 4.0. They can create sales forecasts using Gompertz and Pearl curves, can handle project management issues using MPM and CPM network plans, can apply decision support methods for multiple objectives, and know important aspects of transport and supply chain planning as well as waste disposal logistics.	Attendance time: 42 h Self-study time: 138 h

Course: Corporate Planning (Lecture) *Contents*: Application of operations research methods to questions of strategic, tactical and operational production management in industrial companies: location selection and location factors, product life cycles, forecasts, simulation and selection of suitable production processes and procedures, Industry 4.0, research and development planning in industrial companies, supply chain management, Production and disposal logistics.	2 WLH
Course: Corporate Planning (Exercise) *Contents*: In the exercise, the methods of operations research and the content of the lecture are applied and exercises are calculated. These include: Application of the triple algorithm (Floyd and Warshall algorithm), calculation of forecast data using the Gompertz and Pearl curve, application of MPM and CPM network planning techniques, application of multi-criteria decision support methods, especially utility analysis and PROMETHEE, application the Dijkstra and Kruskal algorithms for determining optimal paths and networks in graphs.	1 WLH
Examination: Written examination (60 minutes)	6 C

Examination requirements: In the examination, students demonstrate knowledge and understanding of concepts and methods for corporate planning for strategic, tactical and operational issues, in particular proof of knowledge of location planning methods and their application, presentation of an overarching understanding of supply chain management and the ability to make critical assessments the different planning approaches.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of production and logistics management is required
Language: German	**Person responsible for module:** PD Dr. Lars-Peter Lauven
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0055: Marketing Channel Strategy**	6 C 2 WLH

Learning outcome, core skills: After successfully completing the course, the students will be able to identify coordination problems within a marketing channel, develop strategies for problem solving and assess their economic benefits. They are given the ability to understand and evaluate research results (in the form of theories, models and empirical studies) regarding marketing channels. The critical examination of hypotheses and methods of testing also enables the students to work scientifically themselves.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Marketing Channel Strategy (Lecture) *Contents*: 1. Introduction – Goals, Structure and Organizational Matters of the Lecture 2. Basic Definitions 3. Marketing Channel Members 4. Market Segmentation 5. Management of the Marketing Channel 6. Channel Conflicts – Sources and Solution Strategies 7. Types of Coordination – Relationship and Institutional Forms 8. Performance Measurement 9. Omni-Channel Strategies	2 WLH
Examination: Written examination (90 minutes)	6 C

Examination requirements: Proof of knowledge about theories, models and methods that analyze questions regarding the design of marketing channels. Creation of solutions for conflicts between marketing channel members. Assessment of the economic benefits of individual types of coordination.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Waldemar Toporowski
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0059: Research Project**	18 C 4 WLH
Learning outcome, core skills: The students will learn not only how to analyze a complex topic using scientific methods, but also how to document, present and discuss their findings. By providing an independent contribution to a complex research project, students should successfully link theory and practice, whilst acquiring additional social skills through group work.	**Workload:** Attendance time: 56 h Self-study time: 484 h
Course: Research Project *Contents*: • Literature research, creation of causal relationship hypotheses, data collection and testing of hypotheses • Practice using scientific methods, in particular data collection and evaluation (multivariate analysis methods) or the creation of software prototypes • Regular presentation and discussion of the intermediate steps with supervisors **Concrete steps:** • Presentation of the topic and relevant milestones • Problem definition • Identification and presentation of the methods used in problem solving • Information analysis (preparation, analysis and summarizing information for decision-making) or the development of a prototype • Final presentation • Compilation of a comprehensive research report including documentation of the steps taken **Sample topics from previous semesters:** • The Use of Artificial Intelligence in Digital Diagnostic Appliances • (Digital) Nudging for IT Security in Hospitals • The Impact of CSR Content Design on Consumer Responses on Social Media • The Importance of Virtual Meetings to Boost Performance	4 WLH
Examination: Presentation (approx. 30 minutes) and a joint research report (max. 15 pages per participant in a group) **Examination prerequisites:** Ongoing project work	18 C
Examination requirements: Scientific examination within small groups of a specified current issue in marketing and information management, reporting the results as part of a group presentation (approx. 30 minutes) and written documentation in the form of a joint research report (maximum 15 pages per participant in a group). The regular participation of all group members is expected.	

Admission requirements: none	**Recommended previous knowledge:**

	Masters seminar (prior knowledge of scientific research is expected and will not be covered in this course)
Language: German	**Person responsible for module:** Prof. Dr. Lutz Maria Kolbe Prof. Dr. Matthias Schumann, Prof. Dr. Manuel Trenz
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: 30	

Additional notes and regulations: The module may not be completed if the module M.WIWI-BWL.0171 Research Projekt has already been successfully completed.

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0109: International Human Resource Management**	6 C 3 WLH
Learning outcome, core skills: After taking this module, students will have gained theoretical knowledge of Human Resource Management (HRM) in an international context, as well as practical knowledge and skills to prepare them for a future career in the HR department and/or management of international companies. Furthermore, the course fosters cross-cultural competence by analyzing the impact of national context and culture on HRM and enables the students to analyze, plan, deliver, and evaluate measures of international HRM.	**Workload:** Attendance time: 42 h Self-study time: 138 h
Course: International Human Resource Management (Lecture) *Contents*: Lectures will introduce relevant theories, basic cultural concepts, and strategic relevance of HRM in an international context. Key functions of international HRM will be discussed (e.g. global HR planning, international staffing & recruiting, training & development, expatriate management, etc.).	2 WLH
Course: International Human Resource Management (Tutorial) *Contents*: Tutorials will help students to discuss and transfer knowledge between theory and practice, using case studies and examples.	1 WLH
Examination: Written examination (60 minutes) **Examination requirements:** • Demonstration of profound knowledge of the various theoretical approaches, functions and measures of international HRM. • Demonstration of cross-cultural competence and understanding of context and culture on HRM issues. • Demonstration of understanding of strategies and current challenges of multinational firms and international HRM and ability to transfer theoretical knowledge in order to solve them.	6 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Fabian Jintae Froese
Course frequency: every winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0112: Corporate Development**	6 C 4 WLH

Learning outcome, core skills: After successful completion of this course, students are able to: • demonstrate a profound knowledge of different perspectives and drivers of corporate development, • identify and define options of actions and strategies for the growth of companies and the conditions necessary to obtain success, • identify and define options of actions and strategies for the reduction of company size and the conditions necessary to obtain success, • apply and critically discuss the tools, strategies, and concepts that have been acquired in order to analyze as well as to tackle case studies, • deal with the ambiguity of real situations and make reasonable decisions.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Corporate Development (Lecture) *Contents*: a) Introduction to corporate development • Definition and practical relevance of ”Corporate Development” b) Tracks and drivers of corporate development processes • In which different tracks do companies develop over time and why? • Models and theories about patterns of change • Measures and mechanisms to manage corporate development and to ensure sustainable success • Models on driving forces of corporate development • Empirical studies discussing tracks and drivers of corporate development processes c) Growing company size • Strategies of corporate development, direction of growth and shifting boundaries of companies • Cooperation and M&A as different growth strategies • Potentials and challenges of different growth strategies d) Reducing company size • When and how do companies reduce their size and how can they do so successfully? • Outsourcing and Downsizing as different strategies to reduce company size • Potentials and challenges of different strategies to reduce company size	2 WLH
Course: Corporate Development (Exercise) *Contents*: In the accompanying practice sessions, students deepen and broaden their knowledge from lectures by applying theories and methods to real-world problem sets.	2 WLH
Examination: Written examination (60 minutes)	6 C

Examination requirements: Students: • demonstrate a profound knowledge of and ability to manage challenges in corporate development, • document a thorough understanding of how to actively design an organizations' development processes, • demonstrate the ability to discuss different measures, strategies, and tools to manage corporate development, • show a profound understanding of empirical studies and theoretical implications and be able to transfer findings on current practical examples in case studies.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in the areas of management and organization as well as organizational design and change
Language: English	**Person responsible for module:** Prof. Dr. Indre Maurer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-BWL.0134: Panel Data Analysis in Marketing**	6 C 2 WLH
Learning outcome, core skills: Panel data refers to observations from different individuals or units (consumers, stores, products, etc.) over several time periods (days, weeks, months, etc.). After successful attendance the students will understand the methodological principles of panel data analysis, especially in the context of consumer behavior and marketing-mix models. Further, they will be able to conduct own panel data analyses using the statistical programming language R.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Panel Data Analysis in Marketing (Lecture with exercise) *Contents*: • Introduction to R • Refreshment in Regression Analysis • Fixed Effects Models in Marketing • Random Effects Models in Marketing • Dynamic Panel Models in Marketing	2 WLH
Examination: Term Paper (max. 6000 words)	6 C
Examination requirements: A self-conducted empirical project. Students will be provided with empirical data, but are welcome to analyze own projects. Students are advised to use the statistical programming language R, but can be allowed to use different statistics software in exceptional cases. Theoretical, methodological and empirical elaboration of a selected topic in panel data analysis with focus on consumer behavior and/or marketing-mix modeling.	

Admission requirements: none	**Recommended previous knowledge:** Basics in Hypothesis testing & Regression analysis Previous knowledge in R is not required
Language: English	**Person responsible for module:** Ossama Elshiewy
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 4
Maximum number of students: 25	

Georg-August-Universität Göttingen Module M.WIWI-BWL.0145: Doing Business in India	3 C 1 WLH
Learning outcome, core skills: After attending this lecture, students have obtained background knowledge on the economic, political, and cultural environment that influence the business in India. In addition, students will obtain insights into successfully doing business in India. This course will prepare students for doing business in India.	**Workload:** Attendance time: 14 h Self-study time: 76 h
Course: Doing Business in India (Lecture) *Contents*: The lecture will introduce the economic, political, and cultural environment that influence business in India. Through a mixture of lectures, case studies, and discussions, students will study how foreign companies and managers do business in India. The contents will include market entry, marketing and human resource management.	1 WLH
Examination: Written examination (60 minutes)	3 C
Examination requirements: • Demonstration of knowledge in doing business in India, • demonstration of the ability to apply theoretical knowledge to practical Indian business challenges.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Fabian Jintae Froese
Course frequency: irregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.WIWI-QMW.0001: Generalized Regression	6 C 4 WLH

Learning outcome, core skills: The students • gain an overview on extended regression modelling techniques that allow to analyse data with non-normal responses. • learn about approaches for modeling nonlinear effects in scatterplot smoothing. • get an introduction to additive models and mixed models for complex regression analyses. • learn how to implement these approaches using statistical software packages.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Generalized Regression (Lecture) *Contents*: Generalized linear models (binary and Poisson regression, exponential families, maximum likelihood estimation, iteratively weighted least squares regression, tests of hypotheses, confidence intervals, model selection and model checking, categorical regression models), nonparametric smoothing techniques (penalized spline smoothing, local smoothing approaches, general properties of scatterplot smoothers, choosing the smoothing parameter, bivariate and spatial smoothing, generalized additive models), mixed models, quantile regression	2 WLH
Course: Generalized Regression (Tutorial) *Contents*: Generalized linear models (binary and Poisson regression, exponential families, maximum likelihood estimation, iteratively weighted least squares regression, tests of hypotheses, confidence intervals, model selection and model checking, categorical regression models), nonparametric smoothing techniques (penalized spline smoothing, local smoothing approaches, general properties of scatterplot smoothers, choosing the smoothing parameter, bivariate and spatial smoothing, generalized additive models), mixed models, quantile regression	2 WLH
Examination: Written examination (90 minutes) or oral examination (approx. 20 minutes)	6 C

Examination requirements: In the exam, the students demonstrate their ability to choose, fit and interpret extended regression modeling techniques. They show a general understanding of the derived estimates and their interpretation in various contexts. The students are able to implement complex regression models using statistical software and to interpret the corresponding results. The exam covers contents of both the lecture and the exercise class.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of statistical modelling using linear regression models

	M.WIWI-QMW.0002 Advanced Statistical Inference (Likelihood & Bayes)
Language: English	**Person responsible for module:** Prof. Dr. Thomas Kneib
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2
Maximum number of students: not limited	

Additional notes and regulations: The actual examination will be published at the beginning of the semester.

Georg-August-Universität Göttingen **Module M.WIWI-QMW.0002: Advanced Statistical Inference (Likelihood & Bayes)**	6 C 4 WLH

Learning outcome, core skills: Upon completion of the module, the students have acquired the following competencies: • foundations and general properties of likelihood-based inference in statistics, • bayesian approaches to statistical learning and their properties, • implementation of both approaches in statistical software using appropriate numerical procedures.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Advanced Statistical Inference (Likelihood & Baye) (Lecture) *Contents*: The likelihood function and likelihood principles, maximum likelihood estimates and their properties, likelihood-based tests and confidence intervals (derived from Wald, score, and likelihood ratio statistics), expectation maximization algorithm, Bootstrap procedures (estimates for the standard deviation, the bias and confidence intervals), Bayes theorem, Bayes estimates, Bayesian credible intervals, prior choices, computational approaches for Bayesian inference, model choice, predictions	2 WLH
Course: Advanced Statistical Inference (Likelihood & Bayes) (Exercise) *Contents*: The likelihood function and likelihood principles, maximum likelihood estimates and their properties, likelihood-based tests and confidence intervals (derived from Wald, score, and likelihood ratio statistics), expectation maximization algorithm, Bootstrap procedures (estimates for the standard deviation, the bias and confidence intervals), Bayes theorem, Bayes estimates, Bayesian credible intervals, prior choices, computational approaches for Bayesian inference, model choice, predictions	2 WLH
Examination: Written examination (90 minutes) or oral examination (approx. 20 minutes)	6 C

Examination requirements: The students demonstrate their general understanding of likelihood-based and Bayesian inference for different types of applications and research questions. They know about the advantages and disadvantages as well as general properties of both approaches, can critically assess the appropriateness for specific problems, and can implement them in statistical software. The exam covers contents of both the lecture and the exercise class.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of mathematics and statistics
Language: English	**Person responsible for module:** Prof. Dr. Thomas Kneib
Course frequency: every year	**Duration:** 1 semester[s]

Number of repeat examinations permitted:	Recommended semester:
twice	1 - 2
Maximum number of students: not limited	

Additional notes and regulations:
The actual examination will be published at the beginning of the semester.

Georg-August-Universität Göttingen Module M.WIWI-QMW.0009: Introduction to Time Series Analysis	6 C 4 WLH
Learning outcome, core skills: The students: • learn concepts and techniques related to the analysis of time series and forecasting, • gain a solid understanding of the stochastic mechanisms underlying time series data, • learn how to analyse time series using statistical software packages and how to interpret the results obtained.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Introduction to Time Series Analysis (Lecture) *Contents*: Classical time series decomposition analysis (moving averages, transformations of time series, parametric trend estimates, seasonal and cyclic components), exponential smoothing, stochastic models for time series (multivariate normal distribution, autocovariance and autocorrelation function), stationarity,spectral analysis, general linear time series models and their properties, ARMA models, ARIMA models, ARCH and GARCH models.	2 WLH
Course: Introduction to Time Series Analysis (Tutorial) *Contents*: Practical and theoretical exercises covering the content of the lecture. Implementation of time series models and estimation by common statistical software (e.g. R or Matlab). Interpretation of estimation results.	2 WLH
Examination: Written examination (90 minutes)	6 C

Examination requirements: The students show their ability to analyze time series using specific statistical techniques, can derive and interpret properties of stochastic models for time series, and can decide on appropriate models for given time series data. The students are able to implement time series analyses using statistical software and to interpret the corresponding results. The exam covers contents of both the lecture and the exercise class.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in statistics M.WIWI-QMW.0004 Econometrics I
Language: English	**Person responsible for module:** Prof. Dr. Helmut Herwartz
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3

Maximum number of students: 50	

Georg-August-Universität Göttingen **Module M.WIWI-QMW.0010: Multivariate Statistics**	6 C 4 WLH

Learning outcome, core skills: The students: • learn the basic concepts of multivariate data analysis, • know how to apply the most common methods of multivariate statistics in practice, • learn how to implement multivariate statistical approaches using the software package R, • know how to interpret the results of multivariate data analyses.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Multivariate Statistics (Lecture) *Contents*: Multivariate distributions and their properties (e.g., multivariate normal distribution), copulas, classification methods, principal component analysis, cluster analysis.	2 WLH
Course: Multivariate Statistics (Exercise) *Contents*: In the accompanying exercise, students deepen and expand the knowledge and skills acquired in the lecture.	2 WLH
Examination: Written examination (90 minutes) or oral examination (approx. 25 minutes)	6 C

Examination requirements: In the exam, the students demonstrate that they are able to apply the basic concepts of multivariate statistics. They can decide for a suitable procedure given an applied problem, implement the approach in statistical software and interpret the results. The exam consists of material from both the lecture and the exercise class.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of statistical modelling using linear regression models M.WIWI-QMW.0002 Advanced Statistical Inference (Likelihood & Bayes)
Language: English	**Person responsible for module:** Prof. Dr. Elisabeth Bergherr
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-QMW.0011: Advanced Statistical Programming with R**	9 C 2 WLH
Learning outcome, core skills: The students acquire advanced understanding of programming concepts in the statistical programming environment R. They learn how to independently implement advanced statistical methodology and how to structure a large programming project. They furthermore develop abilities in debugging and optimizing R code and to present and document the results of their programming project.	**Workload:** Attendance time: 28 h Self-study time: 242 h
Course: Advanced Statistical Programming with R (Seminar) *Contents*: The students work on advanced statistical programming projects using methods and techniques they got to know in the "Introduction to R". This involves implementation of advanced statistical methodology, utilising tools for debugging and profiling code and documenting the code. The progress of the projects is documented in a presentation and a written report.	2 WLH
Examination: Term paper (max. 20 pages) or project work (project documentation in group work (max. 10 pages)) or development of a prototype (prototypical programming development including documentation (max. 20 pages)) **Examination prerequisites:** Two presentations (each ca. 20 minutes)	9 C
Examination requirements: The students work on a programming project with the goal of implementing a given statistical approach in an R package. The programming project is worked on in groups of up to three students. The students document their work in terms of the documentation for their R package and a written report of approximately 15 pages.	

Admission requirements: none	**Recommended previous knowledge:** M.WIWI-QMW.0021 Introduction to Statistical Programming M.WIWI-QMW.0002 Advanced Statistical Inference (Likelihood & Bayes) M.MED.0001 Linear Models and their Mathematical Foundations
Language: English	**Person responsible for module:** Prof. Dr. Thomas Kneib
Course frequency: once a year	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2
Maximum number of students:	

30	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0001: Modeling and System Development**	6 C 2 WLH
Learning outcome, core skills: Upon successful completion, students are able to: • describe and explain the principles and elements of modeling techniques and design possibilities of systems, • apply selected methods for modeling systems independently, • select an appropriate method for modeling a task and delineate versus the benefits of other methods, • outline the development of systems in the business environment and to evaluate and to transfer this to related situations, • analyze and reflect critically selected current trends in the field of system development in group work and • work in groups on tasks with the help of acquired communication and organizational skills.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Modeling and System Development (Lecture) *Contents*: • Basics of systems, models and Software development • System survey (information retrieval and areas of analysis) • Process-oriented analysis and process modeling • Object-oriented analysis and process modeling • Design of systems • Implementation of systems • Integration of systems • Quality management in system development • Configuration management and change management • Cost estimate of system developments	2 WLH
Examination: Written examination (120 minutes) **Examination prerequisites:** Two successfully passed case studies (max. 12 pages each).	6 C
Examination requirements: Students show in the exam that they • can explain, evaluate and apply theories and concepts for modeling processes, application systems and software, evaluate and apply, • can explain and assess what they learned in the lectures regarding aspects of system development , • can analyze complex problems in system development in a short time and can identify both challenges and solutions, • are able to transfer the approaches teached in the lectures to similar problems.	

Admission requirements: none	**Recommended previous knowledge:** none

Language: English	**Person responsible for module:** Prof. Dr. Matthias Schumann
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0002: Integrated Application Systems**	6 C 2 WLH

Learning outcome, core skills: After successful participation in the module, students are able to: • describe and explain the theoretical foundations in connection with integrated theory, • distinguish essential aspects of horizontal and vertical integration and to explain the implementation in integration concepts, • explain and analyze the most important application system types, • explain and evaluate integrated information processing in various economic applications using practical examples, as well as apply and transfer them to related situations, • analyze and critically reflect selected current trends in the field of integrated information processing, • work on tasks in teamwork with the help of learned communication and organizational skills.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Integrated Application Systems (Lecture) *Contents*: • Presentation of the basics of application systems and integration, IT governance, • presentation of objectives and limits of integration as well as different application system architectures and underlying integration concepts, • presentation of electronic data exchange and introduction to Semantic Web and ontologies, • presentation of integrated application systems in the context of CRM, enterprise portals, integrated debtors management, supply chain management, efficient consumer response, integrated production, payment traffic systems, travel distribution systems, and integrated systems in the media industry.	2 WLH
Examination: Written examination (120 minutes) **Examination prerequisites:** Three successfully certified works on case studies.	

Examination requirements: In the exam, students will prove that they: • are able to explain and assess theories and concepts for the integration of application systems, • are able to analyze complex tasks within the framework of integrated information processing in a short period of time and are able to identify both challenges and solution, • are able to transfer lecture-based approaches to comparable problems.	

Admission requirements: none	**Recommended previous knowledge:** none
Language:	**Person responsible for module:**

German	Prof. Dr. Matthias Schumann
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0003: Information Management**	6 C 4 WLH
Learning outcome, core skills: Students: • know the roles and tasks of IT organization within organizations as well as respective evolutions over the last years, • know intra-, extra- and interorganizational requirements for modern information management and can point out common shortcomings in practice, • have detailed knowledge of the model, principles, and objectives of integrated information management with its domains, • can reflect the concepts and tools of integrated information management, and apply it to a problem including written documentation, • understand scientific articles concerning information management and are able to discuss them, • independently and adequately work on scientific research questions related to information management using methods relevant in Business Information Systems.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Information Management (Lecture) *Contents*: • information management: introduction & foundations • IT sales management • IT production management • IT procurement management • strategic IT management • digital business management: introduction & foundations • digital resources • digital demand • digital business models • digital business ecosystems • selected application domains of information systems: smart mobility, digital health, Industry 4.0 • highlights / Q&A	2 WLH
Course: Information Management (Exercise) *Contents*: In the exercises, the lecture content is systematically deepened and prepared for application in the examination context: publications relevant to the lecture are dealt with, the selected lecture content is deepened using practical examples and examination tasks from previous semesters are discussed.	2 WLH
Examination: Written Examination (120 minutes) or oral examination (individual or group examination; approx. 15 minutes) **Examination prerequisites:**	6 C

Attending guest lectures offered as part of this module is mandatory and a prerequisite for participation in the examination. Not attending these lectures / not fulfilling examination prerequisites can lead to exclusion from the examination.	

Examination requirements: In this module's examination, students demonstrate that they are able to apply their knowledge in a solution-driven way on the base of case studies, in addition to the reproduction of foundations and concepts of integrated information management. This includes the transfer of their knowledge on information management to use cases and the application of tools stemming from Business Information Systems in particular. Moreover, students are able to critically appreciate the proposed approach and to adapt it during the application to a given problem.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Lutz Maria Kolbe
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0004: Crucial Topics in Information Management**	12 C 2 WLH
Learning outcome, core skills: The students: • know the state of the art as well as future challenges regarding a current research theme in Information Management, • have profound knowledge within the research field they worked upon, • know and understand methods and approaches in order to elaborate on Information Management topics in a scientific manner, • can elaborate research questions systematically by means of scientific methods.	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Crucial Topics in Information Management (Seminar)	2 WLH
Examination: Presentation (approx. 30 minutes) with written elaboration (max. 8000 words) **Examination prerequisites:** regular attendance; participation on possibly excursions.	12 C
Examination requirements: • Scientific and solution-oriented elaboration of current topics in Information Management, • writing a seminar paper, • oral presentation of the seminar paper's findings, • collaboration with other students in teams.	

Admission requirements: none	**Recommended previous knowledge:** M.WIWI-WIN.0003 Information Management
Language: English	**Person responsible for module:** Prof. Dr. Lutz Maria Kolbe
Course frequency: every winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0005: Seminar in Business Informatics**	12 C 2 WLH

Learning outcome, core skills: After successful participation in the module, students are able to: • describe and explain the foundations of a selected subject of economic informatics, • apply existing knowledge in a selected subject area of economic informatics to a given problem and to discuss it with regard to this problem, • develop, on the basis of existing literature, their own findings, and approaches to solving problems of economic informatics, • assess gained knowledge regarding a problem of economic informatics, • create a scientific elaboration in the form of a term paper, • present the work results in front of an auditorium and • ad hoc answer critical questions on the subject area and to be able to persist in a discussion.	**Workload:** Attendance time: 28 h Self-study time: 332 h

Course: Seminar in Business Informatics (Seminar) *Contents*: • Independent preparation of a scientific term paper, • presentation of the term paper in front of an auditorium.	2 WLH
Examination: Term paper (max. 40 pages) with presentation (about 20 minutes + about 20 minutes discussion) **Examination prerequisites:** Regular attendance	

Examination requirements: In the exam, students will prove that they: • are able to independently analyze a given problem of economic informatics and to solve it with the aid of scientific literature and scientific methods, • can critically reflect their own solutions and identify alternatives, • can write down the compiled results in the form of a term paper and present it in the form of a lecture, • can answer critical questions about the lecture and thus contribute to an intensive and constructive academic discourse, • are present at all seminars.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Matthias Schumann
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3

Maximum number of students: 30	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0008: Change & Run IT**	6 C 4 WLH

Learning outcome, core skills: The course introduces the fundamentals and key concepts of IT Service Management (ITSM) and IT Project Management (ITPM). It covers the contents of the ITIL® framework and its core elements of the service value system. At the end of the course, participants should know the success factors for ITSM and understand how value is created, delivered, and managed by implementing industrial standards. In the ITPM segments, students are introduced to concepts and methods to manage and create IT-driven innovation utilizing agile project management practices.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Change and Run IT (Lecture) *Contents*: • Become familiar with ITSM and the service value concept • Understand the connection between ITIL® and ITSM • Understand, classify, and evaluate processes according to ITIL® • Understand and apply agile project management practices	2 WLH
Course: Change and Run IT (Exercise) *Contents*: • Learn how to apply concrete ITIL® methods and tools • Learn how to apply agile IT project management methods	2 WLH
Examination: Written examination (90 minutes)	6 C

Examination requirements: In the module examination, the students demonstrate that they can reproduce fundamental knowledge and basic concepts of IT service management and project management. They can apply acquired knowledge within case studies in a solution-oriented manner. This includes transferring acquired knowledge to different application contexts. The attendance of guest lectures and other associated learning elements, which may be part of the module, is considered recommended to take the examination.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Lutz Maria Kolbe
Course frequency: every semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 2
Maximum number of students: not limited	

Additional notes and regulations:

The module is offered in each semester. In the summer term, lectures and exercises are in person. In the winter term, only the exercise is in person; the lecture is provided as video recordings.

<table>
<tr><td>Georg-August-Universität Göttingen
Module M.WIWI-WIN.0009: Software & Internet Economics</td><td>4 C
2 WLH</td></tr>
</table>

<table>
<tr><td>Learning outcome, core skills:
After successful participation in the module, students are able to:
describe the principles of internet economy from a theoretical and practical viewpoint and explain them,
explain the properties of digital wares, networks, and network effects and clarify them through the help of practical examples,
explain the essential economic principles of the music industry and the foundations of its value creation,
assess possible pricing strategies of the music industry and point out future solutions,
reflect on strategic and organizational aspects of off-shoring,
work on tasks in groups, applying previously attained communication and organization abilities.</td><td>Workload:
Attendance time:
28 h
Self-study time:
92 h</td></tr>
</table>

<table>
<tr><td>Course: Software & Internet Economics (Online lecture)
Contents:
Foundations of Digital Web Economy:
properties of digital wares,
chances and risks in the supply of digital wares,
network effects and corresponding markets,
practical example: Digital wares.
Digitization:
foundations of digitization,
data as the basis for business models,
Change of the value creation chain,
multi-channel management,
practical example: E-Books.
The Software Industry:
overview and economic principles,
strategies for the software industry (e.g. pricing and sales strategies),
practical example: Cloud Computing.</td><td>2 WLH</td></tr>
<tr><td>Examination: Written examination (120 minutes)</td><td>4 C</td></tr>
</table>

<table>
<tr><td>Examination requirements:
In the exam, students will prove that they:
are able to explain and assess theories and concepts regarding the integration of application systems,
are able to analyze complex tasks concerning integrated information processing in a short span of time and point out challenges as well as possible solutions,</td><td></td></tr>
</table>

• are able to transfer previously studied, lecture-based approaches onto similar problems.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Matthias Schumann
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0026: Machine Intelligence: Concepts and Applications**	6 C 2 WLH

Learning outcome, core skills: The course would introduce modern machine learning and AI methods with focus on real-world practical applications. The course would also consider the subject of ethical AI and practical implementation of ethical AI principles. The aspects related to privacy, explainability, and transferability of AI based systems will be covered. The participants would be able to understand and apply the state-of-the-art machine learning algorithms on a wide range of problems while addressing legal and ethical requirements.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Machine Intelligence: Concepts and Applications (Lecture) *Contents*: • Trustworthy AI • Differentially Private Machine Learning • Secure Machine Learning with Fully Homomorphic Encryption • Explainable AI • Federated Learning • Kernel Methods for Machine Learning	2 WLH
Examination: Project (submission of a project report, max. 6 pages per person)	6 C

Examination requirements: A demonstration of following capabilities: • problem formulation of a selected practical application of artificial intelligence and machine learning, • analytical/computational solution of the formulated problem, • algorithmic implementation of the solution, • computer simulations.	

Admission requirements: none	**Recommended previous knowledge:** Basics of Matrix Algebra, Basics of Signals & Systems
Language: English	**Person responsible for module:** Prof. Dr. Lutz Maria Kolbe Prof. Dr.-Ing. habil. Mohit Kumar
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 4
Maximum number of students: 30	

Georg-August-Universität Göttingen Module M.WIWI-WIN.0032: Information Systems Research	12 C 2 WLH
Learning outcome, core skills: The aim of this seminar is to introduce students to scientific research and scientific writing in the field of information systems. After successful completion of this module, the students have gained in-depth insights into a specific topic in information systems research. Through the mixture of guided introduction and independent work on a clearly defined topic, students develop a basic understanding of the principles of empirical scientific work and acquire the ability to approach a research topic systematically and independently. Students can conduct a systematic review of the scientific literature and are able to develop and derive scientific solutions and findings on this foundation. Depending on their topic, they gather experiences in the application of an empirical method or the implementation of a digital solution. They develop their skills in synthesizing, conducting, presenting, and reflecting on scientific research. In addition to promoting analytical thinking, this seminar will also facilitate the improvement of English writing, presentation, and discussion skills.	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Information Systems Research (Seminar) *Contents*: This seminar deals with current issues in information systems research. Topics include digital strategy and business models, digital platforms, sharing economy, IT innovations, the impact of technologies on decisions, interactions and lives of individuals, among others. Based on their interests, students are assigned to a specific topic to examine. The structure of the seminar is as follows: 1. Introduction to the principles of academic research and scientific writing, 2. Examination of the topic and the research question - Investigation of the theoretical and methodological foundations - Structured analysis of the current state of research - Problem solving - Analysis and structuring of the results - Reflection, 3. Preparation of the term paper, 4. Presentation and discussion of the results.	2 WLH
Examination: Term paper (max. 8000 words) and presentation (approx. 30 minutes) **Examination prerequisites:** Regular attendance	12 C
Examination requirements: • Demonstration of in-depth knowledge on the assigned topic, • proof of an understanding of scientific work, writing, and presenting in general and the application of their selected research method in particular, • evidence of the ability to abstract and reflect the results of the analysis.	

Admission requirements: none	**Recommended previous knowledge:** none

Language: English	**Person responsible for module:** Prof. Dr. Manuel Trenz
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: 10	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0033: Digital Platforms**	6 C 4 WLH
Learning outcome, core skills: The objective of this course is to convey a basic understanding of the paradigms and intricacies of digital platforms and platform business models. Students will be able to apply this knowledge to critically analyze and evaluate digital platform approaches. Moreover, it equips them with the necessary theories and models to develop strategies for digital platforms and to assess current issues in the topic area quantitatively and qualitatively. In the exercise part of the course, students apply their acquired knowledge and thereby advance their problem solving skills.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Digital Platforms (Lecture) *Contents*: Digital platforms are becoming increasingly important. Two-sided markets complement, extend, and replace traditional modes of transacting in many domains. Examples include B2B and B2C e-commerce platforms, platforms for interorganizational integration, resale and auction platforms, crowd work, delivery services as well as P2P services, such as short-term accommodation sharing and ride sharing markets. Importantly, the platform principle bears several particularities which will be examined in this course. Central to the design and operation of digital platforms and associated business models is the existence of network effects, different user types and motives, and the paramount importance of reputation systems and management. Case studies and guest lectures can complement the course. Topics covered in this course include: • The economics of platforms and multi-sided markets • Platform business models • Strategies for starting digital platforms • Competition among and within digital platforms • Platform governance • User motives, types, and representations on digital platforms • Pricing strategies for and on digital platforms • Trust and reputation systems • Network analysis	2 WLH
Course: Digital Platforms (Exercise) *Contents*: Within the accompanying exercise, the students deepen and extend the knowledge and skills acquired in the lecture by means of application tasks and examples.	2 WLH
Examination: Written examination (60 minutes)	6 C
Examination requirements: • Demonstration of in-depth knowledge on the paradigms and intricacies of digital platforms and platform business models, • evidence of the ability to quantitively and qualitatively address current issues on digital platforms.	

Admission requirements: none	**Recommended previous knowledge:** basic Excel skills
Language: English	**Person responsible for module:** Prof. Dr. Manuel Trenz
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0034: Digital Strategy**	6 C 4 WLH
Learning outcome, core skills: This module covers the fundamentals of digital strategy and the use of information systems realizing strategic goals. Students will be able to apply this knowledge to critically analyze and evaluate the opportunities and threats of the digital connectivity, collaborations, and channels. It equips them with the necessary concepts and approaches to develop strategies in digitized market environments. Furthermore, they gain insights into current issues in the topic area such as omnichannel strategies, digital collaboration, digital customer interactions, or ethical issues. Within the exercise part of the course, students apply their acquired knowledge to real life cases. Thereby, students will be equipped with the capability to work in a group on a specific problem and to exploit concepts and theories to address problems observed in practice.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Digital Strategy (Lecture) *Contents*: This course covers the fundamentals of digital business strategies and the opportunities and challenges arising from information systems with a particular focus on digital interactions and exchange with other market entities (i.e., firms, customers). Topics covered in this lecture include: • Digital strategy and digital transformation • Digital business models • Omnichannel strategies • Economies of networks • Information goods and servitization • Data, ethics and privacy • Digital and distributed work	2 WLH
Course: Digital Strategy (Exercise) *Contents*: In the accompanying exercise sessions, students apply their knowledge gained in the lecture by presenting and discussing practical cases.	2 WLH
Examination: Written examination (60 minutes)	4 C
Examination: Case study presentation and discussion	2 C
Examination requirements: • Demonstration of in-depth knowledge on the nature of digital strategy and the role of information systems in this context, • proof of an understanding of the opportunities when competing and collaborating digitally, • evidence of the ability to apply concepts and theories discussed to analyze selected cases.	

Admission requirements:	**Recommended previous knowledge:**

none	none
Language: English	**Person responsible for module:** Prof. Dr. Manuel Trenz
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module M.WIWI-WIN.0040: Increasing Well-Being with Data Analytics	6 C 4 WLH

Learning outcome, core skills:

In this application-focused course, you will engage in a series of weekly challenges designed to demonstrably increase your own (subjective) well-being and build more productive habits using IT.

These challenges will be supported by weekly exercises in which you will learn and independently apply relevant and application-oriented methods to empirical analysis (i.e., data analytics). You will also share your experiences from the course in small groups to reflect on and promote your individual learning process through teamwork.

Overall, the course aims to provide you with the opportunity to develop into a happier individual based on scientifically recognized methods, so that you can use your potential and competencies ("hard skills") collected over the years in a scientifically proven way in your private and professional life and sustainably live them out in the long term.

After the course, students will be able to

• name and understand

- which widespread perceptions regarding well-being are not compatible with academic research and thus rather not to be pursued if students want to become happier in the long run,
- which psychological effects (i.e., human biases and tendencies) lead to these widespread (wrong) perceptions,
- which strategies help against these tendencies,
- what goals should actually be pursued to become scientifically proven happier (especially the role of technology in influencing students‘ well-being),
- how these new goals and related behavioral changes can be integrated and lived in everyday life to positively change behavior in the long run and thus find higher well-being,
- how these changes can be empirically measured and proven using basic statistics (especially with the help of data analytics),
- which topics and trends research (particularly Information Systems) and global players (e.g., SAP, Google and McKinsey) are currently dealing with and will deal with in the future in order to increase the well-being of individuals.

• apply and (empirically) analyze how scientifically recognized activities and interdisciplinary topics (e.g., from information systems and psychology) can be integrated into personal and professional life to increase and maintain your well-being in the long term,

• develop a personally and professionally more accurate and aligned self-image, which is orientated towards actionable insights in business and science and helps you to better reflect and evaluate the individual and social responsibilities of your decisions,

• to look at life as a whole more positively, so that you can use your potentials and competencies ("hard skills") collected over the years in a scientifically proven way in your private and professional life and live them out in the long term.

Workload:

Attendance time:
56 h

Self-study time:
124 h

Course: Increasing Well-Being with Data Analytics (Lecture) *Contents*: In preparation for these challenges, we will: • compare widely held beliefs about well-being with findings from academic research, and ultimately falsify these beliefs, • bringing in theories and concepts from the interdisciplinary research in Information Systems and adjacent fields to explain what troublesome tendencies in human perception (i.e., biases) lead to these perceptions, • present strategies to mitigate these troublesome tendencies, • introduce new perceptions that, according to science and practice, actually lead to better well-being, • present scientifically accepted methods for integrating and sustaining these new perceptions into one's life over the long term.	2 WLH
Course: Increasing Well-Being with Data Analytics (Exercise) *Contents*: • Introduction or recapitulation of the basics of the statistical software R and other data analytics tools, • introduction or recapitulation of the basics of statistics, • application of the findings to sample data sets, • application of the findings to own examples, • reflection on own application.	2 WLH
Examination: Portfolio (100%): Weekly challenges/tasks; preparation, implementation and evaluation of a multi-week technology-based activity to increase personal wellbeing **Examination prerequisites:** Regular attendance in the exercise	6 C

Examination requirements: Demonstrate knowledge of the concepts and content taught in the course (including the influence of technology use on well-being) by applying, evaluating and writing down these concepts and content based on given instructions and personal experience.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge of statistics and the statistical software R is recommended (but not necessary, as the most important contents are taught in the exercises)
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Adam
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 1 - 3

Additional notes and regulations: The lectures are mainly offered in presence, the exercises primarily via live stream. Digital recordings of all lectures and exercises are also made available online via StudIP. In addition, the course is interactive (especially weekly challenges), which requires regular participation. Further information regarding participation in this interactive course will be communicated online or during the kick-off. Language: Slides in English, German mainly for further communication. Submission of the weekly reflection and final reports are either in German or English (mainly self-determined by the students). Details will be provided during the course.

Georg-August-Universität Göttingen Module M.WIWI-WIN.0041: Advanced Topics in Information Systems	12 C 2 WLH
Learning outcome, core skills: After the course, students will be able to: • name and understand the most important terms and theoretical foundations of empirical research methods and scientific writing in information systems, • reproduce in-depth specialist knowledge on a specific topic and a specific method, • apply the theoretical knowledge they have acquired in practice by independently and systematically preparing and conducting empirical studies and evaluating and interpreting the data obtained, • express ideas and arguments better in writing and verbally according to scientific standards.	**Workload:** Attendance time: 28 h Self-study time: 332 h
Course: Advanced Topics in Information Systems (Seminar) *Contents*: In this application-oriented course, students deal with a series of selected questions on advanced topics in information systems and attempt to answer them scientifically with the help of self-implemented empirical studies. These topics are adapted annually to current trends and developments in our increasingly digital world and are assigned based on student preferences. The topics include, among others, human-AI collaborations, management and design of AI, digital nudging & decision-making, digital business & transformation, digital well-being & responsibility, sustainability, information privacy & security, and data analytics. The students‘ independent work is supported by methodological and content-related supervision and guided reflection. The empirical studies are carried out in small groups in order to find the most creative and substantial results possible and to reflect on and promote individual experiences. Overall, the course aims to offer students the opportunity to deal scientifically and creatively with a practical, current, and relevant topic in information systems and to actively contribute their own ideas to answering the question posed. In the course of the seminar: • Introduce basic knowledge and principles of academic research and writing (e.g., structure and content of an empirical study), • Basic knowledge of theories and theoretical contributions are introduced - in comparison to practical implications (e.g., theorization, problematization, finding an interesting and relevant research question), • Basic knowledge of different methods presented (e.g. quantitative and qualitative studies, multi- and mixed-methods approaches), • Content on the selected questions presented and discussed (e.g., previous literature and assumptions), • Implementation of the empirical study, • Presentation, discussion, and writing up of the empirical study.	2 WLH

Examination: Term paper (max. 8,000 words per person, depending on research question and method) and presentations (2 times approx. 30 minutes) in group work **Examination prerequisites:** Regular attendance	12 C

Examination requirements: Demonstrate knowledge of the concepts and content taught in the course (including selected advanced topics on information systems, scientific writing, empirical methods) by applying, presenting, and writing down these concepts and content along given instructions.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Adam
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: 20	

Additional notes and regulations: Language: Slides and written documents (e.g., term paper) in English, German mainly for further communication. Student presentation in either German or English (largely self-determined by the students). Details will be provided during the course.

Georg-August-Universität Göttingen **Module M.WIWI-WIN.0045: Data and Service Ecosystems**	12 C 4 WLH

Learning outcome, core skills: After successfully completing the module, students can independently design and write a scientific paper on the research topic "Digital Ecosystems". The seminar focuses on developing IT artifacts and theories on digital platforms, data spaces, digital services, and service ecosystems. In particular, students can: • independently identify, analyze, and structure a relevant research problem, • apply theories and methods specifically to analyze, evaluate, and design data and service ecosystems, • apply research methods from Information Systems as well as methods in the field of digital and service-oriented ecosystems to specific research contexts, • write a scientific paper independently and in a way that is tailored to a target audience, • actively take up constructive feedback and use it for further developing their work, • hold a scientific presentation and discuss the results with the audience.	**Workload:** Attendance time: 56 h Self-study time: 304 h

Course: Data and Service Ecosystems (Seminar) *Contents*: The seminar is closely integrated into the research fields of the professorship, particularly in the areas of a) digital platforms and data spaces and b) digital service ecosystems. It includes several coaching and presentation sessions and follows a clearly structured milestone plan. Each semester, a specific sub-topic of the research field is investigated in-depth; on request, thematically related topics and questions can also be studied. The students receive individual feedback on their seminar paper in addition to the milestone meetings throughout the semester. **Milestones of the seminar:** **1. Kick-off** • Welcome and getting to know each other • Introduction to the specific focus topic of the current semester **2. Topic assignment** • Allocation of the specific seminar paper topics • Tips on how to develop a convincing abstract, title, and research question or design goal **3. Introduction to scientific work** • Fundamentals of scientific work • Introduction to Information Systems research methods **4. Presentation of motivation and structure (Exposé)** • Presentation and discussion of first drafts **5. Presentation of preliminary results** • Presentation of first results and research designs	4 WLH

6. Final presentation • Presentation of the final results • Grading: 35% of the overall grade **7. Submission of the seminar paper** • Submission of the final written paper • Grading: 65% of the overall grade	
Examination: Term paper (max. 15 pages) with presentation (approx. 10 minutes) **Examination prerequisites:** Regular attendance and successful presentation of preliminary results (milestone 5).	12 C

Examination requirements: • Independently write a scientific paper (65 %), • identify, decompose, and solve research problems in Information Systems using scientific methods, • develop own theoretical and managerial contributions, • present a scientific paper in a structured and convincing manner to an audience (35%).	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Christian Bartelheimer
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 2 - 3
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.iPAB.0003: Statistical genetics, breeding informatics and experimental design**	6 C 4 WLH
Learning outcome, core skills: Novel biotechnological methods allow the production of very large data sets (gene sequences, genotypes, transcriptomes) at decreasing costs. Students learn about statistical and computational methods to use these records for breeding issues. Furthermore, the main experimental designs to plan, implement, and evaluate targeted and efficient experiments for data generation will be treated.	**Workload:** Attendance time: 56 h Self-study time: 124 h
Course: Statistical genetics, breeding informatics and experimental design (Lecture,Exercise) *Contents*: • Gene Expression Analysis • Genome-wide association analysis • QTL mapping • Statistical hypothesis testing • Regression methods • Analysis of variance • Multiple testing • Experimental designs (block designs, randomized designs, Latin squares) • Sample size estimation • Introduction to programming • Fundamentals of databases Literature: Andrea Foulkes: Applied Statistical Genetics with R; Francis O'Donnel: Statistical Experiment Design and Interpretation; An Introduction with Agricultural Examples	4 WLH
Examination: Written examination (60 minutes) **Examination requirements:** Profound knowledge of statistic and informatics methods to use them for breeding issues.	6 C

Admission requirements: none	**Recommended previous knowledge:** Basics in statistics and genetics
Language: English	**Person responsible for module:** Prof. Dr. Armin Schmitt
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 20	

Georg-August-Universität Göttingen **Module M.iPAB.0014: Data Analysis with R**	3 C 2 WLH
Learning outcome, core skills: The students will be able to use methods provided by the statistical package R to perform the analysis of data sets that are typical in the life sciences. A core skill is the identification, usage and evaluation of online resources (e.g. packages and data sets).	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: Data Analysis with R (Block course,Lecture,Exercise) *Contents*: The fundamental concepts of the programming package R will be presented and deepened during practical exercises. Statistical methods will be recapitulated if necessary. Special emphasis is put on visualization methods. Literature: Wiki-book "R programming" https://en.wikibooks.org/wiki/R_Programming "R for Beginners" by Emanuel Paradis https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf "R tips" by Paul E. Johnson http://pj.freefaculty.org/R/Rtips.pdf	2 WLH
Examination: Written examination (90 minutes) **Examination requirements:** Ability to analyze typical data sets with the statistical package R and interpretation of the results.	3 C

Admission requirements: none	**Recommended previous knowledge:** Knowledge of basic statistics concepts
Language: English	**Person responsible for module:** Thomas Martin Lange
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 24	

Georg-August-Universität Göttingen **Module M.iPAB.0015: Applied Machine Learning in Agriculture with R**	6 C 4 WLH

Learning outcome, core skills:	**Workload:**
Modern agricultural research involves more and more the analysis of large datasets comprising mesaurements of several variables. This module aims to teach interested students fundamental analysis skills that permit them to cope with such data sets. In more detail, the techniques that will be treated include: • clustering • artificial neural networks • support vector machine • decision trees • random forests • feature selection Involved mathematical formalism will be avoided. The focus is rather on: • gaining an intuitive understanding of the techniques • to develop an understanding about which type of problem can be treated with which technique • the application of the techniques using machine learning-functions under R • the graphical visualisation of the results • and the interpretation of the results The teaching will be based on the analysis of published real data sets from agricultural research projects as far as possible.	Attendance time: 56 h Self-study time: 124 h

Course: Applied Machine Learning in Agriculture with R (Block course) *Contents*: The course consists of lectures, exercises and project work. After the lectures and the exercises the students will have to carry out a project work that must be finished within eight weeks after the end of the lectures. The students as well as the other research groups are welcome to suggest topics, possibly questions related to their master thesis can be treated. The project work should be a concise written report of about ten pages in which one or several of the techniques that were treated in the course are applied.	4 WLH
Examination: Oral examination (approx. 20 minutes, 60%) and term paper (max. 10 pages, 40%) **Examination requirements:** • Knowledge about the analysis of big-data sets with the statistical package R and interpretation of the results. • Knowledge about different clustering algorithms • Analysis of real agricultural data sets by applying different machine learning-functions under R • Knowledge about feature selection approaches	6 C

Admission requirements: Recommended previous knowledge: Basic knowledge of R	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Felix Heinrich
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: 25	

Georg-August-Universität Göttingen Module S.RW.0112K: Civil Law I (Basic Course)	9 C 8 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Grundkurs I im Bürgerlichen Recht“ • haben die Studierenden grundlegende Kenntnisse im Allgemeinen Teil des Bürgerlichen Rechts und im Deliktsrecht erlangt; • haben die Studierenden gelernt, Anspruchsgrundlagen, Einwendungen und Einreden sowie relative und absolute Rechte zu differenzieren; • kennen die Studierenden die Grundbegriffe und systematischen Grundlagen des Bürgerlichen Rechts; • kennen die Studierenden die dogmatischen Konzeptionen des Allgemeinen Teils des Bürgerlichen Rechts und des Deliktsrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische zivilrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen – im Rahmen der Hausarbeit auch unter Heranziehung und Auswertung der einschlägigen Literatur und Rechtsprechung in vertiefter Form - auseinanderzusetzen.	**Workload:** Attendance time: 112 h Self-study time: 158 h

Course: Grundkurs I im Bürgerlichen Recht (Lecture)	6 WLH
Course: Begleitkolleg für Grundkurs I im Bürgerlichen Recht	2 WLH
Examination: Written examination (120 minutes)	9 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Allgemeinen Teil des Bürgerlichen Rechts und im Deliktsrecht aufweisen, • ausgewählte Tatbestände des Allgemeinen Teils des Bürgerlichen Rechts und des Deliktsrechts beherrschen, • die zugehörigen rechtwissenschaftlichen methodischen Grundlagen beherrschen, • systematisch an einen einfach gelagerten zivilrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können und • allgemeine wissenschaftliche Methoden und Arbeitstechniken (Recherche und Auswertung von Literatur und Rechtsprechung, Erstellen von Gliederungen, Literaturverzeichnissen und Fußnotenapparaten) beherrschen.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language:	**Person responsible for module:**

German	Prof. Dr. Joachim Münch
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0113K: Civil Law II (Basic Course)	9 C 8 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Grundkurs II im Bürgerlichen Recht“ • haben die Studierenden grundlegende Kenntnisse im Leistungsstörungsrecht, Gewährleistungsrecht und im Bereicherungsrecht erlangt; • haben die Studierenden gelernt, zwischen vertraglichen und gesetzlichen Rückabwicklungsregeln zu differenzieren; • kennen die Studierenden das Kaufrecht; • kennen die Studierenden die dogmatischen Konzeptionen des allgemeinen und besonderen Schuldrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische zivilrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 84 h Self-study time: 186 h

Course: Grundkurs II im Bürgerlichen Recht (Lecture)	6 WLH
Course: Begleitkolleg für Grundkurs II im Bürgerlichen Recht	2 WLH
Examination: Written examination (120 minutes)	9 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Leistungsstörungsrecht und Gewährleistungsrecht aufweisen, • ausgewählte Tatbestände des Kaufrechts und des Bereicherungsrecht [= konkretes Rechtsgebiet] beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen einfachen zivilrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: keine	**Recommended previous knowledge:** Kenntnisse im Umfang des Stoffs der Vorlesung Grundkurs BGB I
Language: German	**Person responsible for module:** Prof. Dr. Joachim Münch
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

cf. examination regulations	
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0115K: Civil Law III (Basic Course)	4 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Grundkurs III im Bürgerlichen Recht“ • haben die Studierenden grundlegende Kenntnisse im Bereich der gesetzlichen Schuldverhältnisse erlangt; • haben die Studierenden gelernt, zwischen der Geschäftsführung ohne Auftrag und dem Bereicherungsrecht zu differenzieren; • kennen die Studierenden die dogmatischen Konzeptionen des Bereicherungsrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische zivilrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 92 h

Course: Grundkurs III im Bürgerlichen Recht (Lecture)	2 WLH
Examination: Written examination (120 minutes)	4 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Recht der Geschäftsführung ohne Auftrag und im Bereicherungsrecht aufweisen, • ausgewählte Tatbestände des Bereicherungsrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen einfachen zivilrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: keine	**Recommended previous knowledge:** Kenntnisse im Umfang des Stoffs der Vorlesung Grundkurs BGB II
Language: German, English	**Person responsible for module:** Prof. Dr. Joachim Münch
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0211K: Constitutional Law I	7 C 6 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Staatsrecht I“ • haben die Studierenden grundlegende Kenntnisse im Staatsorganisationsrecht (Staatsstrukturprinzipien, Staatsorgane, Gewaltenteilung, im Überblick Finanzverfassungsrecht) erlangt; • haben die Studierenden gelernt, zwischen verschiedenen Normtypen im Verfassungsrecht zu differenzieren; • kennen die Studierenden die dogmatischen Konzeptionen des Staatsorganisationsrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung, Besonderheiten im Verfassungsrecht) und können diese anwenden; • können die Studierenden die spezifische Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 56 h Self-study time: 154 h

Course: Staatsrecht I (Lecture)	4 WLH
Course: Begleitkolleg für Staatsrecht I	2 WLH
Examination: Written examination (120 minutes)	7 C

Examination requirements:

Durch die Modulprüfung weisen die Studierenden nach, dass sie,

- grundlegende Kenntnisse im Staatsorganisationsrechts aufweisen,
- ausgewählte Tatbestände des Staatsorganisationsrechts beherrschen,
- die zugehörigen methodischen Grundlagen beherrschen und
- systematisch an einen staatsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Thomas Mann
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0212K: Constitutional Law II	7 C 6 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Staatsrecht II“ • haben die Studierenden grundlegende Kenntnisse über die Grundrechte des Grundgesetzes erlangt; • haben die Studierenden gelernt, zwischen Freiheits- und Gleichheitsrechten zu differenzieren; • kennen die Studierenden die verfassungsrechtlichen Grundlagen der deutschen Grundrechte; • kennen die Studierenden die dogmatischen Konzeptionen der Grundrechte in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische grundrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 56 h Self-study time: 154 h

Course: Staatsrecht II (Lecture)	4 WLH
Course: Begleitkolleg für Staatsrecht II	2 WLH
Examination: Written examination (120 minutes)	7 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Staatsrecht II aufweisen, • ausgewählte Tatbestände des Staatsrechts II beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen grundrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Thomas Mann
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0311K: Criminal Law I	8 C 7 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Strafrecht I“ • haben die Studierenden grundlegende Kenntnisse im Allgemeinen Teil des Strafrechts und im Hinblick auf Straftaten gegen Leib und Leben erlangt; • haben die Studierenden gelernt, die verschiedenen Typen von Straftaten sowie die verschiedenen Stufen des Straftatbegriffs zu differenzieren; • kennen die Studierenden die rechtsstaatlichen Grundlagen des Strafrechts; • kennen die Studierenden die dogmatischen Konzeptionen des Strafrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische strafrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 98 h Self-study time: 142 h

Course: Strafrecht I (Lecture)	5 WLH
Course: Begleitkolleg für Strafrecht I	2 WLH
Examination: Written examination (120 minutes)	8 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Allgemeinen Teil des Strafrechts sowie bezüglich der rechtsstaatlichen Grundlagen des Strafrechts aufweisen, • ausgewählte Tatbestände des Besonderen Teils (Straftaten gegen das Leben und Körperverletzungsdelikte) beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen einfachen strafrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Uwe Murmann
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.0313K: Criminal Law II	8 C 7 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Strafrecht II“ • haben die Studierenden vertiefte Kenntnisse im Allgemeinen Teil des Strafrechts und grundlegende Kenntnisse in ausgewählten Deliktsbereichen des Besonderen Teils des Strafrechts erlangt; • haben die Studierenden gelernt, die verschiedenen Typen von Straftaten und die unterschiedlichen Tatbestände des Besonderen Teils zu differenzieren; • kennen die Studierenden die besonderen Erscheinungsformen der Straftat und die grundlegende Systematik des Besonderen Teils; • kennen die Studierenden die dogmatischen Konzeptionen des Strafrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische strafrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 98 h Self-study time: 142 h

Course: Strafrecht II (Lecture)	5 WLH
Course: Begleitkolleg für Strafrecht II	2 WLH
Examination: Written examination (120 minutes)	8 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Allgemeinen und Besonderen Teil des Strafrechts aufweisen, • ausgewählte Tatbestände des Besonderen Teils (insbesondere Straftaten gegen Persönlichkeits- und Vermögenswerte) beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen strafrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Uwe Murmann
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**

Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1130: Commercial Law**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Handelsrecht“ • haben die Studierenden grundlegende Kenntnisse des Handelsrechts erlangt; • haben die Studierenden gelernt, zwischen Kaufleuten und Privaten, insbesondere den verschiedenen Handelsgeschäften zu differenzieren; • kennen die Studierenden die Grundlagen des Handelsrechts und dessen Kernprinzipien; • kennen die Studierenden die dogmatischen Konzeptionen des Handelsrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische handelsrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Handelsrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Handelsrecht aufweisen, • ausgewählte Tatbestände des Handelsrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen handelsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Kenntnisse des Bürgerlichen Rechts, insbesondere des Allgemeinen Teils und des Schuldrechts im Umfang des Stoffs der Vorlesung
Language: German	**Person responsible for module:** Prof. Dr. Gerald Lehrstuhlvertretung (Spindler)
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1131a: Basic Principles of Company Law**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Grundzüge des Gesellschaftsrechts“ • haben die Studierenden Grundlagen des Systems des Gesellschaftsrechts insgesamt erlangt, • haben die Studierenden gelernt, zwischen den verschiedenen Gesellschaftsformen (im Besonderen: GbR, OHG, KH, GmbH) und den Verhältnissen von Geschäftsführung und Vertretung zu differenzieren, • kennen die Studierenden die rechtlichen Grundlagen der Personengesellschaften (BGB-Gesellschaft, OHG, KG) sowie der GmbH (insb. Gründung, Organe und Kapitalschutz), • kennen die Studierenden die dogmatischen Konzeptionen Personengesellschaftsrechts sowie der Grundzüge der Kapitalgesellschaften in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden, • können die Studierenden die spezifische gesellschaftsrechtliche Technik der Falllösung anwenden, • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Grundzüge des Gesellschaftsrechts (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Personengesellschaftsrecht und in Grundzügen des GmbH-Rechts aufweisen, • ausgewählte Tatbestände des Personengesellschaftsrecht und in Grundzügen des GmbH-Rechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen gesellschaftsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Gerald Lehrstuhlvertretung (Spindler)
Course frequency: each winter semester	**Duration:** 1 semester[s]

Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1131b: Basic principles of Law Governing Companies Limited by Shares**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls "Grundzüge des Kapitalgesellschaftsrecht" • haben die Studierenden grundlegende Kenntnisse der Kapitalgesellschaften, insbesondere AG, GmbH erlangt, • haben die Studierenden gelernt, zwischen den verschiedenen Gesellschaftsformen und ihren jeweiligen Innen- und Außenverhältnissen zu differenzieren, • kennen die Studierenden die jeweiligen Besonderheiten der Kapitalgesellschaften, • kennen die Studierenden die dogmatischen Konzeptionen des Kapitalgesellschaftsrechts in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden, • können die Studierenden die spezifische gesellschaftsrechtliche Technik der Falllösung anwenden, • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 28 h Self-study time: 152 h

Course: Grundzüge des Kapitalgesellschaftsrechts (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Kapitalgesellschaftsrecht aufweisen, • ausgewählte Tatbestände des Kapitalgesellschaftsrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen kapitalgesellschaftsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Kenntnisse der Grundzüge des Gesellschaftsrechts
Language: German	**Person responsible for module:** Alle
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.1132: Competition Law	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Wettbewerbsrecht“ • haben die Studierenden grundlegende Kenntnisse im Lauterkeitsrecht (UWG) erlangt, • haben die Studierenden gelernt, verschiedene Tatbestände und Fallgruppen des UWG zu differenzieren, • kennen die Studierenden die methodischen Fragen sowie Probleme bei der Anwendung der Tatbestände auf konkrete, insbesondere innovative Werbe- und Marketingpraktiken • kennen die Studierenden die dogmatischen Konzeptionen des Lauterkeitsrechts in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden, • können die Studierenden die spezifischen lauterkeitsrechtlichen Besonderheiten bei der Technik der Falllösung anwenden, • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Wettbewerbsrecht (UWG) (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Lauterkeitsrecht aufweisen, • ausgewählte Tatbestände des Lauterkeitsrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen lauterkeitsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Andreas Wiebe
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1136: Media Commercial Law**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Wirtschaftsrecht der Medien“ • haben die Studierenden grundlegende ausgewählter wirtschaftsrechtlicher Fragen im Bereich Internet und neue Medien erlangt, • haben die Studierenden gelernt, zwischen den verschiedenen Rechtsbereichen zu differenzieren, • kennen die Studierenden Grundlagen der einschlägigen Rechtsbereiche sowie die Probleme internetspezifischer Fragestellungen, • kennen die Studierenden die dogmatischen Konzeptionen der verschiedenen Bereiche des Wirtschaftsrechts der Medien in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden, • können die Studierenden die spezifische Technik der Falllösung im Bereich des Wirtschaftsrechts der Medien anwenden, • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Wirtschaftsrecht der Medien (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Wirtschaftsrecht der Medien aufweisen, • ausgewählte Tatbestände des Wirtschaftsrecht der Medien beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen wirtschaftsrechtlichen Fall im Bereich der neuen Medien herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Andreas Wiebe
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1137: Intangible Property Rights II (Industrial Property Rights)**	6 C 2 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Immaterialgüterrecht II (Gewerbliche Schutzrechte)“ • haben die Studierenden grundlegende Kenntnisse des Systems des Immaterialgüterrechts sowie der einzelnen gewerblichen Schutzrechte erlangt; • haben die Studierenden gelernt, zwischen den einzelnen gewerblichen Schutzrechten (Patent, Marke, Geschmacksmuster) zu differenzieren; • kennen die Studierenden die Voraussetzungen, Grenzen und Lizenzierungsprobleme der einzelnen Schutzrechte • kennen die Studierenden die dogmatischen Konzeptionen des gewerblichen Rechtsschutzes in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische n Besonderheiten der Falllösung im Bereich der gewerblichen Schutzrechte anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Immaterialgüterrecht II (Gewerbliche Schutzrechte) (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C
Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im gewerblichen Rechtsschutz aufweisen, • ausgewählte Tatbestände des gewerblichen Rechtsschutzes beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen Fall im Bereichen der gewerblichen Schutzrechte herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Andreas Wiebe
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:** from 5
Maximum number of students:	

not limited	

Georg-August-Universität Göttingen **Module S.RW.1139: Intangible Property Rights I (Copyright Law)**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Immaterialgüterrecht I (Urheberrecht)" • haben die Studierenden grundlegende Kenntnisse des Urheberrechts und des Systems der Immaterialgüterrechte erlangt; • haben die Studierenden gelernt, zwischen den verschiedenen Arten der Immaterialgüterrechte zu differenzieren; • kennen die Studierenden die Grundlagen des Urheberrechts und seiner Bedeutung für die digitale Gesellschaft; • kennen die Studierenden die dogmatischen Konzeptionen des Urheberrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische immaterialgüterrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 28 h Self-study time: 152 h

Course: Immaterialgüterrecht I (Urheberrecht) (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements:
Durch die Modulprüfung weisen die Studierenden nach, dass sie,

- grundlegende Kenntnisse im Urheberrecht und in den Grundlagen des Immaterialgüterrechts aufweisen,
- ausgewählte Tatbestände des Urheberrechts beherrschen,
- die zugehörigen methodischen Grundlagen beherrschen und
- systematisch an einen urheberrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.

Admission requirements: none	**Recommended previous knowledge:** Kenntnisse des Bürgerlichen Rechts, insbesondere Allgemeinen Teil, Schuldrecht und Sachenrecht im Umfang des Stoffs der Vorlesung
Language: German	**Person responsible for module:** Prof. Dr. Gerald Lehrstuhlvertretung (Spindler) Wiebe, Andreas, Prof. Dr.
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

cf. examination regulations	
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1140: Youth Media Protection Law**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Jugendmedienschutzrecht mit Bezügen zum Medienstrafrecht“ • haben die Studierenden grundlegende Kenntnisse in der Medienwirkungsforschung sowie in den verfassungsrechtlichen und einfachgesetzlichen Grundlagen des Jugendmedienschutzrechts erlangt; • haben die Studierenden gelernt, die verschiedenen Schutzgrade im Jugendmedienschutzrecht zu differenzieren; • kennen die Studierenden die rechtsstaatlichen Grundlagen des Jugendmedienschutzrechts; • kennen die Studierenden die dogmatischen Konzeptionen des Jugendmedienschutzrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische jugendmedienschutzrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 28 h Self-study time: 152 h

Course: Jugendmedienschutzrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Jugendmedienschutzrecht aufweisen, • ausgewählte Tatbestände des Jugendmedienschutzrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen jugendmedienschutzrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Grundlegende Kenntnisse im Staats- und Verwaltungsrechts sowie im Allgemeinen Teil des Strafrechts
Language: German	**Person responsible for module:** Prof. Dr. Murad Erdemir
Course frequency: each summer semester	**Duration:** 1 semester[s]

Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1142: Cartel Law**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Kartellrecht“ • haben die Studierenden grundlegende im Kartellrecht erlangt; • kennen die Studierenden die dogmatischen Konzeptionen des Kartellrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Kartellrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Kartellrecht aufweisen, • ausgewählte Tatbestände des Kartellrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen kartellrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Kenntnisse des Zivil- und Gesellschaftsrechts im Umfang des Stoffs der Vorlesungen BGB AT und Schuldrecht und Grundzüge des Gesellschaftsrechts
Language: German	**Person responsible for module:** Prof. Dr. Torsten Körber
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.1168: Introduction to European ICT and Media Law	6 C 2 WLH
Learning outcome, core skills:	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Rechtsprobleme des Europäischen Wirtschaftsrechts (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten) oder Essay (1-3 Seiten) **Examination prerequisites:** Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten) oder Essay (1-3 Seiten)	6 C
Examination requirements:	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Zsolt György Balogh
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1172: Digitalisation and legal challenges**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Recht der Digitalisierung“ • haben die Studierenden grundlegende Kenntnisse im Hinblick auf die Digitalisierung im Allgemeinen Teil des Bürgerlichen Rechts erlangt (Willenserklärung, Vertragsabschluss, Zugangsfragen, Identifizierung); • haben die Studierenden gelernt, die verschiedenen Typen der Haftung für Plattformen zu differenzieren; • kennen die Studierenden die technischen und rechtlichen Grundlagen der Digitalisierung des Rechts; • können die Studierenden die dogmatischen Konzeptionen des Zivilrechts in ihrer systematischen, ideellen und praktischen Bedeutung auf Phänomene der Digitalisierung anwenden • kennen die Studierende Grundfragen der Legal Tech-Anwendungen, der Blockchain-Technologie einschließlich des Datenschutzrechts, sowie rechtliche Grundfragen der Künstlichen Intelligenz • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Recht der Digitalisierung (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie • vertiefte Kenntnisse der technologischen und rechtlichen Zusammenhänge der Digitalisierung und ihrer Auswirkungen haben • vertiefte Kenntnisse der Regulierung von technischen Phänomenen haben • die zugehörigen methodischen Grundlagen beherrschen	

Admission requirements: none	**Recommended previous knowledge:** Grundkurs Bürgerliches Recht I bis III
Language: German	**Person responsible for module:** Prof. Dr. Gerald Lehrstuhlvertretung (Spindler)
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1223K: Administrative Law I**	7 C 6 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Verwaltungsrecht I“ • haben die Studierenden grundlegende Kenntnisse vom Allgemeinen Verwaltungsrecht • haben die Studierenden gelernt, die Verwaltungsorganisation und die Rechtsquellen des Verwaltungsrechts zu erfassen. • kennen die Studierenden die Grundbegriffe des Verwaltungsrechts • kennen die Studierenden die verschiedenen Formen des Verwaltungshandelns • kennen die Studierenden die Regelungen des Verwaltungsverfahrens und der Verwaltungsvollstreckung • können die Studierenden zwischen den verschiedenen Formen staatlicher Ersatzleistungen differenzieren • können die Studierenden die häufigsten prozessrechtlichen Konstellationen im Bereich des Verwaltungsrechts (nach der VwGO) erfassen und fallbezogen anwenden • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 84 h Self-study time: 126 h

Course: Begleitkolleg für Verwaltungsrecht I	2 WLH

Course: Verwaltungsrecht I (Lecture)	4 WLH
Examination: Written examination (120 minutes)	7 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie • grundlegende Kenntnisse im allgemeinen Verwaltungsrecht aufweisen • ausgewählte prozessrechtliche Konstellationen beherrschen, • systematisch an einen Fall im allgemeinen Verwaltungsrecht herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Thomas Mann
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Additional notes and regulations:

Georg-August-Universität Göttingen Module S.RW.1229: International and European Economic Law	6 C 2 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Internationales und europäisches Wirtschaftsrecht“ • haben die Studierenden grundlegende Kenntnisse im internationalen Handels- und Investitionsrecht sowie im europäischen Wirtschaftsrecht (Grundfreiheiten, Kartellrecht) und im internationalen und europäischen Recht des geistigen Eigentums erlangt; • kennen die Studierenden die dogmatischen Konzeptionen des Internationales und europäisches Wirtschaftsrecht in ihrer systematischen, ideellen und praktischen Bedeutung und ihrer ökonomischen Dimension; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einfacher Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h
Course: Internationales und europäisches Wirtschaftsrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C
Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im internationalen und europäischen Wirtscahftsrecht aufweisen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen einfachen Fall aus dem internationalen oder europäischen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Europarecht und Völkerrecht, Englisch
Language: German	**Person responsible for module:** Prof. Dr. Peter-Tobias Stoll
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1230: Cases and Developments in International Economic Law**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
After successfully completing the module "Cases and Developments in International Economic Law" • students will have acquired basic knowledge of international economic law, in particular WTO law and international investment law; • know the essential legal foundations and selected decisions; • know the dogmatic concepts of international economic law in their systematic, idealistic and practical significance and their economic dimension; • know the methods of legal interpretation (wording, systematic, historical, teleological interpretation) and are able to apply them; • are able to apply the knowledge they have acquired in solving relevant cases and to deal critically with the legal issues raised.	Attendance time: 28 h Self-study time: 152 h

Course: Cases and Developments in International Economic Law (Lecture,Seminar)	2 WLH
Examination: Oral exam (approx. 15 min.), written exam (90 min.), term paper (max. 12 pages). The form of exam will determined at the start of the semester.	6 C

Examination requirements:	
Through the module examination, students demonstrate that they, • have basic knowledge of international economic law, • master the associated methodological principles, • reproduce and analyze known cases with facts and reasons and • can systematically approach a simple case and solve it in a justifiable manner.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: English	**Person responsible for module:** Prof. Dr. Peter-Tobias Stoll
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.1231: Data Protection Law	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Datenschutzrecht“ • haben die Studierenden grundlegende Kenntnisse im allgemeinen Datenschutzrecht (BDSG) sowie im bereichsspezifischen Datenschutzrecht (TKG, TMG, SGB) erlangt; • haben die Studierenden gelernt, die verschiedenen Typen von Erlaubnisnormen sowie die verschiedenen Rechte der Betroffenen zu differenzieren; • kennen die Studierenden die verfassungsrechtlichen Grundlagen des Rechts auf informationelle Selbstbestimmung und seine Legistlative Ausgestaltung in den wichtigsten Spezialgesetzen; • kennen die Studierenden die dogmatischen Konzeptionen des Datenschutzrechts in ihrer systematischen, ideellen und praktischen Bedeutung; • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • können die Studierenden die spezifische datenschutzrechtliche Technik der Falllösung anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Datenschutzrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im allgemeinen Datenschutzrecht (BDSG) und bei den verfassungsrechtlichen Grundlagen des Datenschutzrechts aufweisen, • ausgewählte Tatbestände des bereichsspezifischen Datenschutzrechtes (Arbeitnehmer-Datenschutz, Datenschutz bei Telekommunikation und Telemedien) beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen datenschutzrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Dr. Fritjof Börner
Course frequency: each semester	**Duration:** 1 semester[s]

Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1233: Telecommunications Law**	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Telekommunikationsrecht“ • haben die Studierenden grundlegende Kenntnisse des Telekommunikationsrechts (wirtschaftliche und verfassungsrechtliche Grundlagen, Zugangs- und Entgeltregulierung sowie weitere Regelungsgehalte des Telekommunikationsgesetzes) erlangt, • haben die Studierenden gelernt, die verschiedenen Phasen der Zugangsregulierung und die Arten der Entgeltregulierung zu differenzieren, • kennen die Studierenden die verfassungsrechtlichen Grundlagen des Telekommunikationsrechts, Grundzüge der Organisation der Bundesnetzagentur und des regulierungsbehördlichen Verfahrens, Grundzüge der besonderen Missbrauchsaufsicht, des Kundenschutzes sowie der Nummern- und Frequenzordnung, • kennen die Studierenden die dogmatischen Konzeptionen des Telekommunikationsrechts in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden, • können die Studierenden die spezifische regulierungsrechtliche Technik der Falllösung anwenden, • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Telekommunikationsrecht (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im Telekommunikationsrecht aufweisen, • ausgewählte Tatbestände der Zugangs- und Entgeltregulierung sowie sonstiger Regelungsgegenstände des Telekommunikationsrechts beherrschen, • die zugehörigen methodischen Grundlagen beherrschen und • systematisch an einen telekommunikationsrechtlichen Fall herangehen und diesen in vertretbarer Weise lösen können.	

Admission requirements: none	**Recommended previous knowledge:** Kenntnisse des Allgemeinen Verwaltungsrechts im Umfang des Stoffs der Vorlesung Verwaltungsrecht I
Language: German	**Person responsible for module:** Prof. Dr. Marcel Kaufmann

Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1317: Criminology I**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Kriminologie I“ • haben die Studierenden grundlegende Kenntnisse über den Gegenstand und die Aufgaben der Kriminologie erlangt; • haben die Studierenden gelernt, kriminalstatistische Daten zu interpretieren und deren Aussagegehalt zu verstehen; • haben die Studierenden Hintergründe und Auswirkungen der strafrechtlichen Selektion kennengelernt; • kennen die Studierenden die wichtigsten Theorien zur Entstehung von Kriminalität und ihre praktische Bedeutung für die Kriminalprävention; • kennen die Studierenden empirisch-kriminologische Forschungsmethoden und haben Grundkenntnisse über Persönlichkeitsmerkmale und Sozialdaten registrierter Straftäter erlangt; • sind die Studierenden in der Lage, die erworbenen Kenntnisse für eine Analyse von Kriminalitätsstruktur und –entwicklung sowie für kriminalpräventive Überlegungen fruchtbar zu machen.	Attendance time: 28 h Self-study time: 152 h

Course: Kriminologie I (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie • grundlegende Kenntnisse im Bereich der Kriminologie aufweisen, • ausgewählte Kriminalitätstheorien beherrschen und in der Lage sind, deren Reichweite und Aussagekraft zu bewerten und auf einen konkreten Sachverhalt zu übertragen, • die Interpretation kriminalstatistischer Daten beherrschen und • Grundlagen der empirisch-kriminologische Forschungsmethoden mit ihren jeweilige Stärken und Schwächen kennen und Forschungsergebnisse entsprechend interpretieren können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Katrin Höffler
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students:	

not limited	

Georg-August-Universität Göttingen Module S.RW.1318: Applied Criminology (Criminology II)	6 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Angewandte Kriminologie“ • haben die Studierenden grundlegende Kenntnisse über die Anwendung kriminologischer Erkenntnisse im Strafrecht erlangt; • haben die Studierenden strafrechtlichen Sanktionen einschl. der Maßregeln der Besserung und Sicherung in ihrer Bedeutung und Wirkung kennengelernt; • kennen die Studierenden empirisch-kriminologische Forschungs-methoden und haben Grundkenntnisse über Persönlichkeitsmerkmale und Sozialdaten registrierter Straftäter erlangt; • kennen die Studierenden Grundlagen der Kriminalprognose; • besitzen die Studierenden Grundkenntnisse im Bereich der Viktimologie und des Umgangs mit Opfern im Strafverfahren; • Beherrschen die Studierenden die Grundlagen der Strafzumessung, Schuldfähigkeit und Schuldfähigkeitsbegutachtung und sind in der Lage, dieses Wissen bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen kriminologischen Fragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 28 h Self-study time: 152 h

Course: Angewandte Kriminologie (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (90 Min.) oder Hausarbeit (max. 10 Seiten).	6 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie • grundlegende Kenntnisse im Bereich der angewandten Kriminologie aufweisen, • die methodischen Grundlagen der Strafzumessung und der Beurteilung der Schuldfähigkeit beherrschen und damit • systematisch an einen konkreten Sachverhalt herangehen und rechtlich zulässige Sanktionen ermitteln sowie in Einzelfällen eine angezeigte Sanktion vorschlagen können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Katrin Höffler
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.1416K: Constitutional Theory	4 C 2 WLH
Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Allgemeine Staatslehre“ • haben die Studierenden grundlegende Kenntnisse in der Allgemeinen Staatslehre und Vergleichenden Regierungslehre erlangt; • haben die Studierenden gelernt, vergleichende Analysen politischer Systeme vorzunehmen; • kennen die Studierenden die Konzepte der Staatstheorie und die unterschiedlichen politischen Systeme (historisch und vergleichend); kennen die Studierenden die theoretischen Konzeptionen der Allgemeinen Staatslehre in ihrer systematischen, ideellen und praktischen Bedeutung.	**Workload:** Attendance time: 28 h Self-study time: 92 h
Course: Allgemeine Staatslehre (Lecture)	2 WLH
Examination: Written examination (120 minutes)	4 C
Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse in der Allgemeinen Staatslehre aufweisen, • ausgewählte Theoriediskurse auf dem Gebiet der Allgemeinen Staatslehre beherrschen, • die zugehörigen methodischen Grundlagen beherrschen.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Thomas Mann
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.1418K: Introduction to Legal and Social Philosophy**	4 C 2 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Einführung in die Rechts- und Sozialphilosophie“ • haben die Studierenden grundlegende Kenntnisse in der Rechtsphilosophie erlangt; • haben die Studierenden gelernt, verschiedene Bereiche der Rechtsphilosophie zu differenzieren: Rechtstheorie und Rechtsethik; • kennen die Studierenden die grundlegenden Theorien der Rechtstheorie und der Rechtsethik; • kennen die Studierenden die wesentlichen Theorien und Prinzipien der Gerechtigkeit; • kennen die Studierenden die Differenzierung von Positivismus und Nichtpositivismus/Naturrecht; • kennen die Studierenden die Radbruchsche Formel und ihre Anwendungen; • haben die Studierenden wesentliche klassische Autoren der Rechtsphilosophie wie Platon, Aristoteles, Thomas von Aquin, Hobbes, Locke, Kant, Hegel zumindest in Ansätzen kennengelernt.	**Workload:** Attendance time: 28 h Self-study time: 92 h

Course: Einführung in die Rechts- und Sozialphilosophie (Lecture)	2 WLH
Examination: Written examination (120 minutes)	4 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse in der Rechtsphilosophie erworben haben.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Dr. Dietmar von der Pfordten
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.1432K: Sociology of Law	4 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „Rechtssoziologie“ • haben die Studierenden grundlegende Kenntnisse über das interdisziplinäre Fach „Rechtsoziologie“ sowie dessen Grundlagen aus den Bezugswissenschaften; • haben die Studierenden gelernt, grundlegende Begriffe wie bspw. „Recht“, „Gerechtigkeit“ methodisch aufzuarbeiten; • kennen die Studierenden die methodischen Grundlagen der Rechtssoziologie; • sind die Studierenden in der Lage, die erworbenen Kenntnisse systematisch darzustellen, Entwicklungslinien nachzuziehen, Grundlagentexte einzuordnen und kritisch auszuwerten ¿ • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung aktueller Probleme umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	Attendance time: 28 h Self-study time: 92 h

Course: Rechtssoziologie (Lecture)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (120 Min.) oder Hausarbeit (mind. 10 Seiten)	4 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse in der Rechtssoziologie aufweisen, • Grundlagentexte systematisch analysieren können, • die zugehörigen methodischen (auch soziologischen) Grundlagen beherrschen und • systematisch an einen Text oder eine Fragestellung herangehen können und diese/n durch Anwendung der erlernten Methoden fundiert diskutieren können.	

Admission requirements: keine	**Recommended previous knowledge:** keine
Language: German	**Person responsible for module:** Prof. Dr. Katrin Höffler
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen Module S.RW.2410: Seminar on E-Commerce-Law and Regulation	12 C 3 WLH

Learning outcome, core skills: Nach erfolgreichem Absolvieren des Moduls „Seminare E-Commerce-Recht und Regulierung" • haben die Studierenden grundlegende Kenntnisse im E-Commerce- und den verschiedenen Bereichen des Regulierungsrechts (insbes. Rundfunkrecht, Wirtschaftsrecht der Medien, Telekommunikationsrecht, Jugendmedienschutzrecht, Datenschutzrecht, Presserecht, E-Commerce and Cyberspace Law, European ICT and Media Law, Europäisches und internationales Wirtschaftsrecht) erlangt; • kennen die Studierenden die Grundlagen von E-Commerce- und Regulierungsrecht und ihre Bedeutung für die digitale Gesellschaft, • kennen die Studierenden die dogmatischen Konzeptionen des E-Commerce- und Regulierungsrechts in ihrer systematischen, ideellen und praktischen Bedeutung, • kennen die Studierenden die Methoden der Gesetzesauslegung (Wortlaut, systematische, historische, teleologische Auslegung) und können diese anwenden; • sind die Studierenden in der Lage, die erworbenen Kenntnisse bei der Lösung einschlägiger Fälle umzusetzen und sich mit den aufgeworfenen Rechtsfragen kritisch auseinanderzusetzen.	**Workload:** Attendance time: 42 h Self-study time: 318 h

Course: Seminare Rechtsgestaltung und Durchsetzung (Lecture)	3 WLH
Examination: Vortrag mit schriftlicher Ausarbeitung (max. 30 Seiten) und Diskussion	12 C

Examination requirements: Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse im gewählten Teilgebiet des E-Commerce- und Regulierungsrechts (insbes. Rundfunkrecht, Wirtschaftsrecht der Medien, Telekommunikationsrecht, Jugendmedienschutzrecht, Datenschutzrecht, Presserecht, E-Commerce and Cyberspace Law, European ICT and Media Law, Europäisches und internationales Wirtschaftsrecht) aufweisen, • ausgewählte Tatbestände des gewählten Teilgebiets des Öffentlichen Rechts beherrschen, • die zugehörigen methodischen und theoretischen Grundlagen beherrschen, • die Grundlagen des wissenschaftlichen Arbeitens beherrschen, • eine Fragestellung bearbeiten und in Form eines wissenschaftlichen Textes darstellen können und • ein erarbeitetes Thema vorzutragen und im Rahmen einer Diskussion zu verteidigen wissen.	

Admission requirements: keine	**Recommended previous knowledge:**

	Kenntnisse des E-Commerce- bzw. einzelner Bereiche des Regulierungsrechts im Umfang des Stoffs der jeweiligen Vorlesung
Language: German	**Person responsible for module:** Prof. Dr. Christine Langenfeld Prof. Dr. Gerald Spindler, Prof. Dr. Andreas Wiebe, Prof. Dr. Torsten Körber
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module S.RW.4105: Legal Tech: with digital competence to method competence**	6 C 2 WLH

Learning outcome, core skills:	**Workload:**
Nach erfolgreichem Absolvieren des Moduls „MdKzMk“ • haben die Studierenden grundlegende Kenntnisse über digitale Kompetenzen, wie sie von der Kultusministerkonferenz in der Strategie „Bildung in der digitalen Welt“ klassifiziert werden; • haben die Studierenden gelernt, die verschiedenen Typen von juristischen Methoden (Subsumtion, Auslegung, Gutachtenstil, Urteilsstil) zu differenzieren und können sie anwenden; • können die Studierenden in juristischen Kontexten Algorithmen erkennen und können sie formulieren; • können die Studierenden nach individueller Schulung zu den Anwendungen des Legal-Tech-Tools BRYTER auf Basis der vorstehenden Zielerreichung selbst ein Modul zum Wissenschafts- und Praxiseinsatz entwickeln; • können die Studierenden mit digitaler und Methodenkompetenz strukturierte Sequenzen zu Lösung eines juristischen Problems/ einer juristischen Aufgabenstellung planen und verwenden; • sind die Studierenden in der Lage, diese Resultate zu präsentieren und kommunizieren; • haben die Studierenden einen Einblick gewonnen in die digitale Entwicklung des Rechtsmarkts und die bestehende Möglichkeiten; • sind die Studierenden sensibilisiert für die Belange des Datenschutzes.	Attendance time: 28 h Self-study time: 152 h

Course: Legal Tech: mit digitaler Kompetenz zur Methodenkompetenz (Course)	2 WLH
Examination: Mündlich (ca. 15 Min.) oder Klausur (120 Min.) oder Hausarbeit (mind. 10 Seiten)	6 C

Examination requirements:	
Durch die Modulprüfung weisen die Studierenden nach, dass sie, • grundlegende Kenntnisse in digitaler und juristischer Methodenkompetenz haben, • und daher ein ausgewähltes juristisches Problem oder eine juristische Aufgabenstellung in Work-Flows mit allen Varianzen und/ oder zielführenden Ergänzungen mit einem Legal-Tech-Tool abbilden können, • kreativ und systematisch an die Erstellung eines Moduls zur bearbeiteten Thematik herangehen und dieses umsetzen und präsentieren können.	

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Katja Isabell Kohler
Course frequency: each semester	**Duration:** 1 semester[s]

Number of repeat examinations permitted: cf. examination regulations	**Recommended semester:**
Maximum number of students: not limited	

Georg-August-Universität Göttingen **Module SK.Bio-NF.7001: Neurobiology**	3 C 2 WLH

Learning outcome, core skills: The students should acquire comprehension in form and function of neurons and their anatomical and physiological features (genetics, subcellular organization, resting membrane potential, action potential generation, stimulus conduction, transmitter release, ion channels, receptors, second messenger cascades, axonal transport). The students acquire knowledge of the physiological basics of sensory systems (olfactory, gustatory, acoustic, mechanosensory and visual perception) as well as motor control. Based on this the students educe understanding for the relation between neuronal circuits and simple modes of behavior (central pattern generators, reflexes, and taxis movements). The students should conceptually learn how neuronal connections are modified by experience (cellular mechanisms of learning and memory) and should learn different types of modification of behavior based on experience and neuronal substrates. The students should acquire fundamental insight into the organization and function of brains and autonomous nervous systems of mammals and invertebrates. The neurobiological basis of behavioral control (orientation, communication, circadian rhythm and sleep as well as motivation and metabolism) is explained. The students will learn physiological and cellular mechanisms of aging and of neurodegenerative diseases.	**Workload:** Attendance time: 30 h Self-study time: 60 h

Course: Neurobiology (Lecture)	2 WLH
Examination: Written examination (90 minutes)	3 C

Examination requirements: The students should have the ability to assess coherence and facts of statements from the field of neurobiology; they should be able to answer questions on the structure and function of neurons and neuronal circuits. Furthermore they should be able to describe and compare neuronal basics of behavioral control, their experience-dependent modification and conceptual mechanisms of complex behavior; they should be able to describe and compare physiological mechanisms of sensory perception and different sensory modalities; they should be able to describe physiological and cellular mechanisms of aging and of neurodegenerative diseases.	

Admission requirements: none	**Recommended previous knowledge:** Basic knowledge in Biology
Language: English	**Person responsible for module:** Prof. Dr. Andrè Fiala
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 4 - 6
Maximum number of students: 30	

Additional notes and regulations: The combination of this module with module SK.Bio.7001 is not possible.

Georg-August-Universität Göttingen **Module SK.Bio.305: Biostatistics with R**	3 C 2 WLH

Learning outcome, core skills: After successful completion of the module, the students are able to deal with the open statistics programming language R and to apply this language to biological data. They gained the ability to apply statistical methods like descriptive statistics, parametric and non-parametric two-random-sample tests, Chi-Quadrat test, correlation analysis, linear regression analysis and ANOVA.	**Workload:** Attendance time: 30 h Self-study time: 60 h

Course: Einführung in die Biostatistik mit R (Seminar)	2 WLH
Examination: Written examination (90 minutes) **Examination prerequisites:** continuous participation in the course; solved exercises **Examination requirements:** Independent analysis of biological data with the help of the programming language R; evaluation and practical application of basic statistical testing methods.	3 C

Admission requirements: none	**Recommended previous knowledge:** basic knowledge in mathematics and statistics
Language: German	**Person responsible for module:** Prof. Dr. Tim Beißbarth
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 5 - 6
Maximum number of students: 23	

Georg-August-Universität Göttingen **Module SK.Bio.356: Biological psychology II**	3 C 2 WLH

Learning outcome, core skills: After passing the module, the students have a general understanding for the central processing of sensory information and the generation of motor-driven behavior. They acquired knowledge in the fields learning, memory, hormones, stress, concentration, chronobiology and homeostasis.	**Workload:** Attendance time: 28 h Self-study time: 62 h

Course: Biologische Psychologie II (Lecture)	2 WLH
Examination: Written examination (30 minutes) **Examination requirements:** The students should master the basics in biopsychology as taught in the lecture. They should have the ability to understand and describe connections between acquisition of cognitive skills, behavioral patterns and biological basics in neurobiology beyond the application of the learned facts and to apply their knowledge to new situations.	3 C

Admission requirements: 2FBA: at least 20 C from the biological introductory modules	**Recommended previous knowledge:** SK.Bio.355 Lecture "Biopsychologie I", basic knowledge in neuroscience
Language: German	**Person responsible for module:** Prof. Dr. Stefan Treue
Course frequency: each winter semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 100	

Additional notes and regulations: The combination of this module with module B.Bio.130 is not possible.

Georg-August-Universität Göttingen Module SK.DH.21: E-Learning	3 C 2 WLH
Learning outcome, core skills: The students • are familiar with the common technologies used in the creation of e-learning components; • can apply their knowledge exemplarily to a specific e-learning unit; • demonstrate basic competence in the digital mediation of knowledge content and research questions in the humanities; • are able to break down complex problems of digital mediation into subtasks and process them in a solution-oriented manner; • are able to evaluate the results of fellow students and enrich them with their own ideas.	**Workload:** Attendance time: 28 h Self-study time: 62 h
Course: E-Learning (exercise or workshop)	2 WLH
Examination: Creation of an e-learning unit with written elaboration (max. 10 pages) **Examination requirements:** The students create a concept for a digital learning unit and implement it practically by applying selected tools of digital teaching (such as ILIAS) and reflecting on them in approaches. In doing so, they demonstrate advanced knowledge of the specific requirements of digital teaching in the humanities.	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Martin Gustav Langner
Course frequency: each semesterirregular	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5
Maximum number of students: 25	

Georg-August-Universität Göttingen **Module SK.Inf.1801: Functional Programming**	5 C (incl. key comp.: 5 C) 3 WLH

Learning outcome, core skills: Studierende erlernen und üben die Grundlagen der Funktionalen Programmierung. Sie lernen Listengeneratoren, Funktionen höherer Ordnung und algebraische Datentypen kennen und üben deren praktische Anwendung. Darüber hinaus erarbeiten sie sich Funktionen höherer Ordnung und fortgeschrittene Funktionale Konzepte (z. B. Monaden, Funktoren) und wenden diese an. Zudem erarbeiten sie sich die Analyse von Funktionalen Programmen und fehlerresistenter Programmierung. Sie diskutieren die Möglichkeiten von Effekten in Funktionaler Programmierung und erlernen Funktionale Datentypen und üben dessen praktische Anwendung.	**Workload:** Attendance time: 42 h Self-study time: 108 h

Course: Funktionale Programmierung (Lecture,Exercise)	3 WLH
Examination: Klausur (90 Min.) oder mündliche Prüfung (ca. 20 Min. plus 15 Min. Vorbereitungszeit) oder (Gruppen-)Projektarbeit mit Vorstellung (max. 25 Seiten, ca. 20 Min.), not graded **Examination requirements:** Die Studierenden demonstrieren den sicheren praktischen Umgang mit Listengeneratoren, Funktionen höherer Ordnung und algebraische Datentypen.Sie können Funktionen höherer Ordnung und fortgeschrittene Funktionale Konzepte (z. B. Monaden, Funktoren) anwenden. Sie analysieren Funktionale Programme und können fehlerresitent programmieren. Sie demonstrieren grundlegendes Verständnis für die Möglichkeiten von Effekten in Funktionaler Programmierung und Funktionale Datentypen und dessen praktische Anwendung.	5 C

Admission requirements: none	**Recommended previous knowledge:** B.Inf.1101
Language: German	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: each summer semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from 5
Maximum number of students: 30	

Georg-August-Universität Göttingen **Module SK.Inf.1802: Good Scientific Practice in Computer and Data Science**	2 C (incl. key comp.: 2 C) 1 WLH
Learning outcome, core skills: After successfully completing the module, students will be able to... • effectively structure a research paper, • are familiar with formal and structural norms regarding outlines, formatting, bibliographies, etc., • identify the principles of good scientific writing, apply them to their own writing and revise the manuscripts of others accordingly, • participate in technical and scientific discussions, • give constructive feedback to colleagues, • present a research project they have worked on and lead a technical discussion about it.	**Workload:** Attendance time: 14 h Self-study time: 46 h
Course: Good Scientific Practice in Computer and Data Science (Seminar) *Contents*: Participants develop an understanding of the basic principles of good scientific practice. They will be able to place scientific work in a broader context and understand the importance of integrity and responsibility in research. They deal intensively with aspects of quality assurance and learn to critically scrutinize scientific statements. They also acquire knowledge about ethical challenges in research and develop strategies to avoid conflicts and misconduct in the scientific environment.	1 WLH
Examination: Oral Presentation (approx. 10 minutes), not graded **Examination prerequisites:** Attendance at 80% of sessions.	2 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: English, German	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from until
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module SK.Inf.1803: Computer Science for Environmental Sustainability**	5 C (incl. key comp.: 5 C) 2 WLH
Learning outcome, core skills: Participants will gain an understanding of computer science applications in environmental sustainability. By the end of the course, students will be able to: • Explain fundamental computer science concepts and methodologies. • Apply computer science technologies to address environmental challenges. • Evaluate computer science solutions for climate change mitigation, biodiversity conservation, and pollution control. • Develop and propose computer science-based solutions for specific environmental problems. • Assess the ethical considerations in deploying computer science for environmental sustainability.	**Workload:** Attendance time: 28 h Self-study time: 122 h
Course: Seminar: Sustainability in Computer Science (Seminar) *Contents*: The course content covers: • Introduction to computer science and its role in addressing environmental challenges • Basics of data science and its applications in environmental studies • Computer science for climate change mitigation, biodiversity conservation, and pollution monitoring • Data collection and analysis methods for environmental computer science • Remote sensing integration with computer science • Computer science applications in sustainable agriculture, renewable energy optimization, and waste management • Ethical considerations in using computer science for environmental sustainability • Future trends and advanced applications of computer science in environmental science Reading materials and additional resources will be provided throughout the course. For early preparation, students can contact the instructor for recommended readings before the term starts.	2 WLH
Examination: Presentation (approx. 35 min) and report (max 15 pages) **Examination requirements:** Students must demonstrate: • Comprehensive understanding of computer science concepts and their application to environmental sustainability. • Ability to develop and present a computer science-based solution to a specific environmental problem. • Proficiency in analyzing and interpreting environmental data using computer science techniques.	5 C

• Knowledge of ethical considerations in the use of computer science for environmental purposes. • Insight into future trends and innovations in computer science for environmental sustainability. **Bewertung** The total score will be calculated from presentation (50%) and report (50%).	

Admission requirements: none	**Recommended previous knowledge:** Basic understanding of environmental issues and basic computer literacy.
Language: English, German	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from until
Maximum number of students: 40	

Georg-August-Universität Göttingen Module SK.Inf.1804: AI Methods in Academia	5 C (incl. key comp.: 5 C) 3 WLH

Learning outcome, core skills:	**Workload:**
Die Studierenden… • analysieren die Funktionen, Potenziale und Grenzen KI-gestützter Werkzeuge für Recherche, Textproduktion und Datenanalyse, • bewerten den Einfluss von KI auf wissenschaftliche Arbeitsweisen, Qualitätsstandards, • entwickeln Strategien für den datenschutzkonformen und nachhaltigen Einsatz von KI im Studium, • nutzen KI-Tools gezielt zur Unterstützung akademischer Aufgaben und reflektieren deren Anwendung kritisch, • übernehmen Verantwortung für einen ethisch fundierten und verantwortungsvollen Umgang mit KI in ihrem Studienalltag und • benennen rechtliche Rahmenbedingungen zum Einsatz von KI-Werkzeugen.	Attendance time: 42 h Self-study time: 108 h

Course: KI Methoden im akademischen Alltag (Lecture) *Contents*: Das Modul “KI-Methoden im akademischen Alltag” vermittelt den Studierenden die Grundlagen und Anwendungsmöglichkeiten von Künstlicher Intelligenz (KI) im universitären Kontext. Sie lernen, KI-gestützte Werkzeuge für Recherche, Textproduktion und Datenanalyse zu analysieren und zu bewerten, sowie Strategien für den datenschutzkonformen und nachhaltigen Einsatz von KI im Studium zu entwickeln. Durch die Anwendung von KI-Tools und die Reflexion ihrer Anwendung werden die Studierenden befähigt, KI-Methoden gezielt zur Unterstützung akademischer Aufgaben einzusetzen. Das Modul schließt mit der Erstellung eines Berichts ab, in dem die Studierenden ihre Erfahrungen und Erkenntnisse bei der Anwendung von KI-Methoden im Universitätsalltag darstellen und reflektieren.	3 WLH
Examination: Term Paper (max. 10 pages), not graded **Examination prerequisites:** Regelmäßige Teilnahme (80%) an den Sitzungen. **Examination requirements:** Fähigkeit zur Analyse und Reflexion von KI-gestützten Methoden im akademischen Alltag; Bewertung von Potenzialen, Herausforderungen und Integrationsmöglichkeiten; Entwicklung und Dokumentation datenschutzkonformer KI-Strategien.	5 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted:	**Recommended semester:**

twice	
Maximum number of students: 50	

Georg-August-Universität Göttingen **Module SK.Inf.1805: Student Self-Governance and Committee Participation at Departmental Level**	3 C (incl. key comp.: 3 C)

Learning outcome, core skills: none	**Workload:** Attendance time: NaN h Self-study time: NaN h

Course: Dezentrale studentische Selbstverwaltung/Gremienarbeit (Key competence)	
Examination: Auflistung/Nachweis der anrechenbaren Tätigkeiten in der Selbstverwaltung und Gremienarbeit, not graded **Examination prerequisites:** Aktive Mitwirkung in der dezentralen studentischen Selbstverwaltung bzw. in Gremien und Kommissionen der Fakultät für Mathematik und Informatik. **Examination requirements:** Nach Maßgabe des nachfolgenden Punktesystems sind mindestens 5 Punkte zu erwerben. Punkte für weitere Tätigkeiten können bei der Prüfungskommission beantragt werden. Mitglied in Gremien und Kommissionen	Punkte pro Jahr • Fakultätsrat	4 • Fachschaftsrat (FSR)	3 • Berufungskommission (BK)	3 • Studienkommission (StuKo), ordentliches Mitglied/Stellvertretung	3/1 • Prüfungskommission (PK), ordentliches Mitglied/Stellvertretung	3/1 • Vorstandmitglied Institut für Informatik	2 • Vorstandmitglied CIDAS	2 • Fachgruppensprecher*in (FGS)	2 • Studentische*r Gleichstellungsbeauftragte*r	2 • Master-Auswahlkommission inklusive Interviews	1 • Delegierte*r der Qualitätsrunden	1 • Auswahlkommission für Stipendien	1	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: each semester	**Duration:**
Number of repeat examinations permitted: twice	**Recommended semester:**

Georg-August-Universität Göttingen **Module SK.Inf.1806: Introduction into Web Development**	6 C (incl. key comp.: 6 C) 4 WLH

Learning outcome, core skills: • erläutern die Funktionalität und das Zusammenspiel der Basistechnologien moderner Webanwendungen (HTTP, HTML, CSS, JavaScript). • analysieren die Architektur moderner Webanwendungen und typischer Softwarestacks und können Vor- und Nachteile benennen. • benennen und erläutern übliche Software-Patterns verbreiteter Frontend-Bibliotheken und -frameworks (z.B. MVC/MVVM, SPA, MPA, Router-Pattern) und können diese anwenden, um interaktive Webanwendungen zu entwickeln. • nutzen und entwerfen APIs zur Kommunikation zwischen Frontend und Backend einer Webanwendung. • entwickeln Webanwendungen barrierefrei und benennen und beachten typische datenschutzrechtliche Anforderungen bei der Arbeit mit personenbezogenen Daten. • entwerfen einfache interaktive Webanwendungen aus Frontend, Backend und Datenbank und können diese technisch umsetzen. • können Webanwendungen in einer Produktivumgebung einsetzen und administrieren.	**Workload:** Attendance time: 56 h Self-study time: 124 h

Course: Introduction into Web Development (Lecture,Exercise) Details zur Veranstaltungsdurchführung sind unter https://webdev.pages.gwdg.de/info/ zu finden.	4 WLH
Examination: Projektarbeit (4-6 Wochen) und entweder eine Hausarbeit (max. 25 Seiten) oder mündliche Prüfung (ca. 20min je zu prüfender Person) **Examination requirements:** Die Studierenden entwickeln eine moderne Webanwendung und präsentieren (mündliche Prüfung) bzw. dokumentieren (Hausarbeit) diese. Dabei reflektieren sie u.A. ihr Vorgehen, sowie technische und strategische Entscheidungen, die sie im Rahmen der Umsetzung getroffen haben.	6 C

Admission requirements: none	**Recommended previous knowledge:** Programmierung (gut), Projektarbeit (grundlegend), Linux (grundlegend), Netzwerke (grundlegend)
Language: German, English	**Person responsible for module:** Prof. Dr. Julian Kunkel
Course frequency: unregelmäßig	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** 3 - 5

Georg-August-Universität Göttingen Module SK.Inf.1807: Project Work - Extension	3 C (incl. key comp.: 3 C) 0,5 WLH

Learning outcome, core skills:	**Workload:**
Vertiefung der Kompetenzen eines anderen Moduls durch zusätzliche Projektarbeit. Dieses Modul dient als Erweiterung eines Modules, das Projektarbeit als Prüfungform anbieten. Insbesondere der folgenen Module. • B.Inf.1803: Fachpraktikum I • B.Inf.1804: Fachpraktikum II • B.Inf.1805: Fachpraktikum III • SK.Inf.1806: Introduction into Web Development Durch erhöhten Aufwand für die Projektarbeit eines anderen Moduls können zusätzliche Credits erworben werden. Dazu ist eine Absprache mit den Lehrenden, der das Modul implementierenden Lehrveranstaltung, verpflichtend. Für die Anmeldung zur Prüfung dieses Moduls ist die vorherige Anmeldung zur reguläre Modulprüfung, für die zusätzliche Credits erworben werden sollen, obligatorisch.	Attendance time: 7 h Self-study time: 83 h

Course: Projektarbeit - Erweiterung (Internship)	0,5 WLH
Examination: siehe erweitertes Modul, not graded **Examination prerequisites:** siehe erweitertes Modul **Examination requirements:** siehe erweitertes Modul	3 C

Admission requirements: none	**Recommended previous knowledge:** none
Language: German, English	**Person responsible for module:** Prof. Dr. Florin-Silviu Manea
Course frequency: each semester	**Duration:** 1 semester[s]
Number of repeat examinations permitted: twice	**Recommended semester:** from until