

Subdivided Module Catalogue
for the Subject

MINT Teacher Education PLUS, Elite Network Bavaria (ENB)

with the degree "LA Master Gymnasium"
(120 ECTS credits)

Examination regulations version: 2020
Responsible: Faculty of Biology
Responsible: Faculty of Chemistry and Pharmacy
Responsible: Faculty of Mathematics and Computer Science
Responsible: Faculty of Physics and Astronomy

Course of Studies - Contents and Objectives

The elite degree programme "MINT-Lehramt PLUS" in the Elite Network of Bavaria is a research-oriented Master's degree programme offered by the Faculty of Biology, the Faculty of Chemistry and Pharmacy, the Faculty of Mathematics and Computer Science and the Faculty of Physics and Astronomy of the Julius-Maximilians-Universität Würzburg. It is being offered as part of a Bachelor's and Master's study model. This Master's degree is an additional professional and research-oriented degree.

The elite Master's programme prepares graduates for a job in the professional fields of education and science. Therefor competences in four different areas are acquired: deepening of a STEM subject (60 ECTS credits), deepening of subject didactics (10 ECTS credits), international, interdisciplinary research (10 ECTS credits) and profession specific key competences (10 ECTS credits). The elite Master programme is completed by a Master thesis (30 ECTS credits).

Graduates have deepened knowledge in one chosen STEM subject. They know current concepts, topics and fields of research as well as research methods of the subject and use this knowledge especially to critically reflect and interpret scientific sources. Graduates apply their knowledge of the subject and its methods to recognise subject related problems, to develop solution approaches, to solve problems and to critically reflect their approach afterwards. In doing so, they act self-organised and independently.

Graduates have deepened knowledge in the didactics of a STEM subject respectively STEM subjects chosen by them. This involves current concepts, topics, results of national and international research as well as specific research methods. They can transfer their knowledge to school and class and, against this background, they can critically reflect school-based activities. Graduates are able to evaluate new research results and to classify them in respect to their current knowledge.

Graduates are able to plan and to conduct research projects self-organised and independently and critically reflect them in the light of current research. In doing so they use their knowledge in special branches of science and/or subject didactics. Moreover, graduates have competences to work on problems interdisciplinarily and cooperatively.

Graduates have deepened knowledge and abilities in the field of key competences, that are of specific importance for a job in the professional fields of education and science.

Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **V** = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2015

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

18-Dec-2019 (2019-59)

12-Jun-2024 (2024-78)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.

The subject is divided into

Abbreviation	Module title	ECTS credits	Method of grading	page
Module Area A: Focus Subject (60 ECTS credits)				
Focus Subject Biology (60 ECTS credits)				
07-GY-BFM-152-m01	Research Methods in Biology	5	B/NB	19
07-GY-FOP-152-m01	Research-oriented working in Biology	7	NUM	20
07-LA-HUBIO-1-152-m01	Basic Human Biology I - GY	6	NUM	22
07-LA-HUBIO-2-152-m01	Basic Human Biology II	5	B/NB	23
07-GY-MIBI-152-m01	Advanced Microbiology - GY	5	NUM	21
07-MS1-152-m01	Neurobiology, Behavioural Physiology and Animal Ecology	10	NUM	51
07-MS1CB-152-m01	Endogenous Clocks	10	NUM	55
07-MS1NMND-152-m01	Neuromodulation and Neuronal Development	10	NUM	67
07-MS1NF1-152-m01	Neurobiology F1	10	NUM	63
07-MS1NF2-152-m01	Neurobiology F2	15	B/NB	65
07-MS1TÖ-152-m01	Animal Ecology and Tropical Biology	10	NUM	69
07-MS1TÖ2-152-m01	Animal Ecology and Tropical Biology 2	10	NUM	71
07-MS1TÖF1-152-m01	Animal Ecology F1	10	NUM	73
07-MS1TÖF2-152-m01	Animal Ecology and Tropical Biology F2	15	B/NB	75
07-MS1K-152-m01	Animal Communication	10	NUM	59
07-MS1ES-152-m01	Experimental Sociobiology	10	NUM	57
07-MS1NB-152-m01	Neurogenetics of Behaviour	10	NUM	61
07-MS1VF1-152-m01	Behavioural Physiology and Sociobiology F1	10	NUM	77
07-MS1VF2-152-m01	Behavioural Physiology and Sociobiology F2	15	B/NB	79
07-MS2-152-m01	Molecular Biology	10	NUM	81
07-MS2ZE1-152-m01	Cell and Developmental Biology Master 1	10	NUM	111
07-MS2ZE2-152-m01	Cell and Developmental Biology Master 2	10	NUM	113
07-MS2ZEF1-152-m01	Cell and Developmental Biology F1	10	NUM	115
07-MS2ZEF2-152-m01	Cell and Developmental Biology F2	15	B/NB	117
07-MS2INF-152-m01	Infection Biology	10	NUM	99
07-MS2PA-152-m01	Pathogenicity of Microorganisms	10	NUM	107
07-MS2MF1-152-m01	Microbiology F1	10	NUM	103
07-MS2MF2-152-m01	Microbiology F2	15	B/NB	105
07-MS2BT-152-m01	Biophysics and Molecular Biotechnology	10	NUM	91
07-MS2BTF1-152-m01	Biophysics and Molecular Biotechnology F1	10	NUM	95
07-MS2BTF2-152-m01	Biophysics and Molecular Biotechnology F2	15	B/NB	97
07-MS2BI-152-m01	Bioinformatics	10	NUM	85
07-MS2BIF1-152-m01	Bioinformatics F1	10	NUM	87
07-MS2BIF2-152-m01	Bioinformatics F2	15	B/NB	89
07-MS31-152-m01	Current Methods in Biology	10	NUM	119
07-MS31POEK-152-m01	Plant Ecology	10	NUM	131
07-MS31PIP-152-m01	Plant Immunobiology and Pharmaceutical Biology	10	NUM	127
07-MS3BB-152-m01	Biophysics and Biochemistry	10	NUM	135
07-MS31MPPF1-152-m01	Molecular Plant Physiology F1	10	NUM	123

07-MS31MPP-F2-152-m01	Molecular Plant Physiology F2	15	B/NB	125
07-MS3BSBF1-152-m01	Biochemistry and Structural Biology F1	10	NUM	143
07-MS3BSBF2-152-m01	Biochemistry and Structural Biology F2	15	B/NB	145
07-MS3BPF1-152-m01	Biophysics of Plant Membrane Proteins F1	10	NUM	139
07-MS3BPF2-152-m01	Biophysics of Plant Membrane Proteins F2	15	B/NB	141
07-MS3SPF1-152-m01	Plant Signalling F1	10	NUM	165
07-MS3SPF2-152-m01	Plant Signalling F2	15	B/NB	167
07-MS3PBMF1-152-m01	Pharmaceutical Biology and Metabolomics F1	10	NUM	155
07-MS3PBMF2-152-m01	Pharmaceutical Biology and Metabolomics F2	15	B/NB	157
07-MS3PPEF1-152-m01	Physiological Plant Ecology F1	10	NUM	159
07-MS3PPEF2-152-m01	Physiological Plant Ecology F2	15	B/NB	161
07-MS3MCPE-F1-152-m01	Molecular and Chemical Plant Ecology F1	10	NUM	151
07-MS3MCPE-F2-152-m01	Molecular and Chemical Plant Ecology F2	15	B/NB	153
07-MS3S-152-m01	Systems Biology	10	NUM	163
07-MS3SYF1-152-m01	Systems Biology F1	10	NUM	169
07-MS3SYF2-152-m01	Systems Biology F2	15	B/NB	171
07-MS3COBF1-152-m01	Computational Biology F1	10	NUM	147
07-MS3COBF2-152-m01	Computational Biology F2	15	B/NB	149
07-MSL1-152-m01	Laboratory Course 1	5	B/NB	180
07-MSL2-152-m01	Laboratory Course 2	10	B/NB	182
07-MSL3-152-m01	Laboratory Course 3	15	B/NB	184
07-MSA1-152-m01	External Internship 1	5	B/NB	173
07-MSA2-152-m01	External Internship 2	10	B/NB	175
07-MSA3-152-m01	External Internship 3	15	B/NB	176
07-ML-152-m01	Linux and Perl	5	B/NB	37
07-MLS1B-152-m01	Methods in Life Sciences B	7	B/NB	41
07-MLS1-152-m01	Methods in Life Sciences	10	NUM	39
07-MLS2B-152-m01	Topics and Concepts in Life Sciences B	7	B/NB	45
07-MLS2-152-m01	Topics and Concepts in Life Sciences	10	NUM	43
07-MS31B-152-m01	Current Methods in Biology B	7	B/NB	121
07-MS31POEK-B-152-m01	Plant Ecology B	5	B/NB	133
07-MS31PIPB-152-m01	Plant Immunobiology and Pharmaceutical Biology B	5	B/NB	129
07-MS3BBB-152-m01	Biophysics and Biochemistry B	5	B/NB	137
07-MS2BTB-152-m01	Biophysics and Molecular Biotechnology B	5	NUM	93
07-MS1B-152-m01	Neurobiology, Behavioural Physiology and Animal Ecology B	7	B/NB	53
07-MNBB-152-m01	Neurogenetics of Behaviour B	5	B/NB	47
07-MENMNB-152-m01	Neuromodulation and Neuronal Development B	5	B/NB	28
07-MECB-152-m01	Endogenous Clocks B	5	B/NB	26
07-MTÖB-152-m01	Animal Ecology and Tropical Biology B	5	B/NB	188
07-MTÖ2B-152-m01	Animal Ecology and Tropical Biology 2 B	5	B/NB	186
07-MKB-152-m01	Animal Communication B	7	B/NB	33
07-MESB-152-m01	Experimental Sociobiology B	7	B/NB	30

07-MS2B-152-m01	Molecular Biology B	7	B/NB	83
07-MS2INF-B-152-m01	Infection Biology B	5	B/NB	101
07-MS2PA-B-152-m01	Pathogenicity of Microorganisms B	5	B/NB	109
07-MBI-B-152-m01	Bioinformatics B	5	B/NB	24
07-MS-B-152-m01	Systems Biology B	5	B/NB	178
07-MKEWO-152-m01	Nucleus Workshop	7	B/NB	35
07-MTROP-152-m01	Tropical Ecology	5	NUM	190
07-MPWD-152-m01	Presentation of Scientific Data	5	B/NB	49
07-MGLN-152-m01	Quality Assurance, Good Practice, Biosafety and Biosecurity	5	NUM	32
07-MVMINT4-152-m01	Special Subject Studies Biology and Natural Sciences 4	5	NUM	196
07-MVMINT4B-152-m01	Special Subject Studies Biology and Natural Sciences 4B	5	B/NB	198
07-MVMINT5-152-m01	Special Subject Studies Biology and Natural Sciences 5	6	B/NB	200
07-MV4-152-m01	Special Subject Studies outside Natural Sciences 4	5	NUM	192
07-MV4B-152-m01	Special Subject Studies outside Natural Sciences 4B	5	B/NB	194
07-DR4-152-m01	Teaching 4	5	B/NB	18
Focus Subject Chemistry (60 ECTS credits)				
08-SCM3-152-m01	Bioorganic Chemistry	5	NUM	271
08-FU-NT-152-m01	Chemically and bio-inspired Nanotechnology for Material Synthesis	5	NUM	224
08-AC-ELO-152-m01	Elemental Organic Chemistry	5	NUM	201
08-AC-FK-152-m01	Solid State Chemistry	3	NUM	203
08-ACM3-161-m01	Solid state chemistry and inorganic materials	5	NUM	206
08-Forsch-LAGY-152-m01	Practical Research Course for Grammar School Teachers	8	B/NB	217
08-OCM-AKP1-161-m01	Advanced Research Project Organic Chemistry	10	B/NB	239
08-PCM6-161-m01	Physical Chemistry (Advanced Lab)	5	B/NB	257
08-ACM1-161-m01	Advanced Inorganic Chemistry	10	NUM	204
08-ACPM-161-m01	Inorganic Chemistry practical course for advanced	10	B/NB	207
08-PH-KAC-152-m01	Clinical-analytical Chemistry	5	NUM	267
08-PCM1a-161-m01	Laser Spectroscopy	5	NUM	245
08-PCM1b-161-m01	Advanced Physical Chemistry (Lab)	5	B/NB	247
08-FU-MaWi1-152-m01	Material Science 1 (Basic introduction)	5	NUM	218
08-FU-MaWi2-152-m01	Material Science 2 (The Material Groups)	5	NUM	220
08-FMM-MP-161-m01	Lab Course Material Science	5	B/NB	215
08-OCM-SYNT-161-m01	Modern Synthetic Methods	5	NUM	243
08-BC-MOLMC-161-m01	Molecular Biology for Advanced Students	5	NUM	208
08-FU-MoMaV-152-m01	Molecular Materials (Lecture)	5	NUM	222
08-PC-MBS-152-m01	Molecular structure and spectroscopy	5	NUM	259
08-PCM3-161-m01	Nanoscale Materials	5	NUM	251
08-OC3-152-m01	Organic Chemistry 3	6	NUM	236
08-OC4-152-m01	Organic Chemistry 4	5	NUM	237
08-OCM-FM-161-m01	Organic Functional Materials	5	NUM	240
08-PCM5-161-m01	Physical Chemistry of Supramolecular Assemblies	5	NUM	255
08-PH-KACP-152-m01	Practical course of clinical-analytical Chemistry	5	B/NB	268
08-FMM-PA-161-m01	Project Work	5	B/NB	216
08-TC-152-m01	Quantum Chemistry	3	NUM	274
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o8-PCM2-161-mo1	Statistical Mechanics and Reaction Dynamics	5	NUM	249
o8-PC-SBL1-152-mo1	Symmetry, chemical bonding and light - Part 1	6	NUM	266
o8-PCM4-161-mo1	Ultrafast spectroscopy and quantum-control	5	NUM	253
o8-BC-VPMM-161-mo1	Practical course "Molecular Machines" for advanced students	10	NUM	211
o8-BC-VPPD-161-mo1	Practical course "Protein Degradation in Eukaryotes" for advanced students	10	NUM	212
o8-BC-VPRB-161-mo1	Practical course "RNA Biochemistry" for advanced students	10	NUM	213
o8-BC-VPSB-161-mo1	Practical course "Structural Biology" for advanced students	10	NUM	214
o8-TCM1-161-mo1	Selected Topics in Theoretical Chemistry	5	NUM	280
o8-ACM2-161-mo1	Bioinorganic Chemistry	5	NUM	205
o8-SCM4-161-mo1	Supramolecular Chemistry (Advanced Lab)	5	B/NB	273
o8-SCM1-152-mo1	Supramolecular Chemistry (Basics)	5	NUM	269
o8-TCM2-161-mo1	Basics and Applications of Quantum Chemistry	5	NUM	282
o8-MCM1-161-mo1	Practical course medicinal chemistry	10	B/NB	232
o8-OCM-NAT-172-mo1	Modern Aspects of Natural Product Chemistry and Biological Chemistry	5	NUM	242
o8-BC-MOLP-172-mo1	Molecular Biology laboratory course	10	NUM	209
o8-TCM3-161-mo1	Numerical Methods and Programming	5	NUM	284
o8-HKM1-152-mo1	Organo- and Biocatalysis	5	NUM	226
o8-MCM2a-161-mo1	Pharmaceutical/Medicinal Chemistry 1	5	NUM	233
o8-MCM2b-161-mo1	Pharmaceutical/Medicinal Chemistry 2	5	NUM	234
o3-FU-PM1-152-mo1	Polymer Chemistry 1 (Lecture and Practical Course)	5	NUM	14
o3-FU-PM2-161-mo1	Polymers II	5	NUM	15
o8-HKM3AC-161-mo1	Practical course "Homogeneous catalysis in Inorganic Chemistry"	5	B/NB	229
o8-HKM3OC-161-mo1	Practical course "Homogeneous catalysis in Organic Chemistry"	5	B/NB	230
o8-SCM2-161-mo1	Supramolecular Chemistry (Practical Course)	5	B/NB	270
o8-TCM4-161-mo1	Quantum Dynamics	5	NUM	286
o8-HKM2-161-mo1	Advanced organometallic chemistry and its application in homogeneous catalysis	5	NUM	228
o8-HKM4-161-mo1	Advanced transition metal chemistry	5	NUM	231
o8-TCAP1-161-mo1	Theoretical Chemistry - Project course quantum chemistry	5	B/NB	276
o8-TCAP2-161-mo1	Theoretical Chemistry - Project course quantum dynamics	5	B/NB	278
o8-MCM3-172-mo1	Drug design	5	NUM	235
Focus Subject Computer Science (60 ECTS credits)				
10-HCI=3DUI-161-mo1	3D User Interfaces	5	NUM	288
10-I=HCI-161-mo1	Introduction into Human-Computer Interaction	5	NUM	334
10-HCI=RIS-182-mo1	Real-Time Interactive Systems	5	NUM	294
10-I-REP-152-mo1	Exam Tutorial for the German Staatsexamen	4	B/NB	403
10-I-3D-152-mo1	3D Point Cloud Processing	5	NUM	380
10-I=AA-152-mo1	Advanced Automation	8	NUM	296
10-I=AGIS-161-mo1	Algorithms for Geographic Information Systems	5	NUM	300
10-I=AG-161-mo1	Computational Geometry	5	NUM	298
10-I-AGT-152-mo1	Algorithmic Graph Theory	5	NUM	382
10-I=APA-161-mo1	Approximation Algorithms	5	NUM	316

10-I=AUT-161-m01	Automata Theory	5	NUM	320
10-I=AVS-161-m01	Avionics Systems	5	NUM	322
10-I=BER-161-m01	Computability Theory	5	NUM	324
07-BI-161-m01	Bioinformatics	5	NUM	16
10-I=CB-161-m01	Compiler Construction	5	NUM	326
10-I-DM-152-m01	Data Mining	5	NUM	386
10-I=DB2-161-m01	Databases 2	5	NUM	328
10-I=DDB-172-m01	Deductive Databases	5	NUM	329
10-I=ES-161-m01	Embedded Systems	8	NUM	332
10-I=EL-161-m01	E-Learning	5	NUM	330
10-I=PA-161-m01	Analysis and Design of Programs	5	NUM	351
10-I=APR-161-m01	Advanced Programming	5	NUM	318
10-I=APR-172-m01	Advanced Programming	5	NUM	384
10-I-HWP-152-m01	Practical course in hardware	10	B/NB	388
10-I=IR-161-m01	Information Retrieval	5	NUM	336
10-I=ICG-152-m01	Interactive Computer Graphics	5	NUM	390
10-I=KT-191-m01	Computational Complexity	5	NUM	394
10-I=KT2-161-m01	Computational Complexity II	5	NUM	342
10-I=KD-191-m01	Cryptography and Data Security	5	NUM	392
10-I=LOG-152-m01	Logic for informatics	5	NUM	396
10-I=PV-152-m01	Project Presentation	5	NUM	398
10-I=RAL-152-m01	Digital computer systems	10	NUM	401
10-I=RAK-152-m01	Computer Architecture	5	NUM	399
10-I=RIÜ-191-m01	Computer Networks and Information Transmission	10	NUM	404
10-I=RK-161-m01	Computer Networks and Communication Systems	8	NUM	362
10-I=SEM1-152-m01	Seminar - Selected Topics in Computer Science 1	5	NUM	406
10-I=TIV-152-m01	Theoretical Informatics	5	NUM	409
10-I=TIT-191-m01	Tutorial Theoretical Informatics	5	B/NB	408
10-I=WBS-152-m01	Knowledge-based Systems	5	NUM	411
10-I=AKA-161-m01	Selected Topics in Algorithms	5	NUM	302
10-I=AKES-161-m01	Selected Topics in Embedded Systems	5	NUM	304
10-I=AKHCI-182-m01	Selected Topics in HCI	5	NUM	305
10-I=AKII-182-m01	Selected Topics in Computer Science	5	NUM	306
10-I=AKIS-161-m01	Selected Topics in Intelligent Systems	5	NUM	307
10-I=AKIT-161-m01	Selected Topics in Internet Technologies	5	NUM	308
10-I=AKITS-172-m01	Selected Topics in IT Security	5	NUM	310
10-I=AKLR-161-m01	Selected Topics in Aerospace Engineering	5	NUM	311
10-I=AKT-161-m01	Selected Topics in Theory	5	NUM	314
10-I=AKSE-161-m01	Selected Topics in Software Engineering	5	NUM	313
10-I=KI1-161-m01	Artificial Intelligence 1	5	NUM	338
10-I=KI2-161-m01	Artificial Intelligence 2	5	NUM	340
10-I=LVS-161-m01	Performance Evaluation of Distributed Systems	8	NUM	344
10-I=LP-172-m01	Logic Programming	5	NUM	343
10-I=NLP-182-m01	Machine Learning for Natural Language Processing	5	NUM	350
10-HCI=MLUI-161-m01	Machine Learning (for User Interfaces)	5	NUM	290
10-I=ML-161-m01	Mathematical Logic	5	NUM	348

10-I=MI-161-m01	Medical Informatics	5	NUM	346
10-I=HCI=MMUI-161-m01	Multimodal User Interfaces	5	NUM	292
10-I=PEB-161-m01	Performance Engineering & Benchmarking of Computer Systems	5	NUM	353
10-I=PRAK-161-m01	Practical course - Current Topics in Computer Science	10	B/NB	358
10-I=PM-182-m01	Professional Project Management	5	NUM	355
10-I=PNN-182-m01	Programming with neural nets	5	NUM	357
10-I=PRJAK-162-m01	Project - Current Topics in Computer Science	5	NUM	359
10-I=RAM-161-m01	Computer Arithmetic	5	NUM	360
10-I=RO1-182-m01	Robotics 1	8	NUM	364
10-I=RO2-152-m01	Robotics 2	8	NUM	365
10-I=SEM3-161-m01	Seminar 1 - Current Topics in Computer Science	5	NUM	369
10-I=SEM4-161-m01	Seminar 2 - Current Topics in Computer Science	5	NUM	370
10-I=SSS-172-m01	Security of Software Systems	5	NUM	372
10-I=ST-161-m01	Discrete Event Simulation	8	NUM	374
10-I=SAR-161-m01	Software Architecture	5	NUM	367
10-I=SSD-152-m01	Spacecraft System Design	8	NUM	371
10-I=STM-162-m01	NLP and Text Mining	5	NUM	376
10-I=VG-161-m01	Visualization of Graphs	5	NUM	378
Focus Subject Computer Mathematics (60 ECTS credits)				
10-M=VATP-161-m01	Algebraic Topology	10	NUM	525
10-M=AAAN-161-m01	Applied Analysis	10	NUM	413
10-M=AALG-161-m01	Topics in Algebra	10	NUM	415
10-M=VGEO-161-m01	Aspects of Geometry	5	NUM	541
10-M=VANA-161-m01	Selected Topics in Analysis	10	NUM	523
10-M=VFNM-161-m01	Selected Topics in Financial Mathematics	10	NUM	535
10-M=VOPT-161-m01	Selected Topics in Optimization	10	NUM	572
10-M=ADGM-161-m01	Differential Geometry	10	NUM	417
10-M=VDIM-161-m01	Discrete Mathematics	5	NUM	531
10-M=VDSY-161-m01	Dynamical Systems	5	NUM	533
10-M=AFTH-161-m01	Complex Analysis	10	NUM	421
10-M=VGEM-161-m01	Geometrical Mechanics	10	NUM	539
10-M=AGMS-161-m01	Geometric Structures	10	NUM	423
10-M-HAG-Ü-162-m01	Overview Algebra and Geometry (Differential Geometry or Projective Geometry) for Teaching Degree (German Gymnasium)	10	NUM	589
10-M-HHA-Ü-162-m01	Overview Higher Analysis for Teaching Degree (German Gymnasium) (Differential Equations and Complex Analysis, or Advanced Analysis and Complex Analysis)	10	NUM	590
10-M-HSA-Ü-162-m01	Overview Stochastics and Applied Mathematics (Numerical Mathematics 1 or Discrete Mathematics) for Teaching Degree (German Gymnasium)	8	NUM	591
10-M=AGPC-161-m01	Giovanni Prodi Lecture (Master)	5	NUM	425
10-M=AOPT-161-m01	Basics in Optimization	10	NUM	432
10-M=VGDS-161-m01	Groups and their Representations	10	NUM	537
10-M=AIST-161-m01	Industrial Statistics 1	10	NUM	426
10-M=VIST-161-m01	Industrial Statistics 2	10	NUM	550

10-M=VKAR-161-mo1	Field Arithmetics	10	NUM	552
10-M=ALTH-161-mo1	Lie Theory	10	NUM	428
10-M=ANGG-161-mo1	Numeric of Large Systems of Equations	10	NUM	430
10-M=VNPE-161-mo1	Numeric of Partial Differential Equations	10	NUM	570
10-M=ARTH-161-mo1	Control Theory	10	NUM	434
10-M=VSTA-161-mo1	Statistical Analysis	10	NUM	580
10-M=ASMR-161-mo1	Stochastic Models of Risk Management	10	NUM	436
10-M=ASTP-161-mo1	Stochastic Processes	10	NUM	438
10-M=ATOP-161-mo1	Topology	10	NUM	440
10-M=AVSM-161-mo1	Insurance Mathematics 1	10	NUM	442
10-M=VVSM-161-mo1	Insurance Mathematics 2	10	NUM	584
10-M=AZTH-161-mo1	Number Theory	10	NUM	446
10-M=AZRA-161-mo1	Time Series Analysis 1	10	NUM	444
10-M=VZRA-161-mo1	Time Series Analysis 2	10	NUM	588
10-M=MP2-161-mo1	Algebra and Dynamics of Quantum Systems	10	NUM	490
10-M=MP1-161-mo1	Analysis and Geometry of Classical Systems	10	NUM	488
10-M=VADG-161-mo1	Applied Differential Geometry	10	NUM	519
10-M=GALG-161-mo1	Research in Groups - Algebra	10	NUM	450
10-M=GDFQ-161-mo1	Research in Groups - Deformation Quantization	10	NUM	455
10-M=GDGE-161-mo1	Research in Groups - Differential Geometry	10	NUM	457
10-M=GDIM-161-mo1	Research in Groups - Discrete Mathematics	10	NUM	459
10-M=GDSC-161-mo1	Research in Groups - Dynamical Systems and Control Theory	10	NUM	461
10-M=GCOA-161-mo1	Research in Groups - Complex Analysis	10	NUM	452
10-M=GGMT-161-mo1	Research in Groups - Geometry and Topology	10	NUM	463
10-M=GCQS-161-mo1	Research in Groups - Control Theory of Quantum Mechanical Systems	10	NUM	454
10-M=GMAI-161-mo1	Research in Groups - Measure and Integral	10	NUM	466
10-M=GMCX-161-mo1	Research in Groups - Mathematics in Context	10	NUM	470
10-M=GMSC-161-mo1	Research in Groups - Mathematics in the Sciences	10	NUM	472
10-M=GNMA-161-mo1	Research in Groups - Numerical Mathematics and Applied Analysis	10	NUM	476
10-M=GROC-161-mo1	Research in Groups - Robotics, Optimization and Control Theory	10	NUM	482
10-M=GSTA-161-mo1	Research in Groups - Statistics	10	NUM	484
10-M=GNTH-161-mo1	Research in Groups - Number Theory	10	NUM	478
10-M=GTSA-161-mo1	Research in Groups - Time Series Analysis	10	NUM	486
10-M=VMPH-161-mo1	Selected Topics in Mathematical Physics	10	NUM	562
10-M=VTRT-161-mo1	Selected Topics in Control Theory	10	NUM	582
10-M=AFAN-161-mo1	Functional Analysis	10	NUM	419
10-M=VGPA-161-mo1	Giovanni Prodi Lecture Advanced Topics (Master)	10	NUM	545
10-M=VGPM-161-mo1	Giovanni Prodi Lecture Modern Topics (Master)	10	NUM	546
10-M=VGPS-161-mo1	Giovanni Prodi Lecture Selected Topics (Master)	10	NUM	547
10-M=VIPR-161-mo1	Inverse Problems	5	NUM	548
10-M=VKGE-161-mo1	Complex Geometry	10	NUM	554
10-M=VMBV-161-mo1	Mathematical Imaging	5	NUM	560
10-M=VKOM-161-mo1	Mathematical Continuum Mechanics	5	NUM	556

10-M=VMTH-161-mo1	Module Theory	5	NUM	564
10-M=VNAN-161-mo1	Non-linear Analysis	5	NUM	568
10-M=VOST-161-mo1	Optimal Control	5	NUM	574
10-M=VPDP-161-mo1	Partial Differential Equations of Mathematical Physics	10	NUM	576
10-M=VPRG-161-mo1	Pseudo Riemannian and Riemannian Geometry	10	NUM	578
10-M=VVSY-161-mo1	Networked Systems	5	NUM	586
10-M=GNLA-161-mo1	Research in Groups - Non-linear Analysis	10	NUM	474
10-M=GOPA-161-mo1	Research in Groups - Operator Algebras	10	NUM	480
10-M=SGPC-161-mo1	Giovanni Prodi Seminar (Master)	5	NUM	504
10-M=SIDC-161-mo1	Interdisciplinary Seminar	5	NUM	507
10-M=SALG-161-mo1	Seminar in Algebra	5	NUM	494
10-M=SADG-161-mo1	Seminar in Applied Differential Geometry	5	NUM	492
10-M=SDSC-161-mo1	Seminar in Dynamical Systems and Control	5	NUM	500
10-M=SFIM-161-mo1	Seminar in Financial and Insurance Mathematics	5	NUM	502
10-M=SCOA-161-mo1	Seminar in Complex Analysis	5	NUM	498
10-M=SGTO-161-mo1	Seminar in Geometry and Topology	5	NUM	505
10-M=SMSC-161-mo1	Seminar Mathematics in the Sciences	5	NUM	509
10-M=SNLA-161-mo1	Seminar in Non-linear Analysis	5	NUM	511
10-M=SNMA-161-mo1	Seminar in Numerical Mathematics and Applied Analysis	5	NUM	513
10-M=SOPT-161-mo1	Seminar in Optimization	5	NUM	515
10-M=SSTA-161-mo1	Seminar in Statistics	5	NUM	517
10-M=VAGE-192-mo1	Algebraic Geometry	10	NUM	521
10-M=VAZT-192-mo1	Algorithmic Number Theory	10	NUM	527
10-M=GADG-192-mo1	Research in Groups - Applied Differential Geometry	10	NUM	448
10-M=GLIE-192-mo1	Research in Groups - Lie Theory	10	NUM	465
10-M=GMAP-192-mo1	Research in Groups - Mathematical Physics	10	NUM	468
10-M=VNAM-192-mo1	Selected Topics in Numerical and Applied Mathematics	10	NUM	566
10-M=VCAL-192-mo1	Computer Algebra	10	NUM	529
10-M=VGFT-192-mo1	Geometric Complex Analysis	10	NUM	543
10-M=VKRY-192-mo1	Cryptography/Coding Theory	10	NUM	558
10-M=SAMA-192-mo1	Seminar Applied Mathematics	5	NUM	496
Focus Subject Computer Physics (60 ECTS credits)				
11-EXE5-161-mo1	Current Topics in Experimental Physics	5	NUM	624
11-EXE6-161-mo1	Current Topics in Experimental Physics	6	NUM	626
11-EXE7-161-mo1	Current Topics in Experimental Physics	7	NUM	630
11-EXE8-161-mo1	Current Topics in Experimental Physics	8	NUM	632
11-EXE6A-161-mo1	Current Topics in Experimental Physics	6	NUM	628
11-EXP6-161-mo1	Current Topics in Physik	6	NUM	634
11-EXP6A-161-mo1	Current Topics in Physik	6	NUM	636
11-EXT5-161-mo1	Current Topics of Theoretical Physics	5	NUM	638
11-EXT6-161-mo1	Current Topics of Theoretical Physics	6	NUM	640
11-EXT7-161-mo1	Current Topics of Theoretical Physics	7	NUM	644
11-EXT8-161-mo1	Current Topics of Theoretical Physics	8	NUM	646
11-EXT6A-161-mo1	Current Topics of Theoretical Physics	6	NUM	642
11-ASM-161-mo1	Methods of Observational Astronomy	6	NUM	598
11-ATTP-161-mo1	Selected Topics of Theoretical Elementary Particle Physics	6	NUM	604
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11-BSV-161-mo1	Image and Signal Processing in Physics	6	NUM	610
11-BMT-161-mo1	Biophysical Measurement Technology in Medical Science	6	NUM	606
11-BWW-161-mo1	Bosonisation and Interactions in One Dimension	6	NUM	612
11-CMS-161-mo1	Computational Materials Science (DFT)	8	NUM	614
11-ASP-161-mo1	Introduction to Space Physics	6	NUM	600
11-FKS-161-mo1	Solid State Spectroscopy	6	NUM	652
11-FPA-161-mo1	Visiting Research	10	NUM	654
11-CSAM-161-mo1	Advanced Topics in Astrophysics	6	NUM	618
11-CSFM-161-mo1	Advanced Topics in Solid State Physics	6	NUM	620
11-L-GKP-152-mo1	General Concepts of Physics	6	NUM	668
11-APL-161-mo1	High Energy Astrophysics	6	NUM	596
11-AKM-161-mo1	Cosmology	6	NUM	592
11-BSM-161-mo1	Models Beyond the Standard Model of Elementary Particle Physics	6	NUM	608
11-L-M3-152-mo1	Modern Physics 3 (Nuclear, Particle and Astrophysics)	6	NUM	670
11-CRP-161-mo1	Renormalization Group and Critical Phenomena	6	NUM	616
11-L-T1-161-mo1	Theoretical Physics 1 for Pre Service Teachers	7	NUM	671
11-L-T2-161-mo1	Theoretical Physics 2 for Pre Service Teachers - Exercises	7	NUM	673
11-NMA-161-mo1	Computational Astrophysics	6	NUM	681
11-GGD-161-mo1	Introduction to Gauge/Gravity Duality	8	NUM	655
11-TPE-161-mo1	Experimental Particle Physics	6	NUM	725
11-KFT-161-mo1	Conformal Field Theory	6	NUM	664
11-KFT2-161-mo1	Conformal Field Theory 2	6	NUM	666
11-MAG-161-mo1	Magnetism	6	NUM	675
11-MAS-161-mo1	Multi-wavelength Astronomy	6	NUM	677
11-NOP-161-mo1	Nano-Optics	6	NUM	683
11-HNS-161-mo1	Optical Properties of Semiconductor Nanostructures	6	NUM	660
11-OHL-161-mo1	Organic Semiconductors	6	NUM	685
11-PKS-161-mo1	Physics of Complex Systems	6	NUM	687
11-PMM-161-mo1	Physics of Advanced Materials	6	NUM	689
11-QFT2-161-mo1	Quantum Field Theory II	8	NUM	695
11-QM2-161-mo1	Quantum Mechanics II	8	NUM	699
11-RTT-161-mo1	Theory of Relativity	6	NUM	705
11-RMFT-161-mo1	Renormalization Group Methods in Field Theory	8	NUM	703
11-SPI-161-mo1	Spintronics	6	NUM	709
11-TEP-161-mo1	Theoretical Elementary Particle Physics	8	NUM	719
11-TFK-161-mo1	Theoretical Solid State Physics	8	NUM	721
11-TFK2-161-mo1	Theoretical Solid State Physics 2	8	NUM	723
11-MRI-171-mo1	Advanced Magnetic Resonance Imaging	6	NUM	679
11-EPP-161-mo1	Introduction to Plasma Physics	6	NUM	622
11-SSC-172-mo1	Surface Science	6	NUM	711
11-STRG1-171-mo1	String Theory 1	8	NUM	713
11-STRG2-171-mo1	String Theory 2	6	NUM	715
11-SLQ-232-mo1	Black Holes	6	NUM	707
11-AST-161-mo1	Theoretical Astrophysics	6	NUM	602
11-AKTF-201-mo1	Selected Topics of Theoretical Solid State Physics	6	NUM	594

11-FFK-201-m01	Field Theory in Solid State Physics	8	NUM	648
11-FK2-201-m01	Solid State Physics 2	8	NUM	650
11-QIC-201-m01	Advanced Theory of Quantum Computing and Quantum Information	6	NUM	697
11-GRTM-201-m01	Group Theory	6	NUM	658
11-HPH-201-m01	Semiconductor Physics	6	NUM	662
11-PTS-201-m01	Phenomenology and Theory of Superconductivity	6	NUM	691
11-QFT1-201-m01	Quantum Field Theory I	8	NUM	693
11-QTR-201-m01	Quantum Transport	6	NUM	701
11-TPSM-201-m01	Particle Physics (Standard Model)	6	NUM	727
11-TEFK-201-m01	Topological Effects in Solid State Physics	8	NUM	717
Module Area B: Focus Subject-based Didactics (10 ECTS credits)				
MINT-B1-162-m01	Advanced Subject Didactics 1	5	NUM	729
MINT-B2-162-m01	Advanced Subject Didactics 2	5	NUM	731
Module Area C: International, interdisciplinary research (10 ECTS credits)				
MINT-C1-162-m01	Research in Groups	5	B/NB	733
MINT-C2-162-m01	Scientific Internship	5	B/NB	734
Module Area D: Subject specific key skills (10 ECTS credits)				
MINT-D1-162-m01	Key Competences for Teaching Professions 1	5	B/NB	735
MINT-D2-162-m01	Key Competences for Teaching Professions 2	5	B/NB	737
Module Area E: Master Thesis (30 ECTS credits)				
MINT-MA-162-m01	Master-Thesis	30	NUM	739

Module title			Abbreviation
Polymer Chemistry 1 (Lecture and Practical Course)			03-FU-PM1-152-m01
Module coordinator		Module offered by	
holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
Basic methods of polymerisation: free radical polymerisations, polyadditions, ionic polymerisations, controlled radical polymerisations; characterisation of polymers and polymer analytics: gel permeation chromatography, endgroup analysis, mass spectrometry, rheology.			
Intended learning outcomes			
The students acquire fundamentals of polymer chemistry and the related methods for their characterisation.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + P (2)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) assessment and b) Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical assignments (2 to 4 random examinations) Language of assessment: German and/or English Assessment offered: Once a year, winter semester creditable for bonus			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Bachelor's degree (1 major) Functional Materials (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Functional Materials (2021) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Bachelor's degree (1 major) Functional Materials (2025)			
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Module title		Abbreviation
Polymers II		03-FU-PM2-161-m01
Module coordinator		Module offered by
holder of the Chair of Functional Materials in Medicine and Dentistry		Faculty of Medicine
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Deepend polymer synthesis methods, special polymers (block copolymers, co-polymerization techniques, complex polymer architectures), biodegradable polymers, polypeptoides, natural polymers. We will discuss the application of the respective polymers: e.g as biomaterials, for electrospinning, for the production of hydrogels and their behavior on surfaces.		
Intended learning outcomes		
The student acquire advanced knowledge in polymer manufacturing, analysis and applications. This involves different synthetic routes with which the different molecules can be prepared from different starting materials. Students can estimate if and how fast a polymer degrades under given circumstances. Furthermore, they gain insight into the field of technically used polymers from nature. Each section also points to possible consequences / disadvantages that synthesis of the various polymers may have, thus drawing students' understanding to ethical concerns.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Bioinformatics		07-BI-161-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Fundamental principles of bioinformatics.		
Intended learning outcomes		
Students are proficient in methods for the analysis of DNA and protein databases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Teaching 4		07-DR4-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	Please consult with course advisory service in advance.
Contents		
Students contribute to and/or independently organise courses for Bachelor's students or pupils. Students organising courses will receive advice on contents and organisation from the degree programme coordinator. The course will comprise 2 weekly contact hours.		
Intended learning outcomes		
Ability to independently organise courses.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Successful completion as certified by the lecturer Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Research Methods in Biology		07-GY-BFM-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Overview of important traditional and modern methods in biology that are applied at the Chairs at the Biocentre, ranging from microscopy and chromatography to polymerase chain reaction (PCR).		
Intended learning outcomes		
Knowledge of the fields of research the Faculty of Biology at the University of Würzburg is investigating.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 45 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (approx. 30 minutes) or d) oral examination in groups of up to 3 candidates (approx. 20 minutes per candidate) or e) presentation (approx. 20 to 30 minutes) or f) practical examination (on average approx. 2 hours; time to complete will vary according to subject area but will not exceed a maximum of 4 hours) or g) term paper (approx. 10 to 30 pages) or h) project (approx. 10 to 30 pages) or i) portfolio. Students will be informed about the method and length of the assessment prior to the course. creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 61 I Nr. 7		
Module appears in		
First state examination for the teaching degree Gymnasium Biology (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Research-oriented working in Biology		07-GY-FOP-152-m01
Module coordinator		Module offered by
Dean of Studies Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module will acquaint students with procedures in biological laboratories. In the research-oriented practical course, students may choose from a range of topics offered by the Faculty of Biology. They will complete a scientific lab course.		
Intended learning outcomes		
Familiarity with fundamental concepts in statistics, e. g. mean value, standard deviation, standard error, creating graphs from raw data, insight into procedures in biological laboratories, deeper familiarity with research methods in a branch of biology, ability to experimentally address scientific problems, ability to design, perform and analyse experiments.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (4)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 45 to 60 minutes) or b) log (approx. 10 to 20 pages) or c) oral examination of one candidate each (approx. 30 minutes) or d) oral examination in groups of up to 3 candidates (approx. 20 minutes per candidate) or e) presentation (approx. 20 to 30 minutes) or f) practical examination (on average approx. 2 hours; time to complete will vary according to subject area but will not exceed a maximum of 4 hours) or g) term paper (approx. 10 to 30 pages) or h) project (approx. 10 to 30 pages) or i) portfolio. Students will be informed about the method and length of the assessment prior to the course. creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 61 I Nr. 7		
Module appears in		
First state examination for the teaching degree Gymnasium Biology (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Module title		Abbreviation
Advanced Microbiology - GY		07-GY-MIBI-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	Admission prerequisite to assessment: exercises. Regular attendance (minimum 80%) and successful completion of exercises (approx. 25 to 30 hours) are prerequisites for admission to assessment.
Contents		
During this lab course, students will deepen their knowledge of the topics covered in the module <i>Grundlagen der Mikrobiologie (Basic Microbiology)</i> . Performing practical laboratory work, students will become familiar with molecular biological methods and approaches.		
Intended learning outcomes		
Students have acquired a fundamental knowledge of methods in both classical microbiology and molecular biology. They are able to use these methods and to discuss current problems in these fields.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 minutes) creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 61 I Nr. 3		
Module appears in		
First state examination for the teaching degree Gymnasium Biology (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Basic Human Biology I - GY		07-LA-HUBIO-1-152-m01
Module coordinator		Module offered by
Dean of Studies Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>This module will be divided up into three sections covering the following topics:</p> <ul style="list-style-type: none"> • human genetics (genetic disease, inheritance), • human physiology (human sensory physiology, nutrition, maintaining physical health), • human developmental physiology (sex organs, impregnation, embryonic development, evolutionary history of modern humans). 		
Intended learning outcomes		
<ul style="list-style-type: none"> • Familiarity with the fundamental principles of human genetics 		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 90 minutes)</p> <p>creditable for bonus</p>		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 61 I Nr. 5		
Module appears in		
<p>First state examination for the teaching degree Gymnasium Biology (2015)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Module studies (Bachelor) Biology (2019)</p> <p>Module studies (Bachelor) Orientierungsstudien (2020)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p>		

Module title		Abbreviation
Basic Human Biology II		07-LA-HUBIO-2-152-m01
Module coordinator		Module offered by
holder of the Chair of Zoology I		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	07-LA-HUBIO-1 or 07-GMR-HUBIO-1
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Experiments to consolidate the students' knowledge of the topics covered in the lecture: We will examine preparations under the microscope, make drawings, develop genetic diagrams showing the inheritance of diseases, perform experiments on human physiology.		
Intended learning outcomes		
Students will be proficient in the theory and practice of research in the field of integrative behavioural biology and will have developed skills required for a career in research.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Logs (approx. 30 hours) and 10 to 15 drawings creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 41 I Nr. 5 § 61 I Nr. 5		
Module appears in		
First state examination for the teaching degree Grundschule Biology (2015) First state examination for the teaching degree Realschule Biology (2015) First state examination for the teaching degree Gymnasium Biology (2015) First state examination for the teaching degree Mittelschule Biology (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) First state examination for the teaching degree Mittelschule Biology (2020 (Prüfungsordnungsversion 2015)) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Bioinformatics B		07-MBI-B-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e. g. net generation sequences, proteomics data), analysis of different functional RNAs (e. g. miRNAs, lncRNAs).		
Intended learning outcomes		
Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biomedicine (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biomedicine (2018) Master's degree (1 major) Biosciences (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Biosciences (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Endogenous Clocks B		07-MECB-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction into endogenous clocks of unicellular organisms, fungi, plants and animals, with a focus on the neuronal organisation of the clock in the brain of mammals and insects. The biological functions of endogenous clocks and the underlying mechanisms will be discussed on the molecular, cellular and organismic levels. It will be explained how clocks adjust to a 24h day with variable photoperiods. Applied aspects regarding e. g. shift work or jetlag will also be discussed.		
Intended learning outcomes		
The students learn fundamental principles underlying chronobiology/endogenous clocks and obtain an insight into current research in the field.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) FOKUS Life Sciences (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023)		
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Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Neuromodulation and Neuronal Development B		07-MENMNDB-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Neuromodulation: cellular and molecular biology of neuromodulators and their receptors, modulation of synaptic transmission and membrane potential, theoretical and functional aspects of neuromodulation, model systems used to study modulation of neuronal circuits. Fundamental principles of molecular developmental neurobiology. Focus is on the establishment of the neuroectoderm, pattern generation and regional specification, neuronal precursors, neuronal growth, differentiation of neurons, axonal pathfinding, neuronal connectivity.		
Intended learning outcomes		
The students learn fundamental principles underlying neuromodulation and neuronal development and obtain an insight into current research in the field.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title			Abbreviation
Experimental Sociobiology B			07-MESB-152-m01
Module coordinator		Module offered by	
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
7	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The lectures highlight the diversity and the evolution of social behaviour, but also focus on the physiological, neurobiological and behavioural mechanisms underlying the organisation of social groups. In a follow-up seminar session, students will deepen their knowledge by presenting and discussing current papers related to the topic of the lecture.			
Intended learning outcomes			
Students understand the value of an integrative approach when looking at complex correlations in behavioural biology. Students are able to recognise and interpret relationships between various aspects of sociobiology. They are able to formulate scientific questions in the context of sociobiology and are able to discuss cutting edge literature in depth.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (1) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
210 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Quality Assurance, Good Practice, Biosafety and Biosecurity			07-MGLN-152-m01
Module coordinator		Module offered by	
Coordinator BioCareers		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Basic Rules of Good Practice in the Life Sciences including laboratory, manufacturing, clinical and manufacturing practices. DIN en iso 9000-9004 standards, environmental protection and Biological safety and security / dual use criteria. Management concepts in the Biosciences.			
Intended learning outcomes			
The students are aware of several regulations and standards in the Life Sciences field and are aware of Quality standards in the Bioscientific context. Furthermore, they deal with management concepts in the field of science, environmental context and industry.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (1) + S (1) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
Teaching cycle: summer semester			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Module title		Abbreviation
Animal Communication B		07-MKB-152-m01
Module coordinator		Module offered by
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The lectures deal with physiological and neurobiological principles of the different communication channels used by animals, but also highlight adaptive values and evolutionary aspects of animal signalling.		
Intended learning outcomes		
Students understand the value of an integrative approach when looking at complex issues in biology. They have learned to connect findings from different research areas, such as physiology, neurobiology, behaviour and ecological conditions, in order to gain a more complete picture of a topic. In addition, students have learned to present and discuss current scientific publications within a broader theoretical framework.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Nucleus Workshop		07-MKEWO-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This course will use a combination of lectures (daily) and practical experiments. Topics to be covered in the lecture (subject to change): - nuclear envelope, nuclear pores and nuclear-cytoplasmic transport. - nuclear envelope, nuclear lamina and their role in chromatin organisation and genetic diseases. - DNA, chromatin and chromosomes. - structure and function of nucleoli. - nuclear-cytoskeletal interactions.		
Intended learning outcomes		
Students are able to perform practical experiments, applying their theoretical knowledge.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (5) + V (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Linux and Perl		07-ML-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to the Linux operating system, writing computer programs using the programming language Perl to answer bioinformatic questions.		
Intended learning outcomes		
Students are able to use Linux as user and to write simple Perl scripts to answer bioinformatic questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 37 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Methods in Life Sciences		07-MLS1-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Versioned molecular techniques, lipid research methods, microscopic methods, immunohistochemistry, mouse models and gene-knockout approaches, protein and molecular biology techniques, PCR, advanced protein biochemistry, methods in bioinformatics and computational biology.		
Intended learning outcomes		
Students are able to review and expand their knowledge of standard molecular techniques and are able to choose methods and techniques to design experiments in a specific research area.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Biosciences (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 39 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)

Module title		Abbreviation
Methods in Life Sciences B		07-MLS1B-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Versioned molecular techniques, lipid research methods, microscopic methods, immunohistochemistry, mouse models and gene-knockout approaches, protein and molecular biology techniques, PCR, advanced protein biochemistry, methods in bioinformatics and computational biology.		
Intended learning outcomes		
Students are able to review and expand their knowledge of standard molecular techniques and are able to choose methods and techniques to design experiments in a specific research area.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: English		
Allocation of places		
--		
Additional information		
--		
Workload		
210 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Topics and Concepts in Life Sciences		07-MLS2-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A broad variety of topics and concepts from the areas of neuroscience, infection and immunity, integrative biology, and biomedicine including for example: protein characterisation, DNA repair, Drosophila, computational biology, and neurocircuits.		
Intended learning outcomes		
Students have an overview of the current research topics in the Graduate School of Life Sciences and are able to explain their significance and scientific background.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (approx. 30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 43 / 739

Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Topics and Concepts in Life Sciences B		07-MLS2B-152-m01
Module coordinator		Module offered by
degree programme coordinator Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A broad variety of topics and concepts from the areas of neuroscience, infection and immunity, integrative biology, and biomedicine including for example: protein characterisation, DNA repair, Drosophila, computational biology, and neurocircuits.		
Intended learning outcomes		
Students have an overview of the current research topics in the Graduate School of Life Sciences and are able to explain their significance and scientific background.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Neurogenetics of Behaviour B		07-MNBB-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
To understand how the brain controls behaviour is at the heart of neuroscience. Both brain and behaviour can be overwhelmingly complex and plastic, yet neurogenetic methods are powerful tools to dissect the principles of how the brain controls behaviour. The lecture and seminar will give a state-of-the art view on current and important topics of behavioural neurobiology (incl. e. g. sleep, control of appetite and feeding, social behaviour, mating, mirror neurons, molecular mechanisms of auditory-guided behaviour, neurogenetic techniques) focusing on genetic model systems such as the fruit fly <i>Drosophila</i> , the mouse, and the nematode <i>C. elegans</i> .		
Intended learning outcomes		
In the lecture, students acquire theoretical and methodological insights into current topics in the field of neurogenetics in general and the neurogenetics of behaviour.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Presentation of Scientific Data			07-MPWD-152-m01
Module coordinator		Module offered by	
Coordinator BioCareers		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
<p>Principles for the preparation of scientific manuscripts, citations and the presentation of scientific data. Students will write a scientific mini review and present this in a talk (15 minutes). Content, structure, coherence and the logical chain of arguments will be discussed. Students will write and publish (where possible) a scientific paper or review on a selected topic in a scientific journal. The students' work will be based on original papers as well as on reviews and will follow the instructions of a scientific journal of the students' choice. These instructions can be found on the website of the respective journal under "Instructions to Authors" or similar. Both length of chapters and structure of the article should be based on the style of the journal selected. Attendance of no less than 20 scientific talks (e. g. defences of doctoral theses, presentations of research projects, retreats) including presentations by guest speakers. Students are to obtain proof of attendance from the organisers or speakers.</p>			
Intended learning outcomes			
<p>The students are familiar with the details of publishing scientific data in written and oral form. They have become familiar with the methodology of scientific publishing in oral or written fashion. In addition, they have enhanced their English reading, speaking and writing skills.</p>			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
<p>a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English</p>			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
<p>Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>			
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Neurobiology, Behavioural Physiology and Animal Ecology			07-MS1-152-m01
Module coordinator		Module offered by	
Dean of Studies Biologie (Biology)		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Timing matters: Temporal organisation in the animal kingdom. Timing plays an important role in all living systems. Animals make use of endogenous clocks to predict and adapt to daily or seasonal changes in environmental parameters. To be at the right place at the right time is of great fitness relevance if -for example- a mating partner or enough food has to be found. Many mutualistic, antagonistic or social interactions can only take place if animals are at the same place at the same time and in the appropriate developmental stage. The lecture gives an introduction to the mechanisms underlying the temporal organisation in the animal kingdom. Adopting an integrative approach, the lecture goes from timing mechanisms on the neuronal level to individual behaviour and then to interactions in social groups, populations or partners in complex and variable ecosystems.			
Intended learning outcomes			
Students get to know the advantages of an integrative approach when analysing complex biological systems. They learn to relate and integrate different fields within biology. In the seminar, students practise the discussion of research findings.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
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Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)			
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Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title			Abbreviation
Neurobiology, Behavioural Physiology and Animal Ecology B			07-MS1B-152-m01
Module coordinator		Module offered by	
Dean of Studies Biologie (Biology)		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
7	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Timing matters: Temporal organisation in the animal kingdom. Timing plays an important role in all living systems. Animals make use of endogenous clocks to predict and adapt to daily or seasonal changes in environmental parameters. To be at the right place at the right time is of great fitness relevance if -for example- a mating partner or enough food has to be found. Many mutualistic, antagonistic or social interactions can only take place if animals are at the same place at the same time and in the appropriate developmental stage. The lecture gives an introduction to the mechanisms underlying the temporal organisation in the animal kingdom. Adopting an integrative approach, the lecture goes from timing mechanisms on the neuronal level to individual behaviour and then to interactions in social groups, populations or partners in complex and variable ecosystems.			
Intended learning outcomes			
Students get to know the advantages of an integrative approach when analysing complex biological systems. They learn to relate and integrate different fields within biology.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
210 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Endogenous Clocks		07-MS1CB-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction into endogenous clocks of unicellular organisms, fungi, plants and animals, with a focus on the neuronal organisation of the clock in the brain of mammals and insects. The biological functions of endogenous clocks and the underlying mechanisms will be discussed on the molecular, cellular and organismic levels. It will be explained how clocks adjust to a 24h day with variable photoperiods. Applied aspects regarding e. g. shift work or jetlag will also be discussed.		
Intended learning outcomes		
The students learn fundamental principles underlying chronobiology/endogenous clocks and obtain an insight into current research in the field. In the seminar, they practise their presentation skills and the discussion of research findings in English.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title			Abbreviation
Experimental Sociobiology			07-MS1ES-152-m01
Module coordinator		Module offered by	
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The lecture covers the diversity and the development of social behaviour as well as the behavioural physiology and mechanisms of neurobiology that are the basis of the organisation of social groups. A special focus is on current research in the Faculty. With the help of selected publications, the seminar will discuss and explore in more detail the topics covered in the lecture.			
Intended learning outcomes			
Students understand the value of an integrative approach when looking at complex correlations in behavioural biology. Students are able to recognise and interpret relationships between various aspects of sociobiology. They are able to formulate scientific questions in the context of sociobiology and are able to discuss cutting edge literature in depth.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (1) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018)			
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Animal Communication		07-MS1K-152-m01
Module coordinator		Module offered by
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The lectures deal with physiological and neurobiological principles of the different communication channels used by animals, but also highlight adaptive values and evolutionary aspects of animal signalling. In a follow-up seminar session, students will deepen their knowledge by presenting and discussing current papers related to the topic of the lecture.		
Intended learning outcomes		
Students understand the value of an integrative approach when looking at complex issues in biology. They have learned to connect findings from different research areas, such as physiology, neurobiology, behaviour and ecological conditions, in order to gain a more complete picture of a topic. In addition, students have learned to present and discuss current scientific publications within a broader theoretical framework.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 59 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Neurogenetics of Behaviour		07-MS1NB-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
To understand how the brain controls behaviour is at the heart of neuroscience. Both brain and behaviour can be overwhelmingly complex and plastic, yet neurogenetic methods are powerful tools to dissect the principles of how the brain controls behaviour. The lecture and seminar will give a state-of-the art view on current and important topics of behavioural neurobiology (incl. e. g. sleep, control of appetite and feeding, social behaviour, mating, mirror neurons, molecular mechanisms of auditory-guided behaviour, neurogenetic techniques) focusing on genetic model systems such as the fruit fly <i>Drosophila</i> , the mouse, and the nematode <i>C. elegans</i> .		
Intended learning outcomes		
In the lecture, students acquire theoretical and methodological insights into current topics in the field of neurogenetics in general and the neurogenetics of behaviour. In the seminar, students practise presenting and discussing research findings in English.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Neurobiology F1		07-MS1NF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A current topic in the field of neurobiology will be investigated. The practical course will be offered in different specialisations: molecular, clinical, cellular, developmental or behavioural neurobiology or in neurogenetics. In addition to a literature search, a variety of neurobiological methods (for example: electrophysiology, immuno-histochemistry, molecular biological techniques, clinical and neurogenetic techniques) and different model systems are offered. The experimental results will be documented and presented in the form of a scientific talk, a publication or a seminar paper.		
Intended learning outcomes		
The participants are able to conduct scientific research within the field of neurobiology. They have acquired the knowledge and skills (e. g. basic and advanced knowledge, special knowledge, advanced methodological background, general and specific methods) to carry out and document neurobiological experiments according to best practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
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Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Neurobiology F2		07-MS1NF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The students will independently work on a smaller project within a current line of research at the Chair. Neurobiological, genetic or molecular techniques will be tested and adapted according to the research aim. The progress of the experiments and the current line of research will be documented and presented in the form of a scientific talk, a publication or a seminar paper.		
Intended learning outcomes		
The participants are able to independently conduct scientific research within the field of neurobiology and to adapt a research plan according to the experimental progress. They have acquired the knowledge and skills (e. g. basic and advanced knowledge, special knowledge, advanced methodological background, general and specific methods) to independently carry out, document and interpret neurobiological experiments according to best practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 65 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Neuromodulation and Neuronal Development		07-MS1NMND-152-m01
Module coordinator		Module offered by
holder of the Chair of Neurobiology and Genetics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Neuromodulation: cellular and molecular biology of neuromodulators and their receptors, modulation of synaptic transmission and membrane potential, theoretical and functional aspects of neuromodulation, model systems used to study modulation of neuronal circuits. Fundamental principles of molecular developmental neurobiology. Focus is on the establishment of the neuroectoderm, pattern generation and regional specification, neuronal precursors, neuronal growth, differentiation of neurons, axonal pathfinding, neuronal connectivity.		
Intended learning outcomes		
The students learn fundamental principles underlying neuromodulation and neuronal development and obtain an insight into current research in the field. In the seminar, students practise presenting and discussing research findings in English.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Animal Ecology and Tropical Biology		07-MS1TÖ-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module consists of a lecture and a seminar. The lecture gives an overview of the theoretical foundations and current issues in animal ecology. Focus will be on biodiversity and ecosystem functions, multi-trophic interactions and food nets, evolutionary ecology, chemical ecology, tropical ecology, agricultural ecology, and global change. In the seminar, recent scientific publications within the topics mentioned above will be presented and discussed.		
Intended learning outcomes		
The students will acquire an advanced knowledge of ecological theories and current research issues in the field of animal ecology. They will be able to interpret scientific publications and apply the acquired knowledge to the solution of current environmental risks.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Animal Ecology and Tropical Biology 2		07-MS1TÖ2-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module provides the fundamentals of the biology of tropical habitats and tropical communities. A special focus is on the global significance of tropical systems (ecosystem goods and ecosystem services), but the biological features of these highly diverse biomes are also highlighted.		
Intended learning outcomes		
The students will acquire deep knowledge of ecological theories and up-to-date research issues in the field of animal ecology of the tropics. They will be qualified to interpret scientific work and apply the knowledge they have acquired to the solution of current environmental risks.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Animal Ecology F1		07-MS1TÖF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This module consists of several exercises and a seminar series over the course of the entire semester. The exercises can be chosen from the following electives: 1. Wild and honeybee ecology (over the course of the semester): fundamentals and techniques of beekeeping, resource utilisation, behaviour experiments, pollinator diversity and plant-pollinator-interactions. 2. Ecology and taxonomy of insects (block, 2 weeks): observation and recording in the habitat, identification and characteristics of different arthropod groups, field experiments. 3. Ecological modelling (block, 2 weeks): current methods of ecological processes modelling, simulation models, the students' own modelling project on current issues in ecology. 4. Agroecology (block, 1 week): insect communities in agroecosystems, biological pest control in landscape context, evaluation of agri-environment schemes. 5. Forest ecology (block, 1 week): arthropod communities in forest ecosystems, methods of detection, influence of management on diversity patterns and functional groups. 6. Tropical ecology (block): small projects ecological or nature conservation-related issues to be implemented in a tropical ecosystem in East Africa. In the seminar, recent scientific publications on the topics covered in the modules listed above will be presented and discussed.</p>		
Intended learning outcomes		
<p>Students will have expanded their knowledge on ecological theories and current research issues in animal ecology. They will be able to design, perform, statistically analyse and interpret scientific research. They will be familiar with animal ecological methods and possible sources of error in data interpretation. They will have deepened their knowledge of the biology and ecology of important functional taxa of arthropods. Students will have acquired the knowledge and skills necessary to perform scientific activities in the context of an F2 practical course or a Master's thesis.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>P (14) + S (1) Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Biology (2015)
 Master's degree (1 major) FOKUS Life Sciences (2015)
 Master's degree (1 major) Biosciences (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Biosciences (2017)
 Master's degree (1 major) Biosciences (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Animal Ecology and Tropical Biology F2		07-MS1TÖF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>In the F2 practical course, students will explore a scientific question as independently as possible. They will develop hypotheses, prepare a work schedule, collect data, perform experiments in the field, greenhouse or laboratory and will statistically analyse data. Students will document the results of their work in a log similar to a short scientific paper, including an introduction, material and methods, findings and a discussion of these. Students will also be required to present their findings during a wrap-up seminar. The various research groups at the Chair of Animal Ecology and Tropical Biology offer a wide variety of opportunities for students to complete an F2 practical course in Germany, another country in Europe or in the tropics. F2 practical courses may be completed in the context of an ongoing research project of the Institute or in cooperation with other institutions. For more detailed information on the F2 practical course as well as current topics or appointments for consultations, please refer to WueCampus, check out the notice board of the Chair or contact the research groups directly.</p>		
Intended learning outcomes		
<p>Students have gained knowledge on experimental setups and methods used in the fields of animal ecology and tropical ecology. They are qualified to design scientific research and are able to collect data and interpret them statistically. They have developed knowledge and skills that allow them to set up a scientific project for their Master's thesis.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>P (29) + S (1) Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English</p>		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016)</p>		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Biosciences (2017)
 Master's degree (1 major) Biosciences (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Behavioural Physiology and Sociobiology F1			07-MS1VF1-152-m01
Module coordinator		Module offered by	
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Students will be integrated into one of the research groups at the Chair and will independently work on one of the current topics in the field of behavioural physiology and sociobiology. They will gain an insight into the latest physiological, neurobiological and behavioural methods. The results obtained will be graphically and statistically analysed, summarised in a scientific report and presented in a talk. Please contact the research groups at the Chair for available topics and opportunities.			
Intended learning outcomes			
The students are able to independently perform scientific experiments in the field of behavioural physiology and sociobiology. In addition, they are able to process and document the results obtained and to present them to a scientific audience.			
Courses (type, number of weekly contact hours, language — if other than German)			
P (14) + S (1) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Behavioural Physiology and Sociobiology F2		07-MS1VF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Behavioral Physiology and Sociobiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Students will be integrated into one of the research groups at the Chair and will independently work on one of the current topics in the field of behavioural physiology and sociobiology. They will learn to plan experimental series and to apply the latest physiological, neurobiological and behavioural methods. The results obtained will be graphically and statistically analysed, summarised in a scientific report and presented in a talk. Please contact the research groups at the Chair for available topics and opportunities.		
Intended learning outcomes		
The students are able to independently perform scientific experiments in the field of behavioural physiology and sociobiology. In addition, they have learned to interpret the results obtained, taking into account current literature, and to place them in the context of other research in the field.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 79 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Molecular Biology			07-MS2-152-m01
Module coordinator		Module offered by	
Dean of Studies Biologie (Biology)		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
<p>Molecular biology of the eukaryotic and prokaryotic cell. The lecture is a joint activity of the Chairs of Cell- and Developmental Biology, Microbiology, Biophysics and Bioinformatics and deals with concepts of modern molecular biology from the point of view of these different disciplines. Participants are recommended to read the textbook "Essential Cell Biology". The section on cell biology (app. a quarter of the lecture) mainly discusses the eukaryotic cell and intends to elucidate the vast diversity in structure and function of molecules, organelles and cells in addition to fundamental principles of modern molecular cell biology. The bioinformatics section (app. a quarter of the lecture) contains a large amount of examples for applications which allow the investigation of the molecular biology of a cell with bioinformatic tools. We closely adhere to the contents of the book "Essential Cell Biology" and present many clear and useful examples for the application of our tools when working on the topics of the other three Chairs. Our vision: bioinformatics essentially is molecular biology based on computing technology (time consuming "wet" experiments can be planned more easily and thus bioinformatics saves precious time). The microbiological section (app. a quarter of the lecture) deals with fundamental molecular aspects of prokaryotic cells. Key aspects include the organisation of the bacterial genome, the transcription and translation machinery, mechanisms of regulation of gene expression, transport of small molecules and macromolecules, cell division and differentiation, bacterial motility and chemotaxis, signal transduction and bacterial communication mechanisms. Recommended reading: (a) Allgemeine Mikrobiologie (Fuchs) and (b) Biology of Microorganisms (Brock).</p>			
Intended learning outcomes			
Master level knowledge about the molecular biology of the eukaryotic and prokaryotic cell.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			

Master's degree (1 major) Biology (2015)
Master's degree (1 major) FOKUS Life Sciences (2015)
Master's degree (1 major) Biosciences (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)

Module title		Abbreviation
Molecular Biology B		07-MS2B-152-m01
Module coordinator		Module offered by
Dean of Studies Biologie (Biology)		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Molecular biology of the eukaryotic and prokaryotic cell. The lecture is a joint activity of the Chairs of Cell- and Developmental Biology, Microbiology, Biophysics and Bioinformatics and deals with concepts of modern molecular biology from the point of view of these different disciplines. Participants are recommended to read the textbook "Essential Cell Biology". The section on cell biology (app. a quarter of the lecture) mainly discusses the eukaryotic cell and intends to elucidate the vast diversity in structure and function of molecules, organelles and cells in addition to fundamental principles of modern molecular cell biology. The bioinformatics section (app. a quarter of the lecture) contains a large amount of examples for applications which allow the investigation of the molecular biology of a cell with bioinformatic tools. We closely adhere to the contents of the book "Essential Cell Biology" and present many clear and useful examples for the application of our tools when working on the topics of the other three Chairs. Our vision: bioinformatics essentially is molecular biology based on computing technology (time consuming "wet" experiments can be planned more easily and thus bioinformatics saves precious time). The microbiological section (app. a quarter of the lecture) deals with fundamental molecular aspects of prokaryotic cells. Key aspects include the organisation of the bacterial genome, the transcription and translation machinery, mechanisms of regulation of gene expression, transport of small molecules and macromolecules, cell division and differentiation, bacterial motility and chemotaxis, signal transduction and bacterial communication mechanisms. Recommended reading: (a) Allgemeine Mikrobiologie (Fuchs) and (b) Biology of Microorganisms (Brock).</p>		
Intended learning outcomes		
Master level knowledge about the molecular biology of the eukaryotic and prokaryotic cell.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Biology (2015)
 Master's degree (1 major) FOKUS Life Sciences (2015)
 Master's degree (1 major) Biosciences (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Biosciences (2017)
 Master's degree (1 major) Biosciences (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 exchange program Biosciences (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Bioinformatics		07-MS2BI-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advances and current results of bioinformatics are explained and discussed, this includes results from genome and sequence analysis, protein domains and protein families, large-scale data analysis (e. g. net generation sequences, proteomics data), analysis of different functional RNAs (e. g. miRNAs, lncRNAs).		
Intended learning outcomes		
Understand recent results in bioinformatics. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions in bioinformatics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Biology (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Biosciences (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's degree (1 major) Biochemistry (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Computer Science (2023)
Master's degree (1 major) Biosciences (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Bioinformatics F1		07-MS2BIF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Detailed insight into methods in bioinformatics; depending on the topic selected, fields covered include: genomics (sequence-, domain analysis and annotation), omics data analysis (NGS, transcriptomics, metabolomics, proteomics), topological and structural analysis of biological interactions including statistical methods, phylogenetic analysis, protein structure analysis. Results are documented in the form of a presentation, a publication or a term paper.		
Intended learning outcomes		
Students have gained knowledge on experimental setups and methods used in the field of bioinformatics. They are able to design experiments, collect data and interpret them statistically, adhering to the principles of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 87 / 739

Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Bioinformatics F2		07-MS2BIF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced insight into methods in bioinformatics; depending on the topic selected, fields covered include: genomics (sequence-, domain analysis and annotation), omics data analysis (NGS, transcriptomics, metabolomics, proteomics), topological and structural analysis of biological interactions including statistical methods, phylogenetic analysis, protein structure analysis. The techniques applied are evaluated on the basis of the results obtained and are modified where necessary. Results are documented in the form of a presentation, a publication or a term paper.		
Intended learning outcomes		
Proficiency in one or more methods in bioinformatics that allows students to independently perform and organise a scientific project in the field of bioinformatics and to document the results obtained. Students are able to design a research project and are prepared for working on a scientific question for their thesis.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
450 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 89 / 739

Master's degree (1 major) Biosciences (2018)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Biophysics and Molecular Biotechnology			07-MS2BT-152-m01
Module coordinator		Module offered by	
holder of the Chair of Biotechnology and Biophysics		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This lecture provides a broad overview of biophysical techniques and their applications. The first part of the lecture discusses fundamental aspects of thermodynamics, kinetics and molecular interactions. The course then moves on to discuss biophysical methods that facilitate the investigation of individual cells down to the level of single molecules. Focus is on electromanipulation and dielectric spectroscopy of cells, biomembranes, electrophysiology, ion channels, protein folding, single-molecule fluorescence methods and high-resolution as well as dynamic microscopy.			
Intended learning outcomes			
Students will have acquired a knowledge of fundamental biophysical methods and their applications that will enable them to independently review relevant literature. In addition, they will have become acquainted with - or, where necessary, will be able to independently acquaint themselves with - biophysical mechanisms.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (1) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
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Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biochemistry (2017)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's degree (1 major) Biosciences (2018)
Master's degree (1 major) Biochemistry (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Biophysics and Molecular Biotechnology B		07-MS2BTB-152-m01
Module coordinator		Module offered by
holder of the Chair of Biotechnology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This lecture provides a broad overview of biophysical techniques and their applications. The first part of the lecture discusses fundamental aspects of thermodynamics, kinetics and molecular interactions. The course then moves on to discuss biophysical methods that facilitate the investigation of individual cells down to the level of single molecules. Focus is on electromanipulation and dielectric spectroscopy of cells, electrokinetic techniques, biomembranes, electrophysiology, ion channels, protein folding, single-molecule fluorescence methods and high-resolution as well as dynamic microscopy.		
Intended learning outcomes		
Students will have acquired a knowledge of fundamental biophysical methods and their applications that will enable them to independently review relevant literature. In addition, they will have become acquainted with - or, where necessary, will be able to independently acquaint themselves with - biophysical mechanisms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 93 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Biophysics and Molecular Biotechnology F1		07-MS2BTF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Biotechnology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This practical course provides students with an insight into different biotechnological and biophysical topics and methods. Under expert guidance, students will perform selected experiments on the following topics: cellular and molecular biotechnology, nano and microsystems biotechnology, biomaterials and biosensors, high-resolution fluorescence microscopy, fluorescence spectroscopy, analysis and electromanipulation of cells.		
Intended learning outcomes		
Students will have acquired a knowledge of fundamental biotechnological and biophysical methods and their applications that will enable them to independently review relevant literature. In addition, they will have become acquainted with - or, where necessary, will be able to independently acquaint themselves with - biophysical mechanisms. Students will have acquired practical experience performing experiments, using a variety of scientific tools. In the seminar, students will have acquired detailed theoretical knowledge on these experiments and will have delivered a short presentation (15 minutes) on one of the experiments they performed.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 95 / 739

Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Biophysics and Molecular Biotechnology F2		07-MS2BTF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Biotechnology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This practical course provides students with an insight into different biotechnological and biophysical topics and is close to laboratory research. Under expert guidance, students will perform selected experiments on one of the following topics: cellular and molecular biotechnology, nano and microsystems biotechnology, biomaterials and biosensors, high-resolution fluorescence microscopy, fluorescence spectroscopy, analysis and electromanipulation of cells. Performing experiments under expert guidance, students will become acquainted with techniques and instruments. Over the duration of the course, students will then be required to work increasingly independently on current research topics. Work on current research topics will spark the students' interest in topics and will help them select a topic for their Master's thesis.</p>		
Intended learning outcomes		
<p>Students will become acquainted with modern biophysical methods and their applications in biotechnology. They will be able to independently work on scientific problems, to independently study relevant literature and to develop a quantitative understanding of biophysical mechanisms. In the seminar, students will acquire further theoretical knowledge on experiments and will give short presentations on experiments performed.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>P (29) + S (1) Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
450 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 97 / 739

Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Infection Biology		07-MS2INF-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamentals of molecular microbiology and infection biology, mechanisms of adherence and invasion, bacterial pathogenicity factors, regulation of virulence, mechanisms of host defence and pathogen interference, current methods in infection biology.		
Intended learning outcomes		
The students are able to understand fundamental theories of molecular microbiology and infection biology, emergence of infectious diseases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Infection Biology B		07-MS2INF-B-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamentals of molecular microbiology and infection biology, mechanisms of adherence and invasion, bacterial pathogenicity factors, regulation of virulence, mechanisms of host defence and pathogen interference, current methods in infection biology.		
Intended learning outcomes		
The students are able to understand fundamental theories of molecular microbiology and infection biology, emergence of infectious diseases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biomedicine (2018) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023)		
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Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Microbiology F1		07-MS2MF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Participants will work independently on a current research project dealing with microbial pathogens and their interactions with the host. Participants will employ a variety of state-of-the-art methods within the fields of molecular biology, microbiology, cellular biology, and immunology as well as data analysis and literature research techniques. Results will be documented and discussed in a seminar paper or an oral presentation.		
Intended learning outcomes		
Participants will acquire the skills to experimentally address scientific questions in molecular biology and infection biology, properly document experimental results and adhere to the standards of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
The internship must be completed full-time within a period of 5 to 6 weeks.		
Workload		
300 h		
Teaching cycle		
Teaching cycle: Ongoing, after consultation with the supervisor and registration for both winter and summer semesters.		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Microbiology F2		07-MS2MF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Participants will work independently on a current research project dealing with microbiology and infection biology. They will apply advanced experimental techniques in microbiology, cell biology and molecular biology according to the project requirements. Progress of the research project will be reported in a seminar paper, a research paper or an oral presentation.		
Intended learning outcomes		
The participants will acquire the skills to independently perform basic research on microbiology and infection biology according to the standards of good scientific practice and to properly document, interpret and present experimental results.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
The internship must be completed full-time within a period of 10 to 12 weeks.		
Workload		
450 h		
Teaching cycle		
Teaching cycle: Ongoing, after consultation with the supervisor and registration for both winter and summer semesters.		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Pathogenicity of Microorganisms		07-MS2PA-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamental principles of the mode of action of microbial pathogenicity factors will be presented using selected prokaryotic and eukaryotic pathogens as model organisms. In addition, current research methods in infection biology will be presented.		
Intended learning outcomes		
Students have gained fundamental knowledge in infection biology and pathogenicity research and the mechanisms behind infectious diseases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Pathogenicity of Microorganisms B		07-MS2PA-B-152-m01
Module coordinator		Module offered by
holder of the Chair of Microbiology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamental principles of the mode of action of microbial pathogenicity factors will be presented using selected prokaryotic and eukaryotic pathogens as model organisms. In addition, current research methods in infectious biology will be presented.		
Intended learning outcomes		
Students have gained fundamental knowledge in infection biology and pathogenicity research and the mechanisms behind infectious diseases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biomedicine (2018) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 109 / 739

Master's degree (1 major) Biosciences (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Cell and Developmental Biology Master 1			07-MS2ZE1-152-m01
Module coordinator		Module offered by	
holder of the Chair of Cell Biology and Developmental Bio-logy		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The module consists of the lecture <i>Zellpathologie (Cytopathology)</i> and the seminar <i>Zellbiologie-Meilensteine und Perspektiven (Milestones and Perspectives of Cell Biology)</i> . The lecture describes pathological states of the cell and unravels their biological causes and consequences, such as infection, apoptosis, senescence, metabolic disorders and cancer. In the seminar <i>Milestones and Perspectives of Cell Biology</i> , classic ground-breaking pu-blications in the field of cell biology are discussed from an unusual point of view.			
Intended learning outcomes			
Students possess a knowledge of the theoretical principles underlying cell pathology and are able to put this in-to the broader context of cell biology research.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (1) + S (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme-ster, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Cell and Developmental Biology Master 2			07-MS2ZE2-152-m01
Module coordinator		Module offered by	
holder of the Chair of Cell Biology and Developmental Bio-logy		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The module consists of the lecture <i>Signale und Differenzierung</i> (Signals and Differentiation) and the seminar <i>Entwicklungsbiologie - Meilensteine und Perspektiven</i> (Milestones and Perspectives of Developmental Biology). The lecture <i>Signals and Differentiation</i> does not attempt to impart pure textbook knowledge. Instead, historically im- portant as well as particularly interesting and important trend-setting topics in developmental biology are pre- sented. The topics range from classical developmental subjects such as tissue regeneration and morphogene- tic cell migration to molecular stem cell biology, epigenetic plasticity, origins of multicellularity and development within changing environments. In the seminar <i>Milestones and Perspectives of Developmental Biology</i> , classic ground-breaking publications in the field of developmental biology are discussed from an unusual point of view.			
Intended learning outcomes			
Participants possess a knowledge of the theoretical and molecular biological principles underlying developmen- tal biology and are able to put this into the broader context of cell and developmental biology research.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (1) + S (2) Module taught in: English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every seme- ster, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)			
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Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Cell and Developmental Biology F1		07-MS2ZEF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Cell Biology and Developmental Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This 5 week full-time practical course provides an introduction to modern cell and developmental biology-related methods with a focus on bio-imaging techniques. A broad variety of model organisms is covered and the participants are encouraged to independently design and perform their own experiments. Participants use their acquired technological skills to analyse important basic biological processes. Large parts of this practical course are devoted to small projects, which should provide sustained insights into current research activities of the Chair. Interactions with Master's students, doctoral researchers and post-docs prepare participants for a working in a team-based environment.		
Intended learning outcomes		
The participants are able to approach complex scientific questions in the fields of cell and developmental biology and to independently implement acquired methodological tools to answer these questions. They are able to perform and document cell and developmental biology-related experiments, adhering to a generally accepted code of scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 115 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Cell and Developmental Biology F2		07-MS2ZEF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Cell Biology and Developmental Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Well-defined aspects of scientific projects are addressed with independently designed experiments in the context of current research projects in the field of cell and developmental biology. The techniques applied are evaluated on the basis of the results obtained and modified where necessary. The results of all experiments as well as the impact on the research project are presented and discussed in a progress report seminar within the research group.		
Intended learning outcomes		
The participants are able to independently carry out scientific experiments in the fields of cell and developmental biology and to modify them according to the outcome. They are able to independently approach current scientific topics and to perform, interpret and document experiments, adhering to accepted rules of scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 117 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Methods in Biology		07-MS31-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This lecture series imparts the theoretical background of fundamental and up-to-date molecular biological methods in plant sciences. Special emphasis is placed on analytical tools, large-scale data analysis and their application.		
Intended learning outcomes		
At the end of the lecture series, students will (I) be able to qualitatively evaluate results acquired with analytical and molecular biological methods and to integrate them into the context of the current scientific knowledge in this field (II) have gained an overview of the advantages/disadvantages of analytical and molecular biological approaches (III) be able to apply the knowledge they have acquired to design their own experimental strategies for addressing a specific research question.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Methods in Biology B		07-MS31B-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
7	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This lecture series imparts the theoretical background of fundamental and up-to-date molecular biological methods in plant sciences. Special emphasis is placed on analytical tools, large-scale data analysis and their application.		
Intended learning outcomes		
At the end of the lecture series, students will (I) be able to qualitatively evaluate results acquired with analytical and molecular biological methods and to integrate them into the context of the current scientific knowledge in this field (II) have gained an overview of the advantages/disadvantages of analytical and molecular biological approaches (III) be able to apply the knowledge they have acquired to design their own experimental strategies for addressing a specific research question.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 121 / 739

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Molecular Plant Physiology F1		07-MS31MPPF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module provides an in-depth insight into molecular biological strategies and methods applied in plant physiology. The students will be integrated into research projects on current topics in molecular plant physiology.		
Intended learning outcomes		
The students have knowledge about basic molecular biological strategies and methods focusing on plant physiology. They are able to perform and organise their scientific laboratory work independently and document the results obtained.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 123 / 739

Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Molecular Plant Physiology F2		07-MS31MPPF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The students perform their research work within the context of a current research project in molecular plant physiology in a largely independent manner under supervision of a principal investigator.		
Intended learning outcomes		
Students are able to work on a scientific question, to design an experimental setup as well as to interpret, document and present their results.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 125 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Plant Immunobiology and Pharmaceutical Biology			07-MS31PIP-152-m01
Module coordinator		Module offered by	
holder of the Chair of Ecophysiology and Vegetation Ecology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
<p>This lecture addresses topics of pathogen recognition and signal transduction in plants, molecular and organismic defence and the pharmaceutical relevance of plant-derived bioactive compounds. Plant immunobiology: interactions between plants and pathogens comprise evolutionary dynamic and complex systems. Different strategies of the pathogens - bacteria, fungi and viruses - as well as defence mechanisms of the host plants will be discussed. The molecular mechanisms of pathogen recognition, signal transduction, regulation of gene expression and activation of local and systemic defence responses are in the focus of this lecture. Differences and similarities between plant and human immune systems will be pointed out. Understanding plant-pathogen-interactions and molecular mechanisms determining susceptibility and defence is fundamental for the development of strategies in plant protection. Evolution, function and pharmaceutical relevance of plant secondary metabolites: Secondary metabolites are part of effective plant defence strategies against microorganisms and herbivores and are often essential for survival. The evolution of secondary metabolism will be discussed and general as well as specific defence strategies will be explained. Pharmacological mechanisms of action and molecular targets of important classes of plant bioactive compounds will be presented. A high proportion of currently used drugs have been developed from plant secondary metabolites that have been used as lead structures to generate potent drugs with improved pharmaceutical properties. Examples of therapies with very potent plant pharmaceuticals (evidence-based medicine) as well as possibilities and limitations of phytotherapy (traditional medicine) will be discussed.</p>			
Intended learning outcomes			
Students are able to understand the interaction between plants and the environment on a molecular level and to discuss the topic in the context of the scientific state of the art.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (1) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 127 / 739

Module appears in

Master's degree (1 major) Biology (2015)
 Master's degree (1 major) Biosciences (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Biosciences (2017)
 Master's degree (1 major) Biosciences (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 exchange program Biosciences (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Plant Immunobiology and Pharmaceutical Biology B			07-MS31PIPB-152-m01
Module coordinator		Module offered by	
holder of the Chair of Pharmaceutical Biology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
<p>This lecture addresses topics of pathogen recognition and signal transduction in plants, molecular and organismic defence and the pharmaceutical relevance of plant-derived bioactive compounds. Plant immunobiology: interactions between plants and pathogens comprise evolutionary dynamic and complex systems. Different strategies of the pathogens - bacteria, fungi and viruses - as well as defence mechanisms of the host plants will be discussed. The molecular mechanisms of pathogen recognition, signal transduction, regulation of gene expression and activation of local and systemic defence responses are in the focus of this lecture. Differences and similarities between plant and human immune systems will be pointed out. Understanding plant-pathogen-interactions and molecular mechanisms determining susceptibility and defence is fundamental for the development of strategies in plant protection. Evolution, function and pharmaceutical relevance of plant secondary metabolites: Secondary metabolites are part of effective plant defence strategies against microorganisms and herbivores and are often essential for survival. The evolution of secondary metabolism will be discussed and general as well as specific defence strategies will be explained. Pharmacological mechanisms of action and molecular targets of important classes of plant bioactive compounds will be presented. A high proportion of currently used drugs have been developed from plant secondary metabolites that have been used as lead structures to generate potent drugs with improved pharmaceutical properties. Examples of therapies with very potent plant pharmaceuticals (evidence-based medicine) as well as possibilities and limitations of phytotherapy (traditional medicine) will be discussed.</p>			
Intended learning outcomes			
Students are able to understand the interaction between plants and the environment on a molecular level and to discuss the topic in the context of the scientific state of the art.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in

Master's degree (1 major) Biology (2015)
 Master's degree (1 major) Biosciences (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Biosciences (2017)
 Master's degree (1 major) Biosciences (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 exchange program Biosciences (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Plant Ecology			07-MS31POEK-152-m01
Module coordinator		Module offered by	
holder of the Chair of Ecophysiology and Vegetation Ecology		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The lecture will deal with the ecological and environmental constraints under which plants grow and develop (biogeography, biodiversity) and with the interactions of plants with abiotic and biotic environmental factors (e. g. plant-insect, plant-fungus interactions). The evolutionary adaptations on the physiological and organismic level will be emphasised in particular (stress and defence reactions, carnivory, plant protection). Corresponding experimental approaches will be illustrated. Based on selected examples from current research, the seminar will address the topics covered in the lecture in more detail. It will be complemented by topic-related guided tours in the Botanical Garden of the University of Würzburg.			
Intended learning outcomes			
Participants are able to identify and interpret ecological and ecophysiological interrelations and to discuss them in the context of the current state of knowledge in these fields.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (1) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
--			
Workload			
300 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)

Module title		Abbreviation
Plant Ecology B		07-MS31POEKB-152-m01
Module coordinator		Module offered by
holder of the Chair of Ecophysiology and Vegetation Ecology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The lecture will deal with the ecological and environmental constraints under which plants grow and develop (biogeography, biodiversity) and with the interactions of plants with abiotic and biotic environmental factors (e. g. plant-insect, plant-fungus interactions). The evolutionary adaptations on the physiological and organismic level will be emphasised in particular (stress and defence reactions, carnivory, plant protection). Corresponding experimental approaches will be illustrated.		
Intended learning outcomes		
Participants are able to identify and interpret ecological and ecophysiological interrelations and to discuss them in the context of the current state of knowledge in these fields.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 133 / 739

exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)

Module title		Abbreviation
Biophysics and Biochemistry		07-MS3BB-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module imparts theoretical and methodological knowledge of plant membrane transport, structural biology and biochemistry which is illustrated with specific examples from current research. Depending on the number of participants and their interests, practical demonstrations of methods that are currently used give students an opportunity to experience the practical aspects of biophysical and biochemical research.		
Intended learning outcomes		
Students are able to use methods dealing with soluble proteins or membrane proteins in the fields of biophysics, structural biology and biochemistry. They are able to interpret the data and to discuss the results within the context of current knowledge.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Biophysics and Biochemistry B		07-MS3BBB-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module imparts theoretical and methodological knowledge of plant membrane transport, structural biology and biochemistry which is illustrated with specific examples from current research. Depending on the number of participants and their interests, practical demonstrations of methods that are currently used give students an opportunity to experience the practical aspects of biophysical and biochemical research.		
Intended learning outcomes		
Students are able to use methods dealing with soluble proteins or membrane proteins in the fields of biophysics, structural biology and biochemistry. They are able to interpret the data and to discuss the results within the context of current knowledge.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Biosciences (2021)
exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Biophysics of Plant Membrane Proteins F1		07-MS3BPF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module provides an in-depth insight into biophysical strategies and methods which are used for the functional characterisation of plant membrane proteins. The students will be integrated into research projects on current topics in molecular plant membrane biology.		
Intended learning outcomes		
The students have knowledge of general biophysical strategies and methods with a focus on plant membrane proteins, they are able to independently work on related scientific issues and to document the results obtained.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		

Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Biophysics of Plant Membrane Proteins F2		07-MS3BPF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The students perform their research work within the context of a current research project on the biophysics of plant membrane proteins in a largely independent manner under supervision of a principal investigator.		
Intended learning outcomes		
The students are able to address scientific issues in biophysics, using appropriate biophysical methods. They are able to independently design the appropriate experiments as well as to analyse, document, present and discuss the results.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023)		
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Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Biochemistry and Structural Biology F1		07-MS3BSBF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module provides an in-depth insight into strategies and methods in protein biochemistry and structural biology. The students will be integrated into research projects on current topics in biochemistry and structural biology.		
Intended learning outcomes		
The students have knowledge about general strategies and methods of protein biochemistry and structural biology with a focus on membrane proteins. They are able to perform and organise their scientific laboratory work independently and document the results obtained.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Biochemistry and Structural Biology F2		07-MS3BSBF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The students perform their research work within the context of a current research project on biochemistry and structural biology in a largely independent manner under supervision of a principal investigator.		
Intended learning outcomes		
The students are able to independently perform and organise their scientific laboratory work in the fields of biochemistry and structural biology and to document the results obtained. They are able to design a research project and are prepared for working on a scientific question for their thesis.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023)		
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Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computational Biology F1		07-MS3COBF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Detailed insight into methods in bioinformatics; depending on the topic selected, fields covered include: genomics (sequence-, domain analysis and annotation), omics data analysis (NGS, transcriptomics, metabolomics, proteomics), topological and structural analysis of biological interactions including statistical methods, phylogenetic analysis, protein structure analysis. Results are documented in the form of a presentation, a publication or a term paper.		
Intended learning outcomes		
Students have gained knowledge on experimental setups and methods used in the field of bioinformatics. They are able to design experiments, collect data and interpret them statistically, adhering to the principles of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computational Biology F2		07-MS3COBF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced insight into methods in bioinformatics; depending on the topic selected, fields covered include: genomics (sequence-, domain analysis and annotation), omics data analysis (NGS, transcriptomics, metabolomics, proteomics), topological and structural analysis of biological interactions including statistical methods, phylogenetic analysis, protein structure analysis. The techniques applied are evaluated on the basis of the results obtained and are modified where necessary. Results are documented in the form of a presentation, a publication or a term paper.		
Intended learning outcomes		
Proficiency in one or more methods in bioinformatics that allows students to successfully conduct scientific research (for their Master's thesis). Ability to independently address topics in bioinformatics as well as document and interpret findings, adhering to the principles of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 149 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Molecular and Chemical Plant Ecology F1		07-MS3MCPEF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Under the guidance of an experienced scientist, students will work on a current research topic from the field of molecular and chemical plant ecology. Particular emphasis will be placed on the molecular and chemical bases of the interactions between plants and abiotic and biotic environmental factors (e. g. cuticular barrier properties, plant-insect, and plant-fungus interactions). Working concepts and complex experiments will be designed, and the results will be documented and presented in the form of presentations, publications or logs. The participants will be involved in ongoing projects and will deepen their knowledge on applying special methods, in molecular biology in particular but also in chemical analysis.		
Intended learning outcomes		
The participants are able to perform scientific experiments in the field of molecular and chemical plant ecology and to apply appropriate methods. They are also able to address and document questions in the field of molecular biology/chemical ecology, adhering to the rules of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 151 / 739

Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)

Module title		Abbreviation
Molecular and Chemical Plant Ecology F2		07-MS3MCPEF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Students will work on projects taken from ongoing research in the supervisors' labs from the field of molecular and chemical plant ecology (e. g. cuticular barrier properties, plant-insect, and plant-fungus interactions). They will do this work to a large extent on their own responsibility by performing advanced experiments, their documentation and evaluation. Based on the results obtained, the analytical, molecular biological and/or microbiological methods applied (e. g. PCR, cloning strategies, chromatography, mass spectrometry) will be critically assessed and, where necessary, modified. The progress of the experiments and their contribution to more general projects will be documented and presented in the form of presentations, publications or logs.		
Intended learning outcomes		
The participants are able to independently perform scientific experiments in the field of molecular and chemical plant ecology and to modify them according to the outcome. They are able to independently address, document and interpret questions in the field of molecular/chemical plant ecology, adhering to the rules of good scientific practice. Students are also able to apply specific techniques required to answer scientific questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 153 / 739

Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)

Module title		Abbreviation
Pharmaceutical Biology and Metabolomics F1		07-MS3PBMF1-152-mo1
Module coordinator		Module offered by
holder of the Chair of Pharmaceutical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>All organisms are able to reprogram their metabolism in response to various endogenous or exogenous perturbations. Reprogramming of metabolism is often correlated to phenotypic changes e. g. in disease development, physiology or behaviour. At the Chair of Pharmaceutical Biology, we apply metabolomics for gene function- or stress response analysis. Students can choose a topic from the variety of ongoing projects. Depending on the scientific question addressed by the research team at the Chair, the methodological approach involves techniques in the field of metabolomics/bioanalytics and/or molecular biology. In this module, students will be trained to use quantitative metabolite analysis methods (chromatography, mass spectrometry) and apply advanced molecular biology techniques. Depending on the project, different model organisms are studied. Prior knowledge in metabolite analysis or mass spectrometry is not required. Current scientific questions in the life sciences form the basis to impart scientific concepts and to train students in the laboratory. The module involves the experimental design, realisation and critical evaluation of scientific experiments as well as the documentation and presentation of the progress. More information is available on request or can be found at http://www.pbio.biozentrum.uni-wuerzburg.de/.</p>		
Intended learning outcomes		
Students will be trained in using specific molecular biology methods and/or metabolomics approaches to address scientific questions, in the documentation of experimental procedures and results, and in the interpretation of data.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		

Master's degree (1 major) Biology (2015)
Master's degree (1 major) FOKUS Life Sciences (2015)
Master's degree (1 major) Biosciences (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Pharmaceutical Biology and Metabolomics F2		07-MS3PBMF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Pharmaceutical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Students will be involved in current research projects in pharmaceutical biology or in collaborative research projects that focus on the regulation of metabolism and analysis of metabolic pathways (e. g. in the context of reactions towards biotic or abiotic stress, functional and phenotypic analysis of mutants, or drug metabolism). Aspects of the scientific question will be independently addressed by the students. Molecular biology methods and/or metabolomic approaches will be optimised for and adapted to the specific problem. Experimental results and progress in the understanding of biological problems will be documented in the form of a log and presented in a seminar. More information is available on request or can be found at http://www.pbio.biozentrum.uni-wuerzburg.de/.</p>		
Intended learning outcomes		
<p>The participants are able to independently carry out scientific experiments and to modify them according to the outcome. They are able to independently approach scientific topics in pharmaceutical biology and to perform, interpret and document experiments, adhering to accepted rules of scientific practice. They are able to apply specific techniques required to answer scientific questions.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>P (29) + S (1) Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English</p>		
Allocation of places		
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Additional information		
--		
Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>		
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Master's degree (1 major) Biosciences (2017)
Master's degree (1 major) Biosciences (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Physiological Plant Ecology F1		07-MS3PPEF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Under the guidance of an experienced scientist, students will work on a current research topic from the field of ecology/ecophysiology. Particular emphasis will be placed on the physiological bases of the interactions between plants and abiotic and biotic environmental factors (e. g. water relations, stress, biogeography). Working concepts and complex experiments will be designed, and the results will be documented and presented in the form of a presentation, a publication or a log. The participants will be involved in ongoing projects and will deepen their knowledge on applying special methods, in ecophysiology in particular but also in chemical analysis.		
Intended learning outcomes		
The participants are able to perform scientific experiments in the field of physiological plant ecology and to apply appropriate methods. They are also able to address and document questions in the field of ecology/ecophysiology, adhering to the rules of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 159 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Physiological Plant Ecology F2		07-MS3PPEF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Students will work on projects taken from ongoing research in the supervisors' labs in the field of plant ecology and ecophysiology (e. g. plant-insect-, plant-fungus interactions; biogeography; water relations). They will do this work to a large extent on their own responsibility by performing advanced experiments, their documentation and evaluation. Based on the results obtained, the ecophysiological and analytical methods applied (e. g. measurement of transpiration, fluorescence microscopy, chlorophyll-fluorometry) will be critically assessed, and, where necessary, modified. The progress of the experiments and their contribution to more general projects will be documented and presented in the form of presentations, publications or logs.		
Intended learning outcomes		
Students have gained knowledge on experimental setups and methods used in the field of plant ecophysiology. They are able to design scientific research, to collect data and to interpret them statistically, adhering to the principles of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Systems Biology		07-MS3S-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.		
Intended learning outcomes		
Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Biology (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Biosciences (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 163 / 739

Master's degree (1 major) Biochemistry (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Plant Signalling F1		07-MS3SPF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Molecular mechanisms of plant signal transduction and regulation of gene expression will be investigated in the context of plant-pathogen interaction, plant responses to abiotic stress, lipid signalling and plant hormone signalling. Specific molecular biology methods which are suitable to address these topics will be applied. In addition, students will gain experience in designing appropriate experimental approaches as well as in the documentation and presentation of results. Students will work on a current research project and learn to independently plan and perform the experiments. More information is available on request or can be found at http://www.p-bio.biozentrum.uni-wuerzburg.de/ .		
Intended learning outcomes		
Students will be trained to apply specific methods in the field of molecular biology, to address scientific questions, to document experimental procedures and results and to interpret experimental data.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Plant Signalling F2		07-MS3SPF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Plant Physiology and Biophysics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Students will independently work on aspects of current research projects in the area of plant signal transduction and stress responses. Results will be discussed in the context of recent publications. The molecular biology and bioanalytical methods which are used will be evaluated and optimised. The aim and progress of the project will be presented in a seminar. More information is available on request or can be found at http://www.pbio.biozentrum.uni-wuerzburg.de/ .		
Intended learning outcomes		
Students are able to independently perform scientific experiments and to use specific techniques in the field of molecular biology and bioanalytics to address scientific questions in the field of plant signal transduction. Students are able to independently work according to the rules of best practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 167 / 739

Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Systems Biology F1		07-MS3SYF1-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The practical course will provide students with advanced insights into a field of systems biology and will, in particular, make students proficient in a dynamical method in systems biology (areas that may be selected include protein structure analysis and protein folding, genome analysis and evolution; dynamic network analysis, the dynamics of protein-protein interactions, modelling cellular regulation; modelling metabolism, statistical modelling).		
Intended learning outcomes		
Students have gained knowledge on experimental setups and methods used in the field of systems biology. They are able to design scientific research, to collect data and to interpret them statistically, adhering to the principles of good scientific practice.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (14) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
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Master's degree (1 major) Biosciences (2018)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Systems Biology F2		07-MS3SYF2-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The practical course will provide students with advanced insights into a field of systems biology and will, in particular, make students proficient in a dynamical method in systems biology (areas that may be selected include protein structure analysis and protein folding, genome analysis and evolution; dynamic network analysis, the dynamics of protein-protein interactions, modelling cellular regulation; modelling metabolism, statistical modelling). The techniques applied are evaluated on the basis of the results obtained and are modified where necessary. Results are documented in the form of a presentation, a publication or a term paper.		
Intended learning outcomes		
Proficiency in one or more methods in systems biology that allows students to independently perform and organise a scientific project in the field of bioinformatics and to document the results obtained. Students are able to design a research project and are prepared for working on a scientific question for their thesis.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (29) + S (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 171 / 739

Master's degree (1 major) Biosciences (2018)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
External Internship 1		07-MSA1-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Practical course during stay abroad on a selected topic in biology (duration: 2-3 weeks).		
Intended learning outcomes		
Proficiency in selected methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 173 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
External Internship 2		07-MSA2-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
External placement on a biological topic. Students spend 4-6 weeks working on a well-defined scientific project and learn how to present their data.		
Intended learning outcomes		
Proficiency in selected methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (15) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 30 to 60 minutes, including multiple choice questions) or b) log (approx. 15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (approx. 20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
External Internship 3		07-MSA3-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
External placement on a biological topic. Students spend 6-9 weeks working on a well-defined scientific lab project and learn how to present their data.		
Intended learning outcomes		
Proficiency in selected methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (30) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
450 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 176 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Systems Biology B		07-MS-B-152-m01
Module coordinator		Module offered by
holder of the Chair of Bioinformatics		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advances and current results of computational systems biology are explained and discussed, this includes results from functional genomics, dynamics of the transcriptome, of metabolism and metabolic networks as well as regulatory networks.		
Intended learning outcomes		
Understand recent results in systems biology. Discuss their implications. Have an advanced (Master) level knowledge of typical technologies and research questions of systems biology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biomedicine (2015) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biomedicine (2018) Master's degree (1 major) Biosciences (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 178 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Biosciences (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Biosciences (2023)
 Master's degree (1 major) Biosciences (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Laboratory Course 1		07-MSL1-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Practical course, summer school or workshop on specific topics in biology (duration: 2-3 weeks).		
Intended learning outcomes		
Proficiency in specific methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (5) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Laboratory Course 2		07-MSL2-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Practical course, summer school or workshop on specific topics in biology (duration: 4-6 weeks).		
Intended learning outcomes		
Proficiency in specific methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (15) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Laboratory Course 3		07-MSL3-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
15	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Practical course, summer school or workshop on specific topics in biology (duration: 6-9 weeks).		
Intended learning outcomes		
Proficiency in specific methods and lab techniques from selected fields of biology. Ability to apply these methods and techniques later on in a research project.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (30) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
450 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Animal Ecology and Tropical Biology 2 B		07-MTÖ2B-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module provides the fundamentals of the biology of tropical habitats and tropical communities. A special focus is on the global significance of tropical systems (ecosystem goods and ecosystem services), but the biological features of these highly diverse biomes are also highlighted.		
Intended learning outcomes		
The students will acquire deep knowledge of ecological theories and up-to-date research issues in the field of tropical ecology. They will be qualified to interpret scientific work and apply the knowledge they have acquired to the solution of current environmental risks.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Students will be informed about the method, length and scope of the assessment prior to the course. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) FOKUS Life Sciences (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021)		
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exchange program Biosciences (2022)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) FOKUS Life Sciences (2025)

Module title		Abbreviation
Animal Ecology and Tropical Biology B		07-MTÖB-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module consists of a lecture and a seminar. The lecture gives an overview of the theoretical foundations and current issues in animal ecology. Focus will be on biodiversity and ecosystem functions, multi-trophic interactions and food nets, evolutionary ecology, chemical ecology, tropical ecology, agricultural ecology, and global change.		
Intended learning outcomes		
The students will acquire an advanced knowledge of ecological theories and current research issues in the field of animal ecology. They will be able to interpret scientific publications and apply the acquired knowledge to the solution of current environmental risks.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) exchange program Biosciences (2022)		

Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Tropical Ecology		07-MTROP-152-m01
Module coordinator		Module offered by
holder of the Chair of Animal Ecology and Tropical Biology		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Small projects on ecological or nature conservation-related issues will be implemented in a tropical ecosystem. Students should become familiar with different project stages from experiment design, implementation and data analysis through to data presentation. In evening seminars, recent publications in the field of tropical ecology will be presented and discussed.		
Intended learning outcomes		
The students will learn about various tropical ecosystems and will acquire advanced knowledge of ecological and nature conservation-related research in the tropics. They will learn field ecological methods for the quantitative detection of insects and their biotic interactions and will acquire statistical knowledge in the field of data analysis.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (3) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Special Subject Studies outside Natural Sciences 4			07-MV4-152-m01
Module coordinator		Module offered by	
Coordinator BioCareers		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	Please consult with course advisory service in advance.	
Contents			
Regular specific lecture, seminar, workshop, retreat or practical course (3 weekly contact hours), offered by JMU or other institutions, in which students will acquire additional skills in areas other than biology or the natural sciences. Assessment ungraded, pass required (5 ECTS credits); decision on credit transfer to be made by module coordinators. Possible subjects are philosophy, pedagogy, history, languages, social studies, psychology, economics, and law.			
Intended learning outcomes			
Specific skills and knowledge on a specific subject in an area other than biology or the natural sciences.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
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Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Special Subject Studies outside Natural Sciences 4B		07-MV4B-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Regular specific lecture, seminar, workshop, retreat or practical course (3 weekly contact hours), offered by JMU or other institutions, in which students will acquire additional skills in areas other than biology or the natural sciences. Assessment ungraded, pass required (5 ECTS credits); decision on credit transfer to be made by module coordinators. Possible subjects are philosophy, pedagogy, history, languages, social studies, psychology, economics, and law.		
Intended learning outcomes		
Specific skills and knowledge on a specific subject in an area other than biology or the natural sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Biosciences (2021)
Master's degree (1 major) Biosciences (2023)
Master's degree (1 major) Biosciences (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Special Subject Studies Biology and Natural Sciences 4			07-MVMINT4-152-mo1
Module coordinator		Module offered by	
Coordinator BioCareers		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	Please consult with course advisory service in advance.	
Contents			
Regular specific lecture, seminar, workshop, retreat or practical course (2 weekly contact hours) in biological or natural sciences with a graded assessment.			
Intended learning outcomes			
Specific skills and knowledge on an interdisciplinary subject in the biological or natural sciences.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)			
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Special Subject Studies Biology and Natural Sciences 4B			07-MVMINT4B-152-mo1
Module coordinator		Module offered by	
Coordinator BioCareers		Faculty of Biology	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	Please consult with course advisory service in advance.	
Contents			
Regular specific lecture, seminar, workshop, retreat or practical course (2 weekly contact hours) in biological or natural sciences; assessment ungraded, pass required.			
Intended learning outcomes			
Specific skills and knowledge on an interdisciplinary subject in the biological or natural sciences.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (30 to 60 minutes, including multiple choice questions) or b) log (15 to 30 pages) or c) oral examination of one candidate each (30 to 60 minutes) or d) oral examination in groups of up to 3 candidates (30 to 60 minutes) or e) presentation (20 to 45 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Special Subject Studies Biology and Natural Sciences 5		07-MVMINT5-152-m01
Module coordinator		Module offered by
Coordinator BioCareers		Faculty of Biology
ECTS	Method of grading	Only after succ. compl. of module(s)
6	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	Please consult with course advisory service in advance.
Contents		
Regular specific lecture, seminar, workshop, retreat or practical course (3 weekly contact hours) in biological or natural sciences; assessment ungraded, pass required.		
Intended learning outcomes		
Specific skills and knowledge on an interdisciplinary subject in the biological or natural sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3) Module taught in: German and/or English Course type: might also be offered in V, Ü, P, R or E format		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Successful completion as certified by the lecturer Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biology (2015) Master's degree (1 major) Biosciences (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biosciences (2017) Master's degree (1 major) Biosciences (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Biosciences (2021) Master's degree (1 major) Biosciences (2023) Master's degree (1 major) Biosciences (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Elemental Organic Chemistry		o8-AC-ELO-152-m01
Module coordinator		Module offered by
lecturer of lecture "Elementorganische Chemie" (Elemental Organic Chemistry)		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module equips students with an advanced knowledge of organometallics. It focuses on their structures and properties, special material classes, reactivity and technical processes.		
Intended learning outcomes		
Students are able to describe the structure and properties of organometallics in an appropriate manner. They are able to systemise them and characterise their structure and reactivity. In addition, they are able to develop and explain principles for the synthesis of elementary organic compounds.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)		
Module appears in		
Bachelor's degree (1 major) Biochemistry (2015) First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Biochemistry (2017) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 201 / 739

First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015))
Bachelor's degree (1 major) Biochemistry (2022)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Solid State Chemistry		o8-AC-FK-152-m01
Module coordinator		Module offered by
lecturer of lecture "Festkörperchemie" (Solid State Chemistry)		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
3	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module equips students with an advanced knowledge of metals, alloys and saline compounds. It focuses on their structures and properties, special material classes, reactivity and technical processes.		
Intended learning outcomes		
Students are able to describe the structure and properties of metals, alloys and saline compounds in an appropriate manner. They are able to systemise them and characterise their structure and reactivity.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
90 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 62 I Nr. 1		
Module appears in		
First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015)) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Advanced Inorganic Chemistry		o8-ACM1-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Inorganic Chemistry		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
2 semester	graduate	--
Contents		
This module discusses advanced topics in main group chemistry and transition metal chemistry. It focuses on special compounds of the main group elements (MGEs), bonding situations of MGEs and MGE compounds, the chemistry of transition metals and coordination chemistry.		
Intended learning outcomes		
Students are able to characterise and explain special compounds of the main group elements. They can describe the chemical properties of transition metals and analyse the structure as well as chemical and physical aspects of coordination compounds.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3) + S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Bioinorganic Chemistry		o8-ACM2-161-m01
Module coordinator		Module offered by
lecturer of seminar "Anorganische Aspekte der Biochemie und Medizinischen Chemie" (Inorganic Aspects of Biochemistry and Medicinal Chemistry)		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module introduces students to the fundamental principles of bioinorganic chemistry (BIC). It discusses the methods of BIC, structures and effects of metalliferous enzymes and applications of BIC in the fields of diagnosis and therapy.		
Intended learning outcomes		
Students are able to describe the principles of, and methods in, BIC. They can explain the structure and effects of metalliferous enzymes and describe applications of BIC in biochemistry and medicine.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Solid state chemistry and inorganic materials		o8-ACM3-161-m01
Module coordinator		Module offered by
lecturer of seminar "Festkörperchemie and Anorganische Materialien" (Solid State Chemistry and Inorganic Materials)		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module provides an introduction to solid-state chemistry. It focuses on the structure, chemical and physical properties, synthesis methods and selected materials of solids.		
Intended learning outcomes		
Students are able to describe the structure and properties of solids. They can explain methods for solid-state synthesis. They can describe important aspects of selected materials regarding the corresponding solids.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Inorganic Chemistry practical course for advanced		o8-ACPM-161-mo1
Module coordinator		Module offered by
focus point coordinator "Inorganic Chemistry"		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to enhance their skills in advanced synthesis and analytical methods in inorganic chemistry. The focus will be on working under inert atmospheres, purification methods, spectral analysis and crystallography. Students will be expected to conduct their work in the lab independently, write a lab report documenting their findings and deliver a presentation.		
Intended learning outcomes		
Students are able to use advanced synthesis and analytical methods in inorganic chemistry in the lab and to interpret their findings. They are able to write a lab report documenting their findings and deliver a presentation.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (24) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
report on practical course (approx. 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 40 working days.		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Molecular Biology for Advanced Students		o8-BC-MOLMC-161-mo1
Module coordinator		Module offered by
holder of the Chair of Biochemistry		Chair of Biochemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Comprising a lecture and an exercise, this module discusses advanced topics in molecular physiology and functional biochemistry.		
Intended learning outcomes		
Students have developed a sound knowledge of molecular biology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Functional Materials (2025)		

Module title			Abbreviation
Molecular Biology laboratory course			o8-BC-MOLP-172-m01
Module coordinator		Module offered by	
holder of the Chair of Biochemistry		Chair of Biochemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
This module equips students with practical skills in the areas of recombinant engineering and characterisation of macromolecular complexes, modern biomolecular techniques, in vivo analysis of biochemical processes, and modern imaging techniques.			
Intended learning outcomes			
Students have developed a knowledge of molecular biology and are able to apply it to practical experiments.			
Courses (type, number of weekly contact hours, language — if other than German)			
P (5)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 45 to 90 minutes) or b) log (10 to 20 pages) or c) oral examination of one candidate each (20 to 30 minutes) or d) oral examination in groups of up to 3 candidates (approx. 15 to 20 minutes per candidate) or e) presentation (20 to 30 minutes) or f) practical examination (on average approx. 2 hours; time to complete will vary according to subject area but will not exceed a maximum of 4 hours) Language of assessment: German and/or English Assessment offered: Once a year, winter semester			
Allocation of places			
Biochemie (Biochemistry) 24 places. Selection process Biochemie (Biochemistry), Bachelor's (180 ECTS credits): Should the number of applications exceed the number of available places, places will be allocated according to the following quotas: Quota 1 (two thirds of places): current average grade of successfully completed modules; among applicants with the same average grade, places will be allocated by lot. Quota 2 (one third of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available. Chemie (Chemistry), Master's and MINT-Lehramt PLUS Master's: 6 places. Selection process: 1. Applications of Master's degree programme Chemie (Chemistry) (120 ECTS credits) will be considered first: Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available. 2. In case that there are places left after procedure 1 is finished completely, these places will be distributed among the students in the Master's degree programme MINT-Lehramt PLUS as follows: Places will be allocated according to the number of subject semesters. Among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated by lot as they become available.			
Additional information			
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Workload			
300 h			

Teaching cycle
--
Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
<p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Chemistry (2018)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Bachelor's degree (1 major) Biochemistry (2022)</p> <p>Master's degree (1 major) Chemistry (2024)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p>

Module title		Abbreviation
Practical course "Molecular Machines" for advanced students		o8-BC-VPMM-161-mo1
Module coordinator		Module offered by
holder of the Chair of Biochemistry		Chair of Biochemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	o8-BC-MOLP
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to explore a research topic. Selected methods and topics in molecular biology and biochemistry; cloning, mutagenesis, protein expression and purification, RNA-protein and protein-protein interactions, isolation and functional analysis of macromolecular complexes.		
Intended learning outcomes		
Students are able to explore a specific research topic and deliver an oral presentation on the results of their work.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 40 working days.		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Practical course "Protein Degradation in Eukaryotes" for advanced students		o8-BC-VPPD-161-m01
Module coordinator		Module offered by
holder of the Chair of Biochemistry		Chair of Biochemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	o8-BC-MOLP
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to explore a research topic in the field of protein degradation in eukaryotes.		
Intended learning outcomes		
Students are able to explore a specific research topic and deliver an oral presentation on the results of their work.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 40 working days.		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Practical course "RNA Biochemistry" for advanced students		o8-BC-VPRB-161-m01
Module coordinator		Module offered by
holder of the Chair of Biochemistry		Chair of Biochemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	o8-BC-MOLP
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to explore a research topic in the field of RNA biochemistry. Ribosomes as "molecular machines", regulatory mechanisms of eukaryotic protein biosynthesis. Gradient centrifugation, in vitro translation in different cell-free systems.		
Intended learning outcomes		
Students are able to explore a specific research topic and deliver an oral presentation on the results of their work. They are able to familiarise themselves with different mechanisms of general and specific translation control with the help of different methods as well as to present their findings in an appropriate and understandable manner.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 40 working days.		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Practical course "Structural Biology" for advanced students		o8-BC-VPSB-161-m01
Module coordinator		Module offered by
holder of the Chair of Biochemistry		Chair of Biochemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	o8-BC-MOLP
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module discusses cloning and the expression of protein constructs for crystallisation. It teaches students the fundamental principles and techniques of crystallisation and crystal optimisation as well as crystallographic data collection.		
Intended learning outcomes		
Students have developed an understanding of the method of selecting protein constructs for crystallisation. They master fundamental skills and techniques for protein crystallisation as well as data collection and processing.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 40 working days.		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Lab Course Material Science		o8-FMM-MP-161-mo1
Module coordinator		Module offered by
lecturers specialisation subject Funktionsmaterialien (Functional Materials)		Chair of Chemical Technology of Material Synthesis
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Ten selected experiments in materials science.		
Intended learning outcomes		
Students have developed an advanced proficiency in the performance of experiments in materials science.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (8)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Project Work		o8-FMM-PA-161-mo1
Module coordinator		Module offered by
head of the research group offering the module		Chair of Chemical Technology of Material Synthesis
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to explore a research topic under the guidance of a supervisor and to describe their findings.		
Intended learning outcomes		
Students have developed an advanced proficiency in the performance of experiments in materials science.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 15 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Practical Research Course for Grammar School Teachers		o8-Forsch-LAGY-152-mo1
Module coordinator		Module offered by
lecturer of the respective research group		Faculty of Chemistry and Pharmacy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	Depending on their choice of topic, students who are writing their Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) in the vertieft studiertes Fach (subject studied with a focus on the scientific discipline) Chemie (Chemistry) are highly recommended to complete module o8-Forsch-LAGY directly before completing module o8-Ch-HA-GY.
Contents		
This module gives students the opportunity to research and write on a defined problem within a given time frame and using the scientific methods they have learned during the programme.		
Intended learning outcomes		
Students are able to conduct research on a defined problem/topic, adhering to the principles of good scientific practice, and to present the results of their work in written form.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (16)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 20 pages) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block placement / block taught practical course with a duration of 30 days.		
Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 62 I Nr. 4		
Module appears in		
First state examination for the teaching degree Gymnasium Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Material Science 1 (Basic introduction)		o8-FU-MaWi1-152-mo1
Module coordinator		Module offered by
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Uncertainty analysis, process engineering: mixing, comminution, agglomeration, separation, drying, conveying. Vacuum technology, coating processes, sintering.		
Intended learning outcomes		
The students possess comprehensive knowledge about various techniques from different areas of the field of chemical process engineering. For a given objective they are able to weigh the pros and cons of different techniques and can suggest ways of fabrication, processing and treatment of materials. Furthermore they are confident in handling of measurement data as well as statistical and systematic errors and possess extensive knowledge about nomenclature, significance as well as practically determining characteristic material properties.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Functional Materials (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Bachelor's degree (1 major) Nanostructure Technology (2020)

Module title		Abbreviation
Material Science 2 (The Material Groups)		o8-FU-MaWi2-152-m01
Module coordinator		Module offered by
holder of the Chair of Chemical Technology of Material Synthesis		Chair of Chemical Technology of Material Synthesis
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Fabrication and properties of the main material groups. Metals: structure and microstructure, phase transitions and properties; thermo-mechanical treatment; Martensitic transitions; ductility and strength; form memory alloys. Ceramics: oxidic and non-oxidic structural ceramics; electric and magnetic properties of functional ceramics; glass. Polymer materials: thermoplasts, duromers, elastomers. Composite materials.		
Intended learning outcomes		
Students have developed a knowledge of the fabrication and properties of the main material groups and are able to apply that knowledge to research problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Functional Materials (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Nanostructure Technology (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 220 / 739

Bachelor's degree (1 major) Functional Materials (2021)
Bachelor's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Chemistry (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Functional Materials (2025)

Module title			Abbreviation
Molecular Materials (Lecture)			o8-FU-MoMaV-152-mo1
Module coordinator		Module offered by	
degree programme coordinator Funktionswerkstoffe (Functional Matrierials)		Chair of Chemical Technology of Material Synthesis	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
Chemical bonds and molecular interactions, supramolecular chemistry, molecular materials, colloids, nanoparticles, thin films.			
Intended learning outcomes			
Students have developed an understanding of the relationship between the physical, chemical and technological properties of materials and their structure. They know the significance of various inter and intramolecular interactions and how they determine the properties of molecular materials. They have learned how to familiarise themselves with a topic in the field, deliver a presentation on that topic, discuss it as well as to give and receive feedback.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) + S (1)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
[a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)] as well as talk (approx. 30 minutes), weighted 3:1 Language of assessment: German and/or English			
Allocation of places			
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Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Functional Materials (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's degree (1 major) Chemistry (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Chemically and bio-inspired Nanotechnology for Material Synthesis			o8-FU-NT-152-m01
Module coordinator		Module offered by	
degree programme coordinator Funktionswerkstoffe (Functional Matrierials)		Chair of Chemical Technology of Material Synthesis	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
Synthesis methods and parameters in sol-gel chemistry as well as characterisation and applications of the created materials. Fundamental principles of biomineralisation, the structure of biomaterials, introduction to bio-inspired material synthesis.			
Intended learning outcomes			
Students have developed a sound knowledge of sol-gel chemistry and biomineralisation.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (4)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Functional Materials (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Chemistry (2024)			
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Organo- and Biocatalysis		o8-HKM1-152-mo1
Module coordinator		Module offered by
lecturer of the seminar "Organo- and Biokatalyse"		Faculty of Chemistry and Pharmacy
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module provides students with deeper insights into topics in organic compounds and enzymes in catalytic processes. Organocatalysis: enantioselective implementation, principles, green chemistry, substance classes and application areas. Biocatalysis: effects of enzymes in view of different aspects, especially regarding organic synthesis.		
Intended learning outcomes		
Students are able to categorise organocatalysts and explain their effects and areas of application. They can describe the structure and applications of enzymes in organic synthesis. They are able to mechanistically describe and analyse the effects of enzymes.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Advanced organometallic chemistry and its application in homogeneous catalysis			o8-HKM2-161-m01
Module coordinator		Module offered by	
lecturer of the seminar "Spezielle Metallorganische Chemie und deren Anwendung in der Homogenkatalyse"		Institute of Inorganic Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This module examines elementary organic compounds of transition metals with homogeneous catalytic applications.			
Intended learning outcomes			
Students can describe and analyse the structure, reactivity and analysis of elementary organic compounds. They are able to characterise special substance classes. They can formulate homogeneous catalysis reactions.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (3) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			

Module title		Abbreviation
Practical course "Homogeneous catalysis in Inorganic Chemistry"		o8-HKM3AC-161-mo1
Module coordinator		Module offered by
lecturer of the seminar "Spezielle Metallorganische Chemie und deren Anwendung in der Homogenkatalyse"		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to enhance their skills in advanced synthesis and analytical methods in homogeneous catalysis. The focus will be on catalyst synthesis and characterisation, spectral analysis and crystallography. Students will be expected to conduct their work in the lab independently, write a lab report documenting their findings and deliver a presentation.		
Intended learning outcomes		
Students are able to use advanced synthesis and analytical methods in homogeneous catalysis in the lab and to interpret their findings. They are able to write a lab report documenting their findings and deliver a presentation.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
report on practical course (approx. 10 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Practical course "Homogeneous catalysis in Organic Chemistry"		o8-HKM ₃ OC-161-m01
Module coordinator		Module offered by
lecturer of the seminar "Spezielle Metallorganische Chemie und deren Anwendung in der Homogenkatalyse"		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to enhance their skills in advanced synthesis and analytical methods in homogeneous catalysis. The focus will be on catalyst synthesis and characterisation, spectral analysis and crystallography. Students will be expected to conduct their work in the lab independently, write a lab report documenting their findings and deliver a presentation.		
Intended learning outcomes		
Students are able to use advanced synthesis and analytical methods in homogeneous catalysis in the lab and to interpret their findings. They are able to write a lab report documenting their findings and deliver a presentation.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
report on practical course (approx. 10 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Advanced transition metal chemistry		o8-HKM4-161-m01
Module coordinator		Module offered by
lecturer of the seminar "Spezielle Übergangsmetallchemie"		Institute of Inorganic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module provides students with deeper insights into topics in the chemistry of transition metals and coordination chemistry. It also provides an introduction to bioinorganic chemistry and discusses recent developments in transition metal chemistry.		
Intended learning outcomes		
Students are able to explain transition metals and coordination compounds demonstrating a high degree of expertise in the field. They can explain the fundamental principles of bioinorganic chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Practical course medicinal chemistry		o8-MCM1-161-m01
Module coordinator		Module offered by
lecturers Pharmazeutische Chemie (Pharmaceutical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected methods and topics in medicinal chemistry (synthesis, testing, analysis, theory, pharmacokinetics).		
Intended learning outcomes		
Students have developed a knowledge of medicinal chemistry and are able to apply it to practical experiments.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (10) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical assignments (2 to 4 random examinations) as well as report (30 to 50 pages) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Pharmaceutical/Medicinal Chemistry 1		o8-MCM2a-161-m01
Module coordinator		Module offered by
lecturers Pharmazeutische Chemie (Pharmaceutical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Chemistry of drugs by field of indication; principles of drug development, strategies for active agent discovery; structure-activity relationships; molecular effect mechanisms; pharmacological principles of the drugs discussed in the module; drug analysis; drug synthesis; biotransformation, pharmacokinetics of individual drugs; history of drug development: discussion of specific examples.		
Intended learning outcomes		
Students have developed a knowledge of pharmaceutical/medicinal chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Pharmaceutical/Medicinal Chemistry 2		o8-MCM2b-161-m01
Module coordinator		Module offered by
lecturers Pharmazeutische Chemie (Pharmaceutical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Chemistry of drugs by field of indication; principles of drug development, strategies for active agent discovery; structure-activity relationships; molecular effect mechanisms; pharmacological principles of the drugs discussed in the module; drug analysis; drug synthesis; biotransformation, pharmacokinetics of individual drugs; history of drug development: discussion of specific examples.		
Intended learning outcomes		
Students have developed a knowledge of pharmaceutical/medicinal chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Drug design		o8-MCM3-172-m01
Module coordinator		Module offered by
lecturers Pharmazeutische Chemie (Pharmaceutical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module discusses advanced topics in natural product chemistry and biological chemistry.		
Intended learning outcomes		
Students are able to discuss advanced topics in natural product chemistry and biological chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation (approx. 30 minutes) with discussion Language of assessment: German and/or English		
Allocation of places		
22 places. 16 places for students of the Master's degree programme Chemie (Chemistry): Places will be allocated according to the same number of subject semesters; students who have chosen Medizinische Chemie (Medicinal Chemistry) as their focus will be given preferential consideration. 6 places for students of the Master's degree programme Biochemie (Biochemistry): Places will be allocated according to the number of subject semesters; among applicants with the same number of subject semesters, places will be allocated by lot. 2 places for students of the Master's degree programme MINT-Lehramt PLUS: Places will be allocated according to the number of subject semesters; among applicants with the same number of subject semesters, places will be allocated by lot; a waiting list will be maintained and places re-allocated by lot as they become available.		
Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Organic Chemistry 3		o8-OC3-152-m01
Module coordinator		Module offered by
holder of the Professorship of Organic Chemistry		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module focuses on polar rearrangements, olefination reactions, pericyclic reactions, carbenes, nitriles and radicals. It discusses the fundamental principles of stereoselective synthesis, asymmetric catalysis, organometallic chemistry and retrosynthesis.		
Intended learning outcomes		
Students are able to formulate olefination reactions. They are able to develop stereoselective syntheses and asymmetric catalyses. Students are able to describe organometallic reactions. They are able to conduct retrosynthetic analyses of molecules.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)		
Module appears in		
First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015)) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Organic Chemistry 4		o8-OC4-152-m01
Module coordinator		Module offered by
holder of the Chair of Organic Chemistry II		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module discusses biologically important bonding classes, their reactions and syntheses, working with special hazardous substances, complicated working and synthesis techniques, purification methods and product analysis.		
Intended learning outcomes		
Students are able to name important heteroaromatics and to formulate their reactions and syntheses. They are able to characterise and categorise dyes. Students are able to describe the structure and selective synthesis of proteins. In addition, they are able to describe the structure of the DNA, carbohydrates, fats, terpenes and steroids.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 62 I Nr. 2		
Module appears in		
Bachelor's degree (1 major) Biochemistry (2015) First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Biochemistry (2017)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015))
Bachelor's degree (1 major) Biochemistry (2022)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Advanced Research Project Organic Chemistry		o8-OCM-AKP1-161-m01
Module coordinator		Module offered by
head of the research group offering the module		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to get involved in the work of one of the research groups based at the Institute of Organic Chemistry and learn some advanced synthesis and analytical methods.		
Intended learning outcomes		
Students are able to describe and use some of the synthesis and analytical methods typically used by the research group as well as to describe theoretical aspects.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (20) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Log (approx. 15 to 20 pages) and talk (approx. 15 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Organic Functional Materials		o8-OCM-FM-161-mo1
Module coordinator		Module offered by
lecturer of the seminar "Organische Funktionsmaterialien"		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The module deals with specific topics in organic functional materials. The focus is on fundamental (photo)physical effects in organic molecular and polymeric semiconductors as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes, or organic solar cells as well as in non-linear optics.		
Intended learning outcomes		
The students are able to explain fundamental (photo)physical processes in organic semiconductors. He/She can explain the synthesis of these semiconductor materials as well as their application in (opto)electronic components such as field effect transistors, organic light-emitting diodes or in organic photovoltaics as well as in nonlinear optics.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022)		

Master's degree (1 major) Chemistry (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title			Abbreviation
Modern Aspects of Natural Product Chemistry and Biological Chemistry			o8-OCM-NAT-172-m01
Module coordinator		Module offered by	
lecturer of the seminar		Institute of Organic Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This module equips students with practical skills in the areas of recombinant engineering and characterisation of macromolecular complexes, modern biomolecular techniques, in vivo analysis of biochemical processes, and modern imaging techniques.			
Intended learning outcomes			
Students have developed a knowledge of molecular biology and are able to apply it to practical experiments.			
Courses (type, number of weekly contact hours, language — if other than German)			
S /Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) Language of assessment: German and/or English			
Allocation of places			
Master's degree programme Chemie (Chemistry): no limitation. Master's degree programme Biochemie (Biochemistry): 20 places. Places will be allocated according to the number of subject semesters; among applicants with the same number of subject semesters, places will be allocated by lot A waiting list will be maintained and places re-allocated as they become available.			
Additional information			
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Workload			
150 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			

Module title			Abbreviation
Modern Synthetic Methods			o8-OCM-SYNT-161-mo1
Module coordinator		Module offered by	
lecturer of the seminar		Institute of Organic Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This module discusses modern stereoselective synthesis methods. It focuses on selected total syntheses, organometallic chemistry and catalysis.			
Intended learning outcomes			
Students are able to stereoselectively plan complex chemical syntheses and to stereochemically analyse them. They can explain total syntheses. They can describe aspects of organometallic chemistry and catalysis in synthesis chemistry.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) + Ü (1) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Laser Spectroscopy		o8-PCM1a-161-mo1
Module coordinator		Module offered by
lecturer of seminar "Laserspektroskopie" (Laser Spectroscopy)		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module introduces students to the fundamental principles of laser spectroscopy. It discusses absorption and emission spectroscopy.		
Intended learning outcomes		
Students are able to explain the components and operating principles of lasers as well as the optical principles of laser technology. They are able to describe the principles of absorption and emission spectroscopy.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022)		
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Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Chemistry (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Advanced Physical Chemistry (Lab)		o8-PCM1b-161-mo1
Module coordinator		Module offered by
lecturer of seminar "Laserspektroskopie" (Laser Spectroscopy)		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to use modern experimental methods in physical chemistry in the laboratory. After a safety briefing, the students autonomously conduct experiments in the laboratory. Students will be expected to take tests and write lab reports to demonstrate their knowledge.		
Intended learning outcomes		
Students have developed a high level of proficiency in modern experimental methods in physical chemistry. They are able to analyse the resulting measurements and write a lab report.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (4) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 20 working days.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Statistical Mechanics and Reaction Dynamics			o8-PCM2-161-mo1
Module coordinator		Module offered by	
lecturer of seminar "Chemische Dynamik" (Chemical Dynamics)		Institute of Physical and Theoretical Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This module discusses selected topics in statistical mechanics and reaction dynamics. Topics to be covered include the fundamental principles of statistical thermodynamics, the transition state theory, uni- and bimolecular reactions as well as charge and energy transfer.			
Intended learning outcomes			
Students have become familiar with selected topics in statistical mechanics and reaction dynamics. They have learned and are able to apply the fundamental principles of statistical thermodynamics.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) + Ü (1) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
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Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Functional Materials (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Chemistry (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Nanoscale Materials		o8-PCM3-161-mo1
Module coordinator		Module offered by
lecturer of the seminar "Nanoskalige Materialien"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module discusses advanced topics in nanoscale materials. It focuses on the structure, properties, fabrication, modern characterisation methods and application areas of nanoscale materials.		
Intended learning outcomes		
Students are able to characterise nanoscale materials. They are able to name analytical methods and application areas of nanoscale materials.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Quantum Technology (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Ultrafast spectroscopy and quantum-control		o8-PCM4-161-mo1
Module coordinator		Module offered by
lecturer of the seminar "Nanoskalige Materialien"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Prior completion of modules o8-PCM1a and o8-PCM1b recommended.
Contents		
This module discusses advanced topics in ultrafast spectroscopy and quantum control. It focuses on ultrashort laser pulses, time-resolved laser spectroscopy and coherent control.		
Intended learning outcomes		
Students are able to describe the generation of ultrashort laser pulses and to characterise them. They can explain the theory of time-resolved laser spectroscopy and name experimental methods. They can describe the principles and applications of quantum control.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 253 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Physics International (2020)
Master's degree (1 major) Quantum Engineering (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Quantum Engineering (2024)
Master's degree (1 major) Physics International (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)

Module title		Abbreviation
Physical Chemistry of Supramolecular Assemblies		o8-PCM5-161-mo1
Module coordinator		Module offered by
lecturer of the seminar "Physikalische Chemie Supramolekularer Strukturen"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module examines the basic interactions between molecules. It discusses the formation and physical-chemical properties of aggregates as well as key applications of supramolecular chemistry.		
Intended learning outcomes		
Students are able to explain the basic interactions between molecules demonstrating a high degree of expertise in the field. They can describe the formation and physical-chemical properties of aggregates. They can name modern applications of supramolecular chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) or c) talk (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 255 / 739

Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Biofabrication (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Physical Chemistry (Advanced Lab)		o8-PCM6-161-mo1
Module coordinator		Module offered by
lecturers Physikalische Chemie (Physical Chemistry)		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to get involved in the work of one of the research groups based at the Institute of Physical Chemistry and learn some advanced synthesis and analytical methods.		
Intended learning outcomes		
Students have become proficient in the research methods typically used by the relevant physical chemistry research group. They are able to analyse their findings and thus help answer topical questions in physical chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (4) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation (approx. 20 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
Additional information on module duration: block taught lab course with approx. 20 working days.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 257 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Molecular structure and spectroscopy		o8-PC-MBS-152-mo1
Module coordinator		Module offered by
lecturer of lecture "Molekülbau and Spektroskopie"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module provides an introduction to molecular structure, spectroscopy and quantum mechanics. The particle in a box model, quantum mechanical description of the hydrogen atom, atomic orbitals, molecular orbitals, chemical bonds. Analysis of molecules on the basis of the harmonic oscillator and rigid rotor models. As regards spectroscopy, a particular focus will be on UV-VIS spectroscopy, vibrational spectroscopy and microwave spectroscopy.		
Intended learning outcomes		
Students are able to explain key models of quantum mechanics and to apply them to molecules. They are able to describe different spectroscopic methods.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 62 I Nr. 1		
Module appears in		
First state examination for the teaching degree Grundschule English (2009) First state examination for the teaching degree Grundschule Biology (2009) First state examination for the teaching degree Grundschule Chemistry (2009) First state examination for the teaching degree Grundschule Geography (2009) First state examination for the teaching degree Grundschule Protestant Theology (2009) First state examination for the teaching degree Grundschule German (2009) First state examination for the teaching degree Grundschule History (2009) First state examination for the teaching degree Grundschule History (2015)		

First state examination for the teaching degree Grundschule Catholic Theology (2009)
 First state examination for the teaching degree Grundschule Mathematics (2009)
 First state examination for the teaching degree Grundschule Music (2009)
 First state examination for the teaching degree Grundschule Physics (2009)
 First state examination for the teaching degree Grundschule Social Science (2009)
 First state examination for the teaching degree Grundschule Science of Sport (2009)
 First state examination for the teaching degree Hauptschule English (2009)
 First state examination for the teaching degree Hauptschule Biology (2009)
 First state examination for the teaching degree Hauptschule Chemistry (2009)
 First state examination for the teaching degree Hauptschule Geography (2009)
 First state examination for the teaching degree Hauptschule Protestant Theology (2009)
 First state examination for the teaching degree Hauptschule German (2009)
 First state examination for the teaching degree Hauptschule History (2009)
 First state examination for the teaching degree Hauptschule Catholic Theology (2009)
 First state examination for the teaching degree Hauptschule Mathematics (2009)
 First state examination for the teaching degree Hauptschule Music (2009)
 First state examination for the teaching degree Hauptschule Physics (2009)
 First state examination for the teaching degree Hauptschule Social Science (2009)
 First state examination for the teaching degree Hauptschule Science of Sport (2009)
 First state examination for the teaching degree Realschule English (2009)
 First state examination for the teaching degree Realschule Biology (2009)
 First state examination for the teaching degree Realschule Chemistry (2009)
 First state examination for the teaching degree Realschule Geography (2009)
 First state examination for the teaching degree Realschule Protestant Theology (2009)
 First state examination for the teaching degree Realschule French Studies (2009)
 First state examination for the teaching degree Realschule German (2009)
 First state examination for the teaching degree Realschule History (2009)
 First state examination for the teaching degree Realschule Computer Science (2012)
 First state examination for the teaching degree Realschule Catholic Theology (2009)
 First state examination for the teaching degree Realschule Mathematics (2009)
 First state examination for the teaching degree Realschule Music (2009)
 First state examination for the teaching degree Realschule Physics (2009)
 First state examination for the teaching degree Realschule Science of Sport (2009)
 First state examination for the teaching degree Sonderpädagogik Pedagogy of Secondary Education (2009)
 First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2009)
 First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2013)
 First state examination for the teaching degree Mittelschule English (2013)
 First state examination for the teaching degree Mittelschule Biology (2013)
 First state examination for the teaching degree Mittelschule Chemistry (2013)
 First state examination for the teaching degree Mittelschule Geography (2013)
 First state examination for the teaching degree Mittelschule Protestant Theology (2013)
 First state examination for the teaching degree Mittelschule German (2013)
 First state examination for the teaching degree Mittelschule History (2013)
 First state examination for the teaching degree Mittelschule Catholic Theology (2013)
 First state examination for the teaching degree Mittelschule Mathematics (2013)
 First state examination for the teaching degree Mittelschule Physics (2013)
 First state examination for the teaching degree Mittelschule Social Science (2013)
 First state examination for the teaching degree Mittelschule Science of Sport (2013)
 Bachelor's degree (1 major) Biochemistry (2015)
 First state examination for the teaching degree Grundschule English (2015)
 First state examination for the teaching degree Grundschule Biology (2015)
 First state examination for the teaching degree Grundschule Chemistry (2015)
 First state examination for the teaching degree Grundschule Geography (2015)

First state examination for the teaching degree Grundschule German (2015)
 First state examination for the teaching degree Grundschule Catholic Theology (2015)
 First state examination for the teaching degree Grundschule Mathematics (2015)
 First state examination for the teaching degree Grundschule Pedagogy of Primary Education (2015)
 First state examination for the teaching degree Grundschule Physics (2015)
 First state examination for the teaching degree Grundschule Social Science (2015)
 First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Biology (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Chemistry (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Geography (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in German (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in History (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Catholic Theology (Primary School) (2015)
 First state examination for the teaching degree Grundschule Art Education in Primary School (2015)
 First state examination for the teaching degree Grundschule Didactics in Science of Sport (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Mathematics (Primary School) (2015)
 First state examination for the teaching degree Grundschule Music Education in Primary School (2015)
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015)
 First state examination for the teaching degree Grundschule Didactics in Social Science (Primary School) (2015)
 First state examination for the teaching degree Grundschule Science of Sport (2015)
 First state examination for the teaching degree Realschule English (2015)
 First state examination for the teaching degree Realschule Biology (2015)
 First state examination for the teaching degree Realschule Chemistry (2015)
 First state examination for the teaching degree Realschule Geography (2015)
 First state examination for the teaching degree Realschule Protestant Theology (2015)
 First state examination for the teaching degree Realschule French Studies (2015)
 First state examination for the teaching degree Realschule German (2015)
 First state examination for the teaching degree Realschule History (2015)
 First state examination for the teaching degree Realschule Computer Science (2015)
 First state examination for the teaching degree Realschule Catholic Theology (2015)
 First state examination for the teaching degree Realschule Mathematics (2015)
 First state examination for the teaching degree Realschule Physics (2015)
 First state examination for the teaching degree Realschule Science of Sport (2015)
 First state examination for the teaching degree Gymnasium Chemistry (2015)
 First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Primary School) (2015)
 First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Primary School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Primary School) (2015)
 First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Ergonomics (Teaching at the German Mittelschule) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Biology (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Chemistry (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Geography (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Middle School) (2015)

First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Social Science (Middle School) (2015)
 First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2015)
 First state examination for the teaching degree Mittelschule English (2015)
 First state examination for the teaching degree Mittelschule Biology (2015)
 First state examination for the teaching degree Mittelschule Chemistry (2015)
 First state examination for the teaching degree Mittelschule Geography (2015)
 First state examination for the teaching degree Mittelschule Protestant Theology (2015)
 First state examination for the teaching degree Mittelschule German (2015)
 First state examination for the teaching degree Mittelschule History (2015)
 First state examination for the teaching degree Mittelschule Catholic Theology (2015)
 First state examination for the teaching degree Mittelschule Mathematics (2015)
 First state examination for the teaching degree Mittelschule Physics (2015)
 First state examination for the teaching degree Mittelschule Social Science (2015)
 First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Ergonomics (Teaching at the German Mittelschule) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Biology (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Chemistry (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Geography (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Protestant Theology (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Catholic Theology (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Art Education in Middle School (2015)
 First state examination for the teaching degree Mittelschule Didactics in Science of Sport (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Mathematics (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Music Education in Middle School (2015)
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Didactics in Social Science (Middle School) (2015)
 First state examination for the teaching degree Mittelschule Science of Sport (2015)
 First state examination for the teaching degree Mittelschule Teaching at the German Mittelschule (2015)
 First state examination for the teaching degree Grundschule Protestant Theology (2015)
 First state examination for the teaching degree Grundschule Music (2015)
 First state examination for the teaching degree Grundschule Didactics in Protestant Theology (Primary School) (2015)
 First state examination for the teaching degree Realschule Music (2015)
 First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Primary School) (2015)
 First state examination for the teaching degree Mittelschule Music (2015)

First state examination for the teaching degree Realschule French Studies (2016)
 First state examination for the teaching degree Grundschule English (2016)
 First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2016)
 First state examination for the teaching degree Realschule English (2016)
 First state examination for the teaching degree Mittelschule English (2016)
 First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2016)
 First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Bachelor's degree (1 major) Biochemistry (2017)
 First state examination for the teaching degree Grundschule Physics (2018)
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018)
 First state examination for the teaching degree Realschule Physics (2018)
 First state examination for the teaching degree Mittelschule Physics (2018)
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018)
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 First state examination for the teaching degree Mittelschule Biology (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Biology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Biology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Chemistry (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule German (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule English (2020 (Prüfungsordnungsversion 2016))
 First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2020 (Prüfungsordnungsversion 2016))
 First state examination for the teaching degree Mittelschule Protestant Theology (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Protestant Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Geography (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Geography (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule History (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Catholic Theology (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Catholic Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Mathematics (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Mathematics (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Art Education in Middle School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Science of Sport (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Didactics in Science of Sport (Middle School) (2020 (Prüfungsordnungsversion 2015))

First state examination for the teaching degree Mittelschule Music (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Music Education in Middle School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Mittelschule Teaching at the German Mittelschule (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2020 (Prüfungsordnungsversion 2016))
 First state examination for the teaching degree Sonderpädagogik Didactics in Chemistry (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Geography (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Middle School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Teaching at the German Mittelschule (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Science of Sport (Primary School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Mathematics (Primary School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Protestant Theology (Primary School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Sonderpädagogik Didactics in Catholic Theology (Primary School) (2020 (Prüfungsordnungsversion 2015))
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020)
 First state examination for the teaching degree Grundschule Physics (2020)
 First state examination for the teaching degree Realschule Physics (2020)
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020)
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)
 First state examination for the teaching degree Mittelschule Physics (2020)
 First state examination for the teaching degree Grundschule Political and Social Studies (2020)
 First state examination for the teaching degree Grundschule Didactics in Political and Social Studies (Primary School) (2020)

First state examination for the teaching degree Sonderpädagogik MS-Didaktik Career and Economics (2020)
First state examination for the teaching degree Sonderpädagogik Didactics in Political and Social Studies (Secondary School) (2020)
First state examination for the teaching degree Mittelschule MS-Didaktik Career and Economics (2020)
First state examination for the teaching degree Mittelschule Didactics in Political and Social Studies (Secondary School) (2020)
First state examination for the teaching degree Mittelschule Political and Social Studies (2020)
First state examination for the teaching degree Grundschule History (2021)
First state examination for the teaching degree Realschule History (2021)
First state examination for the teaching degree Mittelschule History (2021)
First state examination for the teaching degree Grundschule Pedagogy of Primary Education (2021)
First state examination for the teaching degree Sonderpädagogik Pedagogy of Primary Education (2021)
Bachelor's degree (1 major) Biochemistry (2022)
First state examination for the teaching degree Realschule English (2023)
First state examination for the teaching degree Grundschule English (2023)
First state examination for the teaching degree Grundschule Didactics in English (Primary School) (2023)
First state examination for the teaching degree Mittelschule English (2023)
First state examination for the teaching degree Mittelschule Didactics in English (Middle School) (2023)
First state examination for the teaching degree Sonderpädagogik Didactics in English (Middle School) (2023)
First state examination for the teaching degree Realschule Geography (2023)
First state examination for the teaching degree Grundschule Geography (2023)
First state examination for the teaching degree Mittelschule Geography (2023)
First state examination for the teaching degree Grundschule German (2024)
First state examination for the teaching degree Realschule German (2024)
First state examination for the teaching degree Sonderpädagogik Didactics in German (Middle School) (2024)
First state examination for the teaching degree Mittelschule Didactics in German (Middle School) (2024)
First state examination for the teaching degree Grundschule Didactics in German (Primary School) (2024)
First state examination for the teaching degree Sonderpädagogik Didactics in German (Primary School) (2024)
First state examination for the teaching degree Mittelschule German (2024)
First state examination for the teaching degree Grundschule Music Education in Primary School (2024)
First state examination for the teaching degree Sonderpädagogik Music Education in Primary School (2024)
First state examination for the teaching degree Mittelschule Music Education in Middle School (2024)
First state examination for the teaching degree Sonderpädagogik Music Education in Middle School (2024)
First state examination for the teaching degree Mittelschule MS-Didaktik Career and Economics (2024)
First state examination for the teaching degree Sonderpädagogik MS-Didaktik Career and Economics (2024)
First state examination for the teaching degree Grundschule History (2024)
First state examination for the teaching degree Realschule History (2024)
First state examination for the teaching degree Mittelschule History (2024)
First state examination for the teaching degree Mittelschule Didactics in History (Middle School) (2024)
First state examination for the teaching degree Sonderpädagogik Didactics in History (Middle School) (2024)
First state examination for the teaching degree Grundschule Didactics in History (Primary School) (2024)
First state examination for the teaching degree Grundschule Art Education in Primary School (2024)
First state examination for the teaching degree Sonderpädagogik Art Education in Primary School (2024)
First state examination for the teaching degree Sonderpädagogik Art Education in Middle School (2024)
First state examination for the teaching degree Mittelschule Art Education in Middle School (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Symmetry, chemical bonding and light - Part 1			o8-PC-SBL1-152-mo1
Module coordinator		Module offered by	
lecturer of lecture "Symmetrie, chemische Bindung and Licht"		Institute of Physical and Theoretical Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
6	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
This module provides an introduction to the symmetry of molecules. It focuses on group theory, symmetry operations, point groups, character tables and selection rules. The module deals with the chemical bond based on the qualitative MO theory and gives an introduction to the fundamentals of computational chemistry.			
Intended learning outcomes			
Students are able to analyse the symmetry of molecules. They are able to draw conclusions about the spectroscopic properties of a particular molecule from the symmetry of that molecule.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) + Ü (2)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
180 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)			
Module appears in			
First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015)) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			
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Module title		Abbreviation
Clinical-analytical Chemistry		o8-PH-KAC-152-m01
Module coordinator		Module offered by
lecturer of lecture "Klinisch-analytische Chemie" (Clinical and Analytical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module discusses advanced topics in clinical analytical chemistry.		
Intended learning outcomes		
Students have developed an advanced knowledge of molecular biology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 120 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Chemistry (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Practical course of clinical-analytical Chemistry		o8-PH-KACP-152-m01
Module coordinator		Module offered by
lecturer of lecture "Klinisch-analytische Chemie" (Clinical and Analytical Chemistry)		Institute of Pharmacy and Food Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module covers practical topics in clinical chemistry and clinical diagnostics as well as the related analytical methods.		
Intended learning outcomes		
Students have developed a knowledge of clinical analytical chemistry and are able to apply it to practical experiments.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (5)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Biochemistry (2017) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Biochemistry (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Supramolecular Chemistry (Basics)		o8-SCM1-152-m01
Module coordinator		Module offered by
lecturer of lecture "Organischen Chemie"		Faculty of Chemistry and Pharmacy
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module introduces students to the fundamental principles of supramolecular chemistry. It focuses on interactions between molecules, molecular recognition by receptors, complexes, supramolecular polymers, coordination polymers and networks, liquid crystals, self-assembly in aqueous media, synthetic ion channels and modern applications of supramolecular chemistry.		
Intended learning outcomes		
Students are able to explain interactions between molecules demonstrating a high degree of expertise in the field as well as to describe the formation, structure and polymers of coordination compounds. They are able to describe the self-assembly of polymers in aqueous media as well as to identify the characteristics of synthetic ion channels. They can name modern applications of supramolecular chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biofabrication (2015) Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Supramolecular Chemistry (Practical Course)		o8-SCM2-161-m01
Module coordinator		Module offered by
lecturer of lecture "Supramolekularen Chemie (Organische Chemie/Physikalische Chemie)"		Faculty of Chemistry and Pharmacy
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	o8-SCM1
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to perform some of the key experiments in supramolecular chemistry. They will perform syntheses of host-guest complexes, dye aggregates and nanoparticles and use advanced analytical methods to characterise them.		
Intended learning outcomes		
Students are able to perform syntheses of host-guest complexes and use spectroscopic methods to analyse and characterise them. They are able to produce nanoparticles and to characterise them microscopically.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Bioorganic Chemistry		o8-SCM3-152-m01
Module coordinator		Module offered by
lecturer of lecture "Bioorganische Chemie" (Bioorganic Chemistry)		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Bioorganic chemistry unites the central questions of organic chemistry, biochemistry, medicinal chemistry and spectroscopy with a focus on biomolecules. At the core of bioorganic chemistry is the synthesis and purposeful manipulation of biomolecules, such as nucleic acids, peptides, proteins, carbohydrates and lipids. This includes the framework of structure-function relationships and the fundamental understanding of biological mechanisms, to enable applications towards biomaterials, biosensing, bioimaging, clinical diagnostics and therapeutics.</p> <p>Key concepts covered in the course are nucleic acid chemistry, peptide chemistry, carbohydrate chemistry, bioorthogonal reactions, molecular diversity, solid-phase synthesis, molecular recognition and interactions (ligand-receptor interactions, signal transduction)</p>		
Intended learning outcomes		
The students will have a molecular understanding of the structure and reactivity of biomolecules. The students obtain knowledge of modern synthetic methods in bioorganic chemistry and can explain principles of molecular interactions and recognition mechanisms. They can describe modern aspects of nucleic acids, proteins, carbohydrates and lipids.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (3)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 45 to 90 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (15 to 30 minutes per candidate) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Biochemistry (2015) Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Biochemistry (2017)
Master's degree (1 major) Chemistry (2018)
Master's degree (1 major) Biochemistry (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Chemistry (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Supramolecular Chemistry (Advanced Lab)		o8-SCM4-161-m01
Module coordinator		Module offered by
lecturer of lecture "Supramolekularen Chemie (Organische Chemie/Physikalische Chemie)"		Institute of Organic Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	o8-SCM2
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to enhance their skills in advanced synthesis and analytical methods in supramolecular chemistry. Students will be expected to conduct their work in the lab independently, document their findings and deliver a presentation.		
Intended learning outcomes		
Students are able to use advanced synthesis and analytical methods in supramolecular chemistry in the lab and to interpret their findings. They are able to deliver a presentation on their findings.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation (approx. 20 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 20 working days.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Quantum Chemistry		o8-TC-152-mo1
Module coordinator		Module offered by
lecturer of lecture "Quantenchemie"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
3	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
This module provides students with deeper insights into advanced topics in quantum chemistry. It focuses on spin, the Pauli principle, Slater determinants, the Hartree-Fock method, correlation energy, configuration interaction and excited states, the Born-Oppenheimer approximation and bonding models of H ₂ ⁺ .		
Intended learning outcomes		
Students are able to describe excited states of molecules with the help of key concepts and models.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
90 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)		
Module appears in		
Bachelor's degree (1 major) Chemistry (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Functional Materials (2015) First state examination for the teaching degree Grundschule Chemistry (2015) First state examination for the teaching degree Realschule Chemistry (2015) First state examination for the teaching degree Gymnasium Chemistry (2015) First state examination for the teaching degree Mittelschule Chemistry (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Bachelor's degree (1 major) Biochemistry (2017)
 Bachelor's degree (1 major) Chemistry (2017)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 First state examination for the teaching degree Mittelschule Chemistry (2020 (Prüfungsordnungsversion 2015))
 Bachelor's degree (1 major) Functional Materials (2021)
 Bachelor's degree (1 major) Biochemistry (2022)
 Bachelor's degree (1 major) Mathematics (2023)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Bachelor's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Theoretical Chemistry - Project course quantum chemistry		o8-TCAP1-161-m01
Module coordinator		Module offered by
head of the research group offering the module		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to get involved in the work of one of the research groups based at the Institute of Theoretical Chemistry and learn some of the methods typically used in the discipline. The focus will be on quantum chemistry.		
Intended learning outcomes		
Students have learned some of the methods typically used in theoretical chemistry and, in particular, in quantum chemistry. They are able to explain issues that are relevant to the field of quantum chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (5)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 20 working days.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Theoretical Chemistry - Project course quantum dynamics		o8-TCAP2-161-m01
Module coordinator		Module offered by
head of the research group offering the module		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module gives students the opportunity to get involved in the work of one of the research groups based at the Institute of Theoretical Chemistry and learn some of the methods typically used in the discipline. The focus will be on quantum dynamics.		
Intended learning outcomes		
Students have learned some of the methods typically used in theoretical chemistry and, in particular, in quantum dynamics. They are able to explain issues that are relevant to the field of quantum dynamics.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (5)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Additional information on module duration: block taught lab course with approx. 20 working days.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Chemistry (2024) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Selected Topics in Theoretical Chemistry		o8-TCM1-161-mo1
Module coordinator		Module offered by
lecturer of lecture "Theoretische Chemie"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module introduces students to the fundamental principles of theoretical chemistry.		
Intended learning outcomes		
Students are able to describe the mathematical and physical principles underlying the quantum chemical and quantum dynamical approaches of theoretical chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022)		
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Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Chemistry (2024)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Basics and Applications of Quantum Chemistry		o8-TCM2-161-mo1
Module coordinator		Module offered by
lecturer of lecture "Computational Chemistry"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This module introduces students to the fundamental principles of computational chemistry.		
Intended learning outcomes		
Students are able to explain the theoretical principles of computational chemistry and to apply methods in computational chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022)		
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Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title			Abbreviation
Numerical Methods and Programming			o8-TCM3-161-mo1
Module coordinator		Module offered by	
lecturer of lecture "Programmieren in Theoretischer Chemie"		Institute of Physical and Theoretical Chemistry	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
This module provides an introduction to the fundamentals of programming in theoretical chemistry and discusses its application areas.			
Intended learning outcomes			
Students are able to explain and use one of the programming languages typically used in theoretical chemistry as well as to name its application areas.			
Courses (type, number of weekly contact hours, language — if other than German)			
S (2) + Ü (2)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English			
Allocation of places			
--			
Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)			
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Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Quantum Dynamics		o8-TCM4-161-mo1
Module coordinator		Module offered by
lecturer of lecture "Quantendynamik"		Institute of Physical and Theoretical Chemistry
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Time-dependent Schrödinger equation, propagators, time-dependent perturbation theory, adiabatic theorem, diabatic and adiabatic states, non-adiabatic dynamics, mixed quantum-classical dynamics.		
Intended learning outcomes		
The students possess knowledge about the time-dependent description of the nuclear and electronic dynamics in molecules. Their insight into the methods and the numerical realizations allow them to carry out applications in the field of theoretical chemistry.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Chemistry (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Chemistry (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 286 / 739

Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Functional Materials (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Chemistry (2024)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
3D User Interfaces		10-HCI=3DUI-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This module will give students the opportunity to learn about the specificities of 3D User Interfaces (3DUI) development using Virtual, Augmented or Mixed Reality technologies. The module content will be mainly dedicated to learn and practice the skills essential to the design and implementation of high-quality 3D interaction techniques. Design guidelines as well as classical and innovative 3D Interaction techniques will be studied. In addition, the course will address novel research themes such as 3D interaction for large displays and games; and integrating 3DUIs with mobile devices, robotics, and the environment. Students will be assessed through a group practical project (team work), which will consist of a program, a presentation, a technical report (2 ages) and a video. Previous years, the assignment replicated the IEEE 3DUI Contest 2011, where teams of students competed between each other to find the best solution (see results at https://www.youtube.com/watch?v=gYs-pBW7Agc and https://www.youtube.com/watch?v=gYs-pBW7Agc)</p>		
Intended learning outcomes		
<p>After the course, the students will gain a solid background on the theory and the methods to create your own 3D spatial interfaces. They will have a broad understanding of the particular difficulties of designing and developing spatial interfaces, as well as evaluating them. Students will also learn about traditional and novel 3D input/output devices (e.g. motion tracking system and Head-mounted Display).</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>presentation of project results (approx. 30 minutes) Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
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Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI, GE.</p>		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
<p>Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018)</p>		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Computer Science (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Machine Learning (for User Interfaces)		10-HCI=MLUI-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us practical speech recognition, effective web search, self-driving cars, and a vastly improved understanding of the human genome. Machine learning is so pervasive today that you probably use it dozens of times a day without knowing it. It is one of today's prominent paradigms in HCI applicable in all areas where the understanding of user input of high variability, specifically for natural interactions using, e.g., gesture, speech, or eye-gaze, is paramount. Many researchers also think it is the best way to make progress towards human-level AI.</p> <p>In this course, students will learn about the most effective machine learning techniques, and gain practice implementing them and getting them to work. Students not only learn the theoretical underpinnings of learning, but also gain the practical know-how needed to quickly and powerfully apply these techniques to new problems. Finally, they learn about some of Silicon Valley's best practices in innovation as it pertains to machine learning and AI.</p> <p>This course provides a broad introduction to machine learning, data-mining, and statistical pattern recognition. Topics include: (i) Supervised learning (parametric/non-parametric algorithms, support vector machines, kernels, neural networks). (ii) Unsupervised learning (clustering, dimensionality reduction, recommender systems, deep learning). (iii) Best practices in machine learning (bias/variance theory; innovation process in machine learning and AI). The course will also draw from numerous case studies and applications, so that you'll also learn how to apply learning algorithms to building gesture-based and multimodal interfaces, text and speech understanding (web search, anti-spam), smart robots (perception, control), computer vision, medical informatics, audio, database mining, and other areas.</p>		
Intended learning outcomes		
<p>After the course, the students will be able to solve machine learning tasks on their own using assistive technologies, e.g., like Octave. In addition, they will be able to derive main principles and apply these in own programs. Students will be able to choose the appropriate approach and tools to solve a given machine learning task in various application area, specifically in HCI.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>presentation of project results (approx. 40 minutes) Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
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Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI,GE.</p>		
Workload		
150 h		

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3 b)
Module appears in
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Computer Science (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Multimodal User Interfaces		10-HCI=MMUI-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The multimodal interaction paradigm simultaneously uses various modalities like speech, gesture, touch, or gaze, to communicate with computers and machines. Basically, multimodal interaction includes the analysis as well as the synthesis of multimodal utterances. This course concentrates on the analysis, i.e., the input processing. Input processing has the goal to derive meaning from signal to provide a computerized description and understanding of the input and to execute the desired interaction. In multimodal systems, this process is interleaved between various modalities and multiple interdependencies exist between simultaneous utterances necessary to take into account for a successful machine interpretation.</p> <p>In this course, students will learn about the necessary steps involved in processing unimodal as well as multimodal input. The course will highlight typical stages in multimodal processing. Using speech processing as a primary example, they learn about:</p> <ol style="list-style-type: none"> 1. A/D conversion 2. Segmentation 3. Syntactical analysis 4. Semantic analysis 5. Pragmatic analysis 6. Discourse analysis <p>A specific emphasize will be on stages like morphology and semantic analysis. Typical aspects of multimodal interdependencies, i.e., temporal and semantic interrelations are highlighted and consequences for an algorithmic processing are derived. Prominent multimodal integration (aka multimodal fusion) approaches are described, including transducers, state machines, and unification.</p>		
Intended learning outcomes		
<p>After the course, the students will be able to build their own multimodal interfaces. They will have a broad understanding of all the necessary steps involved and will know prominent algorithmic solutions for each of them. Student will learn about available tools for reoccurring tasks and their pros and cons.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>presentation of project results (approx. 40 minutes) Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
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Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI,GE.</p>		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3 b)

Module appears in

Master's degree (1 major) Computer Science (2016)
Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's degree (1 major) Computer Science (2017)
Master's degree (1 major) Computer Science (2018)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Computer Science (2021)
Master's degree (1 major) Aerospace Computer Science (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Computer Science (2023)
Master's degree (1 major) Aerospace Computer Science (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Real-Time Interactive Systems		10-HCI=RIS-182-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This course provides an introduction into the requirements, concepts, and engineering art of highly interactive human-computer systems. Such systems are typically found in perceptual computing, Virtual, Augmented, Mixed Reality, computer games, and cyber-physical systems. Lately, these systems are often termed Real-Time Interactive Systems (RIS) due to their common aspects.</p> <p>The course covers theoretical models derived from the requirements of the application area as well as common hands-on and novel solutions necessary to tackle and fulfill these requirements. The first part of the course will concentrate on the conceptual principles characterizing real-time interactive systems. Questions answered are: What are the main requirements? How do we handle multiple modalities? How do we define the timeliness of RIS? Why is it important? What do we have to do to assure timeliness? The second part will introduce a conceptual model of the mission-critical aspects of time, latencies, processes, and events necessary to describe a system's behavior. The third part introduces the application state, its requirements of distribution and coherence, and the consequences these requirements have on decoupling and software quality aspects in general. The last part introduces some potential solutions to data redundancy, distribution, synchronization, and interoperability. Along the way, typical and prominent state-of-the-art approaches to reoccurring engineering tasks are discussed. This includes pipeline systems, scene graphs, application graphs (aka field routing), event systems, entity and component models, and others. Novel concepts like actor models and ontologies will be covered as alternative solutions. The theoretical and conceptual discussions will be put into a practical context of today's commercial and research systems, e.g., X3D, instant reality, Unity3d, Unreal Engine 4, and Simulator X.</p>		
Intended learning outcomes		
<p>After the course, the students will have a solid understanding of the boundary conditions defined by both, the physiological and psychological characteristics of the human users as well as by the architectures and technological characteristics of today's computer systems. Participants will gain a solid understanding about what they can expect from today's technological solutions. They will be able to choose the appropriate approach and tools to solve a given engineering task in this application area and they will have a well-founded basis enabling them to develop alternative approaches for future real-time interactive systems.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes).</p> <p>If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).</p> <p>Language of assessment: German and/or English</p> <p>creditable for bonus</p>		
Allocation of places		
--		
Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI. Cf. Section 3 Subsection 3 Sentence 8 FSB (subject-specific provisions).</p>		

Workload
150 h
Teaching cycle
--
Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 3 b)
Module appears in
Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Information Systems (2022) Master's degree (1 major) Computer Science (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Advanced Automation		10-I=AA-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced topics in automation systems as well as instrumentation and control engineering, for example from the field of sensor data processing, actuators, cooperating systems, mission and trajectory planning.		
Intended learning outcomes		
The students have an advanced knowledge of selected topics in automation systems. They are able to implement advanced automation systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes) creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT,IS,ES,LR,GE		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Space Science and Technology (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Module studies (Master) Computer Science (2019) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computational Mathematics (2022)		
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Master's degree (1 major) Mathematics (2022)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computational Geometry		10-I=AG-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In many areas of computer science -- for example robotics, computer graphics, virtual reality and geographic information systems -- it is necessary to store, analyse, create or manipulate spatial data. This class is about the algorithmic aspects of these tasks: We will acquire techniques that are needed to plan and analyse geometric algorithms and data structures. Every technique will be illustrated with a problem in the practical areas listed above.		
Intended learning outcomes		
The students are able to decide which algorithms or data structures are suitable for the solution of a given geometric problem. The students are able to analyse new problems and to come up with their own efficient solutions based on the concepts and techniques acquired in the lecture.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 298 / 739

Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Computer Science (2021)
Master's degree (1 major) Aerospace Computer Science (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Aerospace Computer Science (2023)

Module title		Abbreviation
Algorithms for Geographic Information Systems		10-I=AGIS-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Algorithmic foundations of geographic information systems and their application in selected problems of acquisition, processing, analysis and presentation of spatial information. Processes of discrete and continuous optimisation. Applications such as the creation of digital height models, working with GPS trajectories, tasks of spatial planning as well as cartographic generalisation.		
Intended learning outcomes		
The students are able to formalise algorithmic problems in the field of geographic information systems as well as to select and improve suitable approaches to solving these problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IS,HCI		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's degree (1 major) Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)

Module title		Abbreviation
Selected Topics in Algorithms		10-I=AKA-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in algorithmics.		
Intended learning outcomes		
The students understand the basic approach of algorithmic computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)

Module title		Abbreviation
Selected Topics in Embedded Systems		10-I=AKES-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in embedded systems.		
Intended learning outcomes		
The students possess specialised knowledge in the area of embedded systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): ES.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		

Module title		Abbreviation
Selected Topics in HCI		10-I=AKHCI-182-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in HCI.		
Intended learning outcomes		
The students understand the basic approach of human-computer interaction. They are able to understand the solutions to complex problems in this area and to transfer them to related questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü/S (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (60 to 120 minutes) If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		

Module title		Abbreviation
Selected Topics in Computer Science		10-I=AKII-182-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in computer science.		
Intended learning outcomes		
The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü/S (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) eXtended Artificial Intelligence (xtAI) (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		

Module title		Abbreviation
Selected Topics in Intelligent Systems		10-I=AKIS-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in intelligent systems.		
Intended learning outcomes		
The students possess an advanced knowledge in the area of intelligent systems. They are able to understand solutions to complex problems in this area and to transfer them to related questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IS.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020)		

Module title		Abbreviation
Selected Topics in Internet Technologies		10-I=AKIT-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in computer communication, for example design aspects of future internet structures: setup and control structures of the internet, multicast protocols, protocols for multimedia communication, optical networks, control mechanisms for redundant and real-time communication networks, p2p networks, ad-hoc networks, or -- new concepts and technologies in mobile communication: digital modulation, signal propagation, channel coding, modern transmission technologies (adaptive modulation and coding, hybrid ARQ, OFDM, MI-MO), mac layer, mobileIP, routing in ad-hoc networks, vertical handover, UMTS IP multimedia subsystem, or -- planning and management methods in telecommunication networks: planning methods (forward engineering, reverse engineering), network management paradigms (central and decentral), framework for network management (IETF traffic engineering, ITU-T TMN, OSI management), planning and management methods (IP management mechanisms, network design, measurement, acquisition and evaluation of traffic and performance data, visualisation, result handling, simulation and analysis of networks), management tools, outlook and perspectives, or -- other current topics.		
Intended learning outcomes		
The students have a knowledge of advanced and current topics in the management and design of modern wired and wireless communication systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Computer Science (2017)
Master's degree (1 major) Computer Science (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Computer Science (2021)
Master's degree (1 major) Aerospace Computer Science (2021)

Module title		Abbreviation
Selected Topics in IT Security		10-I=AKITS-172-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in IT security.		
Intended learning outcomes		
The students possess an advanced knowledge in the area of IT security. They are able to understand solutions to complex problems in this area and to transfer them to related questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020)		

Module title		Abbreviation
Selected Topics in Aerospace Engineering		10-I=AKLR-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in aerospace engineering, for example: satellite communication, rocket science, propulsion systems, sensors and actuators for orientation control, perturbation of orbits, interplanetary orbits, rendezvous and docking, design of space ships, design of planetary bases, life support systems, special aspects of operations, payloads, optical systems, RADAR, earth monitoring, thermo management, structure of space ships, special areas of navigation, space environment, environment simulation, verification and test of space faring systems, space astronomy and planet missions, space medicine and biology, material science, quality management, space law, aeroflight topics, avionics for airplanes, air traffic control, areal navigation, pilot interfaces, air traffic control, air traffic management.		
Intended learning outcomes		
The students possess an advanced knowledge about the respective topic of the selected area and are able to consider these foundations in their future plans of air or spaceborne systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Separate written examination for Master's students. Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): LR.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Computer Science (2021)
Master's degree (1 major) Aerospace Computer Science (2021)

Module title		Abbreviation
Selected Topics in Software Engineering		10-I=AKSE-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in software engineering.		
Intended learning outcomes		
The students possess an advanced knowledge about selected aspects of software engineering.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		

Module title		Abbreviation
Selected Topics in Theory		10-I=AKT-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in theory.		
Intended learning outcomes		
The students understand the basic approach of theoretical computer science. They are able to understand the solutions of complex problems in this area and apply them to similar questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) Computer Science (2021) Master's degree (1 major) Aerospace Computer Science (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)

Module title		Abbreviation
Approximation Algorithms		10-I=APA-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The task of finding the optimal solution for a given problem is omnipresent in computer science. Unfortunately, there are many problems without an efficient algorithm for an optimal solution. As a result, in practice, methods are used which do not always give the optimal solution but always give good solutions. This lecture will discuss drafting and analysing techniques for algorithms which have a proven approximation quality. With the help of practical optimisation problems, the lecture will introduce students to important drafting techniques such as greedy, local search, scaling as well as methods based on linear programming.</p>		
Intended learning outcomes		
<p>The students are able to analyse easy approximation methods in terms of their quality. They understand fundamental drafting techniques such as greedy, local search and scaling as well as methods based on linear programming and are able to apply these to new problems.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
--		
Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,GE</p>		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
<p>Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018)</p>		
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Module studies (Master) Computer Science (2019)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Computer Science (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Computer Science (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Advanced Programming		10-I=APR-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.</p>		
Intended learning outcomes		
<p>Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
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Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IS,LR, HCI, ES,GE</p>		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)</p>		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)

Module title		Abbreviation
Automata Theory		10-I=AUT-161-mo1
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Finite automata, regular languages, star-free languages, natural equivalence relations, predicate logic with words, language acceptance through monoids, syntactic monoid, predicate logical and algebraic characterisation of regular languages and star-free languages, two-way automata.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of finite automata, regular languages, star-free languages, natural equivalence relations, predicate logic with words, language acceptance through monoids, syntactic monoid, predicate logical and algebraic characterisation of regular and star-free languages, two-way automata.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, IT, ES, HCI, GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019)		

Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Avionics Systems		10-I=AVS-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VIII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The course <i>Avionik-Systeme (Avionics Systems)</i> offers an overview of software, hardware, sensors, actuators and communication of airplanes and satellites: 1. software module and the software structure 2. control 3. ground control, 4. sensors and actuators, 5. sensor fusion, 6. reliability		
Intended learning outcomes		
At the end of the course, the students should be familiar with typical structures of avionic systems for satellites and airplanes. They should be able to design these. They should be able to program simple controls.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): ES,LR		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Computer Science (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Computer Science (2025)

Module title		Abbreviation
Computability Theory		10-I=BER-161-mo1
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Gödel numbering, computable functions, decidable and countable sets, halting problem, m-reducibility, creative and productive sets, relative computability, Turing reduction, countable degrees, arithmetic hierarchy.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of Gödel numbers, countable functions, decidable and countable sets, halting problem, m-reducibility, creative and productive sets, relative computability, Turing reduction, countable degrees, arithmetic hierarchy.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,SE,IT,IS,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Compiler Construction		10-I=CB-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Lexical analysis, syntactic analysis, semantics, compiler generators, code generators, code optimisation.		
Intended learning outcomes		
The students possess knowledge in the formal description of programming languages and their compilation. They are able to perform transformations between them with the help of finite automata, push-down automata and compiler generators.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IT,IS,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Information Systems (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Databases 2		10-I=DB2-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Data warehouses and data mining; web databases; introduction to Datalog.		
Intended learning outcomes		
The students have advanced knowledge about relational databases, XML and data mining.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE, IS, HCI.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Business Information Systems (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Aerospace Computer Science (2020) Master's degree (1 major) eXtended Artificial Intelligence (xtAI) (2020)		

Module title		Abbreviation
Deductive Databases		10-I=DDB-172-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Syntax and semantics of definite and normal logic programs; Model, proof, and fixpoint theory; Connection to relational databases; Evaluation methods for Datalog; Negation and stratification; Structural properties of logic programs: recursion, equivalence, transformation; Outlook on disjunctive logic programs.		
Intended learning outcomes		
The students have fundamental and practicable knowledge about Datalog (including negation). They are able to compactly implement declarative programs in Datalog and to compare existing programs w.r.t. their equivalence and other properties.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) eXtended Artificial Intelligence (xtAI) (2020) Master's degree (1 major) Artificial Intelligence & Extended Reality (2024)		

Module title		Abbreviation
E-Learning		10-I=EL-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Learning paradigms, learning system types, author systems, learning platforms, standards for learning systems, intelligent tutoring systems, student models, didactics, problem-oriented learning and case-based training systems, adaptive tutoring systems, computer-supported cooperative learning, evaluation of learning systems.		
Intended learning outcomes		
The students possess a theoretical and practical knowledge about eLearning and are able to assess possible applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IT,IS,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Media Communication (2019)		
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Master's degree (1 major) Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Embedded Systems		10-I=ES-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Models of embedded systems, implementation methods (ASIC, AISIP, micro controller), verification of embedded systems, implementation planning static, periodic and dynamic, binding problems, hardware synthesis, software synthesis.		
Intended learning outcomes		
The students are familiar with the technical possibilities for the design of embedded systems and master the most important techniques for the modelling, verification and optimisation of such systems in hardware and software.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,SE,ES,LR,GE		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 332 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Aerospace Computer Science (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Aerospace Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Aerospace Computer Science (2023)

Module title		Abbreviation
Introduction into Human-Computer Interaction		10-I=HCI-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Human-Computer Interaction is concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. This course gives an introduction into the principle biological, physiological, and psychological constraints as defined by the human user and relates these constraints to the conceptual and technical solutions of today's computer systems and existing as well as prospective interaction metaphors between humans and computers.</p> <p>The course covers topics about human perception and cognition, memory and attention, the design of interactive systems, prominent evaluation methods, the principles of computer systems, typical input processing techniques, interface technology, and examples of typical interaction metaphors, from text-based input to graphical desktops to multimodal interfaces. Accompanying lab-work will introduce students to typical tasks involved in this field, i.e., prominent evaluation methods and prototyping of interfaces.</p>		
Intended learning outcomes		
<p>After the course, the students will have a broad understanding of the underlying principles of human users and computer systems. They will understand the constraints and capabilities of current user interfaces and they will learn about the necessary steps applied in user-centered design and development approaches.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>presentation of project results (approx. 30 minutes)</p> <p>Language of assessment: German and/or English</p> <p>creditable for bonus</p>		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): HCI.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Computer Science (2016)</p> <p>Master's degree (1 major) Digital Humanities (2016)</p> <p>Master's degree (1 major) Computer Science (2017)</p> <p>Master's degree (1 major) Computer Science (2018)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p>		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Information Retrieval		10-I=IR-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
IR models (e. g. Boolean and vector space model, evaluation), processing of text (tokenising, text properties), data structures (e. g. inverted index), query elements (e. g. query operations, relevance feedback, query languages and paradigms, structured queries), search engine (e. g. architecture, crawling, interfaces, link analysis), methods to support IR (e. g. recommendation systems, text clustering and classification, information extraction).		
Intended learning outcomes		
The students possess theoretical and practical knowledge in the area of information retrieval and have acquired the technical know-how to create a search engine.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT,IS,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Digital Humanities (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 336 / 739

Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Artificial Intelligence 1		10-I=KI1-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Intelligent agents, uninformed and heuristic search, constraint problem solving, search with partial information, propositional and predicate logic and inference, knowledge representation.		
Intended learning outcomes		
The students possess theoretical and practical knowledge about artificial intelligence in the area of agents, search and logic and are able to assess possible applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,SE,IS,HCI		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's degree (1 major) Information Systems (2019)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Physics International (2020)
Master's degree (1 major) Quantum Engineering (2020)
Master's degree (1 major) Quantum Technology (2021)

Module title		Abbreviation
Artificial Intelligence 2		10-I=KI2-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Planning, probabilistic closure and Bayesian networks, utility theory and decidability problems, learning from observations, knowledge while learning, neural networks and statistical learning methods, reinforcement learning, processing of natural language.		
Intended learning outcomes		
The students possess theoretical and practical knowledge about artificial intelligence in the area of probabilistic closure, learning and language processing and are able to assess possible applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,SE,IS,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)

Module title		Abbreviation
Computational Complexity II		10-I=KT2-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Properties of NP-complete sets, autoreducibility, interactive proof systems, polynomial time hierarchy, complexity of probabilistic algorithms.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of properties of NP-complete sets, autoreducibility, interactive proof systems, polynomial time hierarchies, complexity of probabilistic algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes).</p> <p>If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).</p> <p>Language of assessment: German and/or English</p> <p>creditable for bonus</p>		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, ES		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Computer Science (2016)</p> <p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Computational Mathematics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Computer Science (2017)</p> <p>Master's degree (1 major) Computer Science (2018)</p> <p>Master's degree (1 major) Computational Mathematics (2019)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p>		
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Module title		Abbreviation
Logic Programming		10-I=LP-172-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Logic-relational programming paradigm, top-down evaluation with SLD(NF) resolution. Introduction to the logic programming language Prolog: recursion, predicate-oriented programming, backtracking, cut, side effects, aggregations. Connection to (deductive) databases. Comparison with Datalog, short introduction of advanced concepts like constraint logic programming.		
Intended learning outcomes		
The students have fundamental and practicable knowledge of logic programming. They are able to implement compact and declarative programs in Prolog, and to compare this approach to the traditional imperative programming paradigm.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Performance Evaluation of Distributed Systems		10-I=LVS-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Traffic theoretic models, fundamental concepts of theory of probability, transformation techniques, stochastic processes, methods for performance analysis of technical systems, queue-/traffic theory, analysis of Markov, non-Markov and time critical systems, matrix analytical method, practical examples for performance analysis of computer systems and networks: throughput and goodput analysis and other characteristics.		
Intended learning outcomes		
The students possess the methodic knowledge and the practical skills necessary to model technical systems by means of the theory of probability and mathematical statistics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,GE		
Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 344 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Aerospace Computer Science (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Aerospace Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)

Module title		Abbreviation
Medical Informatics		10-I=MI-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Electronic patient folder, coding of medical data, hospital information systems, operation of computers in infirmary and functional units, medical decision making and assistance systems, statistics and data mining in medical research, case-based training systems in medical training.		
Intended learning outcomes		
The students possess theoretical and practical knowledge about the application of computer science methods in medicine.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IT,IS,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 346 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Mathematical Logic		10-I=ML-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Propositional logic, first-order predicate logic, proof and deduction, Gödel's completeness theorem, Tarski theorem, Gödel's incompleteness theorem, undecidability and nonaxiomatisability of elemental arithmetic.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of propositional logic, first-order predicate logic, proof and deduction, Gödel's completeness theorem, Tarski theorem, Gödel's incompleteness theorem, undecidability and nonaxiomatisability of elemental arithmetic.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,SE,IS,ES		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 348 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Machine Learning for Natural Language Processing		10-I=NLP-182-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The lecture conveys advanced knowledge about methods in computational text processing. To this end, it presents state of the art models and techniques in the area of machine learning, as well as their technical background, and their respective applications in Natural Language Processing. As one important building block of almost all modern NLP-models, different techniques for learning representations of words, so called Word Embeddings, are presented. Starting from this we cover, among others, models from the area of Deep Learning, like CNNs, RNNs and Sequence-to-Sequence architectures. The theoretical foundations of these models, like their training with Backpropagation, are also covered in depth. For all models presented in the lecture, we show their application to problems like sentiment analysis, text generation and machine translation in practice.</p>		
Intended learning outcomes		
<p>The participants have solid knowledge on problems and methods in the area of computational text processing and are able to identify and apply suitable methods for a specific task.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus</p>		
Allocation of places		
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Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, IS, HCI.</p>		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p>		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 350 / 739

Module title		Abbreviation
Analysis and Design of Programs		10-I=PA-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Program analysis, model creation in software engineering, program quality, test of programs, process models.		
Intended learning outcomes		
The students are able to analyse programs, to use testing frameworks and metrics as well as to judge program quality.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IS,ES,GE		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019)		
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Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Physics International (2020)
Master's degree (1 major) Quantum Engineering (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)

Module title		Abbreviation
Performance Engineering & Benchmarking of Computer Systems		10-I=PEB-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to performance engineering of commercial software systems, performance measurement techniques, benchmarking of commercial software systems, modelling for performance prediction, case studies.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of performance metrics, measurement techniques, multi-factorial variance analysis, data analysis with R, benchmark approaches, modelling with queue networks, modelling methods, resource demand approximation, petri nets.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IT,ES,HCI,GE		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 353 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)

Module title		Abbreviation
Professional Project Management		10-I=PM-182-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	We recommend completing module 10-I=PRJAK in parallel.
Contents		
Project goals, project assignment, project success criteria, business plan, environment analysis and stakeholder management, initialisation, definition, planning, execution/control, finishing of projects, reporting, project communication and marketing, project organisation, team building and development, opportunity and risk management; conflict and crisis management, change and claim management; contract and procurement management, quality management, work techniques, methods and tools; leadership and social skills in project management, program management, multiproject management, project portfolio management, PMOs; peculiarities of software projects; agile project management/SCRUM, combination of classic and agile methods.		
Intended learning outcomes		
The students possess practically relevant knowledge about the topics of production management and/or professional project management. They are familiar with the critical success criteria and are able to initiate, define, plan, control and review projects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE, IT, IS, ES, LR, HCI, GE.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Management (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 355 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
exchange program Business Management and Economics (2022)

Module title		Abbreviation
Programming with neural nets		10-I=PNN-182-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Overview over NN, implementation of important NN-architectures like FCN, CNN and LSTMs, practical example for NN-architectures, among others in the area of image and language processing.		
Intended learning outcomes		
Knowledge about possible applications and limitations of NN, for important architectures (eg. FCN, CNN, LSTM) and how they are implemented in NN-tools like Tensorflow/Keras, ability to program network structures from literature, to prepare data and solve concrete tasks for NN.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE, IT, IS, HCI, GE.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Practical course - Current Topics in Computer Science		10-I=PRAK-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Completion of a practical task.		
Intended learning outcomes		
The practical allows participants to work on a problem in computer science in teams.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
term paper (5 to 15 pages)		
Language of assessment: German and/or English		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI, GE		
Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016)		
Master's degree (1 major) Computer Science (2017)		
Master's degree (1 major) Computer Science (2018)		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Project - Current Topics in Computer Science		10-I=PRJAK-162-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Completion of a project task (in Teams).		
Intended learning outcomes		
The project allows participants to work on a problem in computer science in teams.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (4)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
project report (10 to 15 pages) and presentation of project (15 to 30 minutes) Each project is offered one time only. The project will not be repeated; there will not be another project with the same topic. Assessment can, therefore, only be offered for the project offered in the respective semester. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI, GE.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Management (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Media Communication (2019) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Computer Arithmetic		10-I=RAM-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Spaces of numerical computation, raster and rounding, definition and implementation of computational arithmetic and interval calculation.		
Intended learning outcomes		
The students possess knowledge about the spaces of numerical computation, raster and roundings, definition and implementation of computational arithmetic and interval calculation. They master the application of algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,ES		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computer Networks and Communication Systems		10-I=RK-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Properties of computer and communication systems: data traffic in distributed systems. Performance analysis of computer networks and communication systems: problem statement and introduction to method architecture and structure of computer networks: network structure, network access, access methods, digital transfer hierarchies, dataflow control and traffic control, transfer network. Communication protocols: fundamental principles and ISO architecture models. Internet: structure and basic mechanism, TCP/IP, routing, network management. Mobile communication networks: fundamental concepts, GSM, UMTS. Future communication systems and networks.		
Intended learning outcomes		
The students possess an intricate knowledge of the structure of computer networks and communication systems as well as fundamental principles to rate these systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Separate written examination for Master's students. Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT, ES, LR.		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Robotics 1		10-I=RO1-182-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science XVII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
History, applications and properties of robots, direct kinematics of manipulators: coordinate systems, rotations, homogenous coordinates, axis coordinates, arm equation. Inverse kinematics: solution properties, end effector configuration, numerical and analytical approaches, examples of different robots for analytical approaches. Workspace analysis and trajectory planning, dynamics of manipulators: Lagrange-Euler model, direct and inverse dynamics. Mobile robots: direct and inverse kinematics, propulsion system, tricycle, Ackermann steering, holonomes and non-holonomie restrictions, kinematic classification of mobile robots, posture kinematic model. Movement control and path planning: roadmap methods, cell decomposition methods, potential field methods. Sensors: position sensors, speed sensors, distance sensors.		
Intended learning outcomes		
The students master the fundamentals of robot manipulators and vehicles and are, in particular, familiar with their kinematics and dynamics as well as the planning of paths and task execution.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 90 minutes) Separate written examination for Master's students. Language of assessment: English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IS, ES, LR, HCI, GE.		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Robotics 2		10-I=RO2-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science XVII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Foundations of dynamic systems, controllability and observability, controller design through pole assignment: feedback and feed-forward, state observer, feedback with state observer, time discrete systems, stochastic systems: foundations of stochastics, random processes, stochastic dynamic systems, Kalman filter: derivation, initialising, application examples, problems of Kalman filters, extended Kalman filter.		
Intended learning outcomes		
The students master all fundamentals that are necessary to understand Kalman filters and their use in applications of robotics. The students possess a knowledge of advanced controller and observer methods and recognise the connections between the dual pairs controllability - observability as well as controller design and observer design. They also recognise the relationship between the Kalman filter as a state estimator and an observer.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 90 minutes) creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT, ES, LR		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Space Science and Technology (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Software Architecture		10-I=SAR-161-mo1
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to software architecture, architectural styles and patterns, software metrics, evaluation of architectural styles, software components, interface models and design guidelines, design-by-contract, component-based software engineering, service-oriented architectures, microservice architectures, scalability of databases, cloud-native and serverless computing, continuous integration, continuous delivery, continuous deployment, model-driven architecture		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge about advanced topics in software engineering with a focus on modern software architectures and fundamental approaches to model-driven software engineering.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE,IT,ES		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Module studies (Master) Computer Science (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 367 / 739

Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Information Systems (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Information Systems (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Computer Science (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Management (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Information Systems (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Information Systems (2025)
 Master's degree (1 major) Management (2025)
 Master's degree (1 major) Computer Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar 1 - Current Topics in Computer Science		10-I=SEM3-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.		
Intended learning outcomes		
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on a topic from the field of computer science Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI, GE.		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Digital Humanities (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Seminar 2 - Current Topics in Computer Science		10-I=SEM4-161-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Independent review of a current topic in computer science based on literature and, where applicable, software with written and oral presentation.		
Intended learning outcomes		
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
term paper (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion on the topic of the seminar Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, SE, IT, IS, ES, LR, HCI, GE		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Spacecraft System Design		10-I=SSD-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction: history of space flight, system design of spacecraft. Space dynamics: two-body dynamics, Kepler orbits, disturbance forces, transfer orbits. Mission analysis: earth and sun-synchronous orbits, shadows, solar angle of incidence. Thermal control of satellites: thermal analysis, thermal design and technologies, verification of thermal designs. Telecommunication: ground contact analysis, data transmission, satellite monitoring (telemetry, telecommando). Structure and mechanisms. Energy systems: primary, secondary, management, power generation: solar cells. On-board data processing. Propulsion systems. Tests (mechanical, electrical). Operation of spacecraft. Ground segment.		
Intended learning outcomes		
The students master system aspects of the layouting of technical systems. Using the example of spacecraft, major subsystems and their integration into a working whole are being analysed.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes) creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): ES, LR		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Space Science and Technology (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Computer Science (2021)		

Module title		Abbreviation
Security of Software Systems		10-I=SSS-172-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The lecture provides an overview of common software vulnerabilities, state-of-the-art attack techniques on modern computer systems, as well as the measures implemented to protect against these attacks. In the course, the following topics are discussed:</p> <ul style="list-style-type: none"> • x86-64 instruction set architecture and assembly language • Runtime attacks (code injection, code reuse, defenses) • Web security • Blockchains and smart contracts • Side-channel attacks • Hardware security 		
Intended learning outcomes		
<p>Students gain a deep understanding of software security, from hardware and low-level attacks to modern concepts such as blockchains. The lecture prepares for research in the area of security and privacy, while the exercises allow students to gain hands-on experience with attacks and analysis of systems from an attacker's perspective.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: English creditable for bonus</p>		
Allocation of places		
--		
Additional information		
<p>Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): SE, IS, LR, HCI, ES. Basic programming knowledge in C is required.</p>		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computer Science (2017)		
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Master's degree (1 major) Computer Science (2018)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) eXtended Artificial Intelligence (xtAI) (2020)

Module title		Abbreviation
Discrete Event Simulation		10-I=ST-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to simulation techniques, statistical groundwork, creation of random numbers and random variables, random sample theory and estimation techniques, statistical analysis of simulation values, inspection of measured data, planning and evaluation of simulation experiments, special random processes, possibilities and limits of model creation and simulation, advanced concepts and techniques, practical execution of simulation projects.		
Intended learning outcomes		
The students possess the methodic knowledge and the practical skills necessary for the stochastic simulation of (technical) systems, the evaluation of results and the correct assessment of the possibilities and limits of simulation methods.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): IT,IS,ES,GE		
Workload		
240 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 374 / 739

Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) eXtended Artificial Intelligence (xtAI) (2020)

Module title		Abbreviation
NLP and Text Mining		10-I=STM-162-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Foundations in the following areas: definition of NLP and text mining, properties of text, sentence boundary detection, tokenisation, collocation, N-gram models, morphology, hidden Markov models for tagging, probabilistic parsing, word sense disambiguation, term extraction methods, information extraction, sentiment analysis. The students possess theoretical and practical knowledge about typical methods and algorithms in the area of text mining and language processing mostly for English. They are able to solve problems through the methods taught. They have gained experience in the application of text mining algorithms.		
Intended learning outcomes		
The students possess theoretical and practical knowledge about typical methods and algorithms in the area of text mining and language processing. They are able to solve practical problems with the methods acquired in class. They have gained experience in the application of text mining algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English		
Allocation of places		
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Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT, IT, HCI.		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Computer Science (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Information Systems (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Computer Science (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Information Systems (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Visualization of Graphs		10-I=VG-161-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This course covers the most important algorithms to draw graphs. Methods from the course <i>Algorithmische Graphentheorie (Algorithmic Graph Theory)</i> such as divide and conquer, flow networks, integer programming and the planar separator theorem will be used. We will become familiar with measures of quality of a graph drawing as well as algorithms to optimise these measures.		
Intended learning outcomes		
The participants get an overview of graph visualisation and become familiar with typical tools. They consolidate their knowledge about the modelling and solving of problems with the help of graphs and graph algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
Focuses available for students of the Master's programme Informatik (Computer Science, 120 ECTS credits): AT,IT,HCI,GE		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Master's degree (1 major) Computer Science (2016) Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computer Science (2017) Master's degree (1 major) Computer Science (2018) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 378 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computer Science (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Computer Science (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Computer Science (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
3D Point Cloud Processing		10-I-3D-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science XVII		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Laser scanning, Kinect and camera models, basic data structures (lists, arrays, oc-trees), calculating normals, k-d trees, registration, features, segmentation, tracking, applications for airborne mapping, applications to mobile mapping.		
Intended learning outcomes		
Students understand the fundamental principles of all aspects of 3D point cloud processing and are able to communicate with engineers / surveyors / CV people / etc. Students are able to solve problems of modern sensor data processing and have experienced that real application scenarios are challenging in terms of computational requirements, in terms of memory requirements and in terms of implementation issues.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 380 / 739

Bachelor's degree (1 major) Computer Science (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Bachelor's degree (1 major) Aerospace Computer Science (2020)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
Bachelor's degree (1 major) Mathematics (2023)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Algorithmic Graph Theory		10-I-AGT-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science I		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
We discuss typical graph problems: We solve round trip problems, calculate maximal flows, find matchings and colourings, work with planar graphs and find out how the ranking algorithm of Google works. Using the examples of graph problems, we also become familiar with new concepts, for example how we model problems as linear programs or how we show that they are fixed parameter computable.		
Intended learning outcomes		
The students are able to model typical problems in computer science as graph problems. In addition, the participants are able to decide which tool from the course helps solve a given graph problem algorithmically. In this course, students learn in detail how to estimate the run time of given graph algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 382 / 739

Bachelor's degree (1 major) Computer Science (2019)
 Module studies (Bachelor) Computer Science (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Bachelor's degree (1 major) Aerospace Computer Science (2020)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
 Bachelor's degree (1 major) Mathematics (2023)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Advanced Programming		10-I-APR-172-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science II		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
With the knowledge of basic programming, taught in introductory lectures, it is possible to realize simpler programs. If more complex problems are to be tackled, suboptimal results like long, incomprehensible functions and code duplicates occur. In this lecture, further knowledge is to be conveyed on how to give programs and code a sensible structure. Also, further topics in the areas of software security and parallel programming are discussed.		
Intended learning outcomes		
Students learn advanced programming paradigms especially suited for space applications. Different patterns are then implemented in multiple languages and their efficiency measured using standard metrics. In addition, parallel processing concepts are introduced culminating in the use of GPU architectures for extremely quick processing.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Computer Science (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Business Information Systems (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 384 / 739

Master's degree (1 major) Physics International (2020)
 Master's degree (1 major) Quantum Engineering (2020)
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)
 Master's degree (1 major) Quantum Technology (2021)
 Bachelor's degree (1 major) Business Information Systems (2021)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
 Bachelor's degree (1 major) Business Information Systems (2023)
 Master's degree (1 major) Quantum Engineering (2024)
 Master's degree (1 major) Physics International (2024)
 Bachelor's degree (1 major) Business Information Systems (2024)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
 Bachelor's degree (1 major) Digital Business & Data Science (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Data Mining		10-I-DM-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Foundations in the following areas: definition of data mining and knowledge, discovery in databases, process model, relationship to data warehouse and OLAP, data preprocessing, data visualisation, unsupervised learning methods (cluster and association methods), supervised learning (e. g. Bayes classification, KNN, decision trees, SVM), learning methods for special data types, other learning paradigms.		
Intended learning outcomes		
The students possess a theoretical and practical knowledge of typical methods and algorithms in the area of data mining and machine learning. They are able to solve practical knowledge discovery problems with the help of the knowledge acquired in this course and by using the KDD process. They have acquired experience in the use or implementation of data mining algorithms.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Business Information Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Bachelor's degree (1 major) Aerospace Computer Science (2017)
Bachelor's degree (1 major) Computer Science (2017)
Bachelor's degree (1 major) Computer Science (2019)
Bachelor's degree (1 major) Business Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Bachelor's degree (1 major) Business Information Systems (2020)
Bachelor's degree (1 major) Aerospace Computer Science (2020)
Bachelor's degree (1 major) Computer Science und Sustainability (2021)
Bachelor's degree (1 major) Business Information Systems (2021)
Master's degree (1 major) Information Systems (2022)
Bachelor's degree (1 major) Mathematics (2023)
Bachelor's degree (1 major) Business Information Systems (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Practical course in hardware		10-I-HWP-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
10	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.		
Intended learning outcomes		
The students are able to independently review, prepare and perform experiments with the help of experiment descriptions, to independently search for additional information as well as to document and evaluate experiment results.		
Courses (type, number of weekly contact hours, language — if other than German)		
P (6)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
portfolio: completion of approx. 3 to 10 project assignments (approx. 250 hours total) and presentation of results (approx. 10 minutes per project)		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 388 / 739

Bachelor's degree (1 major) Mathematics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Interactive Computer Graphics		10-I-ICG-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science IX		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Computer graphics studies methods for digitally synthesising and manipulating visual content. This course specifically concentrates on interactive graphics with an additional focus on 3D graphics as a requirement for many contemporary as well as for novel human-computer interfaces and computer games. The course will cover topics about light and images, lighting models, data representations, mathematical formulations of movements, projection as well as texturing methods. Theoretical aspects of the steps involved in ray-tracing and the raster pipeline will be complemented by algorithmical approaches for interactive image syntheses using computer systems. Accompanying software solutions will utilise modern graphics packages and languages like OpenGL, GLSL and/or DirectX.		
Intended learning outcomes		
At the end of the course, the students will have a broad understanding of the underlying theoretical models of computer graphics. They will be able to implement a prominent variety of these models, to build their own interactive graphics applications and to choose the right software tool for this task.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 390 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Cryptography and Data Security		10-I-KD-191-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography systems, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response methods, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of private key cryptography systems, Vernam one-time pad, AES, perfect security, public key cryptography, RSA, Diffie-Hellman, Elgamal, Goldwasser-Micali, digital signature, challenge-response method, secret sharing, millionaire problem, secure circuit evaluation, homomorphous encryption		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Computational Complexity		10-I-KT-191-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of complexity measurements and classes, general relationships between space and time classes, memory consumption versus computation time, determinism versus indeterminism, hierarchical theorems, translation methods, P-NP problem, completeness problems, Turing reduction, interactive proof systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Logic for informatics		10-I-LOG-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Syntax and semantics of propositional logic, equivalence and normal forms, Horn formulas, SAT, resolution, infinite formula sets, syntax and semantics of predicate logic.		
Intended learning outcomes		
The students are proficient in the following areas: syntax and semantics of propositional logic, equivalence and normal forms, Horn formulas, SAT, resolution, infinite formula sets, syntax and semantics of predicate logic.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		
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Bachelor's degree (1 major) Mathematics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Project Presentation		10-I-PV-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Presentation of a project developed by the student (e. g. Bachelor's thesis, software project) analogous to a presentation for laypersons with a knowledge of computer science at a trade fair. The project, which may also be work-in-progress, is presented with the help of a poster, a short talk and optionally a live demonstration.		
Intended learning outcomes		
The students are able to present a project they developed and to create the required media.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (5)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
presentation of a project developed by the candidate analogous to a presentation for laypersons with a knowledge of computer science at a trade fair as well as discussion (approx. 10 to 15 minutes total) Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Computer Architecture		10-I-RAK-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Instruction set architectures, command processing through pipelining, statical and dynamic instruction scheduling, caches, vector processors, multi-core processors.		
Intended learning outcomes		
The students master the most important techniques to design fast computers as well as their interaction with compilers and operating systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes).</p> <p>If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).</p> <p>Language of assessment: German and/or English</p> <p>creditable for bonus</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
<p>§ 22 II Nr. 3 b)</p> <p>§ 69 I Nr. 1 c): Rechnerarchitektur</p>		
Module appears in		
<p>Bachelor's degree (1 major) Computer Science (2015)</p> <p>Bachelor's degree (1 major) Mathematics (2015)</p> <p>Bachelor's degree (1 major) Computational Mathematics (2015)</p> <p>Bachelor's degree (1 major) Aerospace Computer Science (2015)</p> <p>First state examination for the teaching degree Gymnasium Computer Science (2015)</p> <p>Master's degree (1 major) Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Bachelor's degree (1 major) Aerospace Computer Science (2017)</p> <p>Bachelor's degree (1 major) Computer Science (2017)</p> <p>Bachelor's degree (1 major) Computer Science (2019)</p> <p>Master's degree (1 major) Physics (2020)</p>		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Physics International (2020)
 Bachelor's degree (1 major) Aerospace Computer Science (2020)
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
 Bachelor's degree (1 major) Mathematics (2023)
 Master's degree (1 major) Physics International (2024)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Digital computer systems		10-I-RAL-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Introduction to digital technologies, Boolean algebras, combinatory circuits, synchronous and asynchronous circuits, hardware description languages, structure of a simple processor, machine programming, memory hierarchy.		
Intended learning outcomes		
The students possess a knowledge of the fundamentals of digital technologies up to the design and programming of easy microprocessors as well as knowledge for the application of hardware description languages for the design of digital systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Orientierungsstudien (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Business Information Systems (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		page 401 / 739

Bachelor's degree (1 major) Aerospace Computer Science (2020)
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)
 Bachelor's degree (1 major) Business Information Systems (2021)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
 Bachelor's degree (1 major) Mathematics (2023)
 Bachelor's degree (1 major) Business Information Systems (2023)
 Bachelor's degree (1 major) Business Information Systems (2024)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Exam Tutorial for the German Staatsexamen		10-I-REP-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
4	(not) successfully completed	--
Duration	Module level	Other prerequisites
2 semester	undergraduate	--
Contents		
Revision of contents of modules covering the subject as well as the subject didactics of computer science.		
Intended learning outcomes		
The students have refreshed their skills for the solution of the type of problems asked in the written state examination.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
One exercise per area covered in the state examination		
Allocation of places		
--		
Additional information		
--		
Workload		
120 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 2 f) § 22 II Nr. 3 b)		
Module appears in		
First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Computer Networks and Information Transmission		10-I-RIÜ-191-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science III		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<ul style="list-style-type: none"> • Computer networks and the Internet: Structure and Mechanisms of Telecommunication • Communication Protocols: Basic Principles and the Layer Model • Computer and Communication Systems: Network Systems, Data Traffic in Distributed Systems and inter-network Communication • The Internet: Important Protocols and Routing • Architecture and Structure of Computer Networks: Network Architecture, Access Mechanisms, Flow Control and Traffic Management • Coding Theory: Mechanisms for Error Detection and Error Correction • Information Theory: Entropy of Data • Digital Communication Systems: Signal Modulation 		
Intended learning outcomes		
Students command the technical, theoretical as well as practical knowledge to understand the structure of computer networks, the Internet and communication systems for telecommunication.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>written examination (approx. 60 to 120 minutes).</p> <p>If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).</p> <p>creditable for bonus</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b), § 69 I Nr. 1 c)		
Module appears in		
<p>Bachelor's degree (1 major) Computer Science (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Bachelor's degree (1 major) Aerospace Computer Science (2020)</p> <p>Bachelor's degree (1 major) Computer Science und Sustainability (2021)</p> <p>Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)</p>		
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Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
 Bachelor's degree (1 major) Mathematics (2023)
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Seminar - Selected Topics in Computer Science 1		10-I-SEM1-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Independent review of a current topic in computer science on the basis of literature and, where applicable, software with written and oral presentation. The topics in modules 10-I-SEM1 and 10-I-SEM2 must come from different areas (this usually means that they are assigned by different lecturers).		
Intended learning outcomes		
The students are able to independently review a current topic in computer science, to summarise the main aspects in written form and to orally present these in an appropriate way.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written elaboration (approx. 10 to 15 pages) and presentation (approx. 30 to 45 minutes) with subsequent discussion on a topic from the field of computer science Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Computer Science (2019) Bachelor's degree (1 major) Business Information Systems (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Business Information Systems (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		
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Bachelor's degree (1 major) Business Information Systems (2021)
Bachelor's degree (1 major) Business Information Systems (2023)
Bachelor's degree (1 major) Business Information Systems (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Tutorial Theoretical Informatics		10-I-TIT-191-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of calculations, P-NP problem, NP completeness.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of computations, P-NP problem, NP completeness.		
Courses (type, number of weekly contact hours, language — if other than German)		
Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) exercises (consisting in completion of approx. 11 home work exercise sheets, presentation of own solutions in the exercise groups as well as approx. 5 short assessments written in the exercise group) or b) written examination (approx. 180 to 240 minutes) Die Prüfungsart ist vom Prüfling festzulegen		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Mathematics (2023)		

Module title		Abbreviation
Theoretical Informatics		10-I-TIV-152-m01
Module coordinator		Module offered by
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of calculations, P-NP problem, NP completeness.		
Intended learning outcomes		
The students possess a fundamental and applicable knowledge in the areas of computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of computations, P-NP problem, NP completeness.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate).		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 a) § 69 I Nr. 1 a)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Bachelor's degree (1 major) Aerospace Computer Science (2020)
Bachelor's degree (1 major) Computer Science und Sustainability (2021)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
Bachelor's degree (1 major) Mathematics (2023)

Module title		Abbreviation
Knowledge-based Systems		10-I-WBS-152-m01
Module coordinator		Module offered by
holder of the Chair of Computer Science VI		Institute of Computer Science
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
Foundations in the following areas: knowledge management systems, knowledge representation, solving methods, knowledge acquisition, learning, guidance dialogue, semantic web.		
Intended learning outcomes		
The students possess theoretical and practical knowledge for the understanding and design of knowledge-based systems including knowledge formalisation and have acquired experience in a small project.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
Module appears in		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Business Information Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019)		
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Bachelor's degree (1 major) Business Information Systems (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Bachelor's degree (1 major) Business Information Systems (2020)
Bachelor's degree (1 major) Aerospace Computer Science (2020)
Bachelor's degree (1 major) Computer Science und Sustainability (2021)
Bachelor's degree (1 major) Business Information Systems (2021)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)
Bachelor's degree (1 major) Mathematics (2023)
Bachelor's degree (1 major) Business Information Systems (2023)
Bachelor's degree (1 major) Business Information Systems (2024)
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Bachelor's degree (1 major) Games Engineering (2025)

Module title		Abbreviation
Applied Analysis		10-M=AAAN-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>In-depth study of functional analysis and operator theory, Sobolev spaces and partial differential equations, theory of Hilbert spaces and Fourier analysis, spectral theory and quantum mechanics, numerical methods (in particular FEM methods), principles of functional analysis, function spaces, embedding theorems, compactness, theory of elliptic, parabolic and hyperbolic partial differential equations with methods from functional analysis.</p> <p>Recommended previous knowledge: Familiarity with the contents of the module "Functional Analysis" is strongly recommended.</p>		
Intended learning outcomes		
The student is acquainted with the fundamental notions, methods and results of higher analysis. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics and other natural and engineering sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Topics in Algebra		10-M=AALG-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Contemporary topics in algebra, for example coding theory, elliptic curves, algebraic combinatorics or computer algebra. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".		
Intended learning outcomes		
The student is acquainted with fundamental concepts and methods in a contemporary field of algebra, and is able to apply these skills to complex questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 415 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Differential Geometry		10-M=ADGM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Central and advanced results in differential geometry, in particular about differentiable and Riemannian manifolds. Recommended previous knowledge: Basic knowledge from the modules "Introduction to Differential Geometry", "Introduction to Topology" and "Geometric Analysis" is recommended.		
Intended learning outcomes		
The student is acquainted with concepts and methods for differentiable manifolds or Riemannian manifolds, is able to apply these methods and knows about the interaction of local and global methods in differential geometry.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 417 / 739

Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Functional Analysis		10-M=AFAN-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Banach and Hilbert spaces, bounded operators, principles of functional analysis, further contemporary topics in functional analysis and applications to other fields of mathematics.		
Recommended previous knowledge: Familiarity with the contents of the module "Advanced Analysis" is strongly recommended.		
Intended learning outcomes		
The student is acquainted with fundamental concepts and methods in a contemporary field of functional analysis, and is able to apply these skills to complex questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Complex Analysis		10-M=AFTH-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth study of mapping properties of analytic functions and their generalisations with modern analytic and geometric methods. Structural properties of families of holomorphic and meromorphic functions. Special functions (e. g. elliptic functions).		
Recommended previous knowledge: Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended.		
Intended learning outcomes		
The student is acquainted with the fundamental notions, methods and results of higher complex analysis, in particular the (geometric) mapping properties of holomorphic functions. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
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Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Geometric Structures		10-M=AGMS-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Tits buildings, generalised polygons or related geometric structures, automorphisms, BN pairs in groups, Moufang conditions, classification results.		
Recommended previous knowledge: Basic knowledge from the modules "Introduction to Differential Geometry" and "Introduction to Topology" is recommended.		
Intended learning outcomes		
The student is acquainted with the fundamental notions, methods and results concerning a type of geometric structure. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 423 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Giovanni Prodi Lecture (Master)		10-M=AGPC-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to a specialised topic in mathematics by an international expert.		
Intended learning outcomes		
The student is acquainted with the fundamental concepts and methods of a contemporary research topic in mathematics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Industrial Statistics 1		10-M=AIST-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Theory of parameter and domain estimates, tests for statistical estimates, distribution models, empirical distribution analysis, comparative analysis, statistical product testing, survey sampling, audit sampling.		
Intended learning outcomes		
The student masters the fundamental statistical methods for industrial applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Lie Theory		10-M=ALTH-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Linear Lie groups and their Lie algebras, exponential function, structure and classification of Lie algebras, classic examples, applications, e. g. in physics and control theory.</p> <p>Recommended previous knowledge: Basic knowledge of the contents of the modules "Functional Analysis" and "Introduction to Topology" is recommended. Furthermore, basic knowledge of the contents of the module "Introduction to Differential Geometry" is useful.</p>		
Intended learning outcomes		
The student is acquainted with the fundamental results, theorems and methods in Lie theory. He/She is able to apply these to common problems, and knows about the interactions of group theory, analysis, topology and linear algebra.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Numeric of Large Systems of Equations		10-M=ANGG-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Discretisation of elliptic differential equations, classical iteration methods, preconditioners, multigrid methods. Recommended previous knowledge: Basic knowledge of numerical mathematics, such as that acquired in the modules "Numerical Mathematics 1" and "Numerical Mathematics 2", is required. Knowledge of the contents of the module "Basics in Optimization" is also recommended.		
Intended learning outcomes		
The student is acquainted with the most important methods for solving large systems of equations, and knows the most efficient way to solve a given system of equations.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 430 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Basics in Optimization		10-M=AOPT-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamental methods and techniques in continuous optimization, unrestricted optimization, conditions for optimality, restricted optimization, examples and applications in natural and engineering sciences as well as economics.		
Intended learning outcomes		
The student knows the fundamental methods of continuous optimization, can judge their strengths and weaknesses and can decide which method is the most suitable in applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Econometrics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Control Theory		10-M=ARTH-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to mathematical systems theory: stability, controllability and observability, state feedback and stability, basics in optimal control.		
Recommended previous knowledge: Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.		
Intended learning outcomes		
The student is acquainted with the fundamental notions and methods of control theory. He/She is able to establish a connection between these results and broader theories, and learns about the interactions of geometry and other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Bachelor's degree (1 major) Aerospace Computer Science (2020)
Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)

Module title		Abbreviation
Stochastic Models of Risk Management		10-M=ASMR-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Measure theory, risk diagrams, failure mode and effects analysis, risk assessment in auditing, shortfall measures, value at risk, conditional value at risk, axiomatic of risk measures, modelling of interdependencies, copula, modelling of functional interrelations, regression models, basics in time series modelling, aggregated losses, estimates of shortfall measures, estimates of value at risk and conditional value at risk, basics in empirical time series analysis, methods of exponential smoothing, predictions and prediction domains, estimates of value at risk in time series, elementary empirical regression analysis, simulation methods.		
Intended learning outcomes		
The student is acquainted with the fundamental methods of stochastic risk analysis.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Stochastic Processes		10-M=ASTP-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Markov chains, queues, stochastic processes in $C[0,1]$, Brownian motion, Donsker's theorem, projective limits. Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.		
Intended learning outcomes		
The student is acquainted with the fundamental notions and methods of stochastic processes and can apply them to practical problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Topology		10-M=ATOP-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Set-theoretic topology, topological invariants (e. g. fundamental group, connection), construction of topological spaces, covering spaces.		
Intended learning outcomes		
The student is acquainted with the fundamental results, theorems and methods in topology and is able to apply these to common problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Insurance Mathematics 1		10-M=AVSM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The module discusses policies on one life: distributions of future lifetime, life tables, life table approximations, types of benefits, present value, expectation principle, premium calculation, commutation functions, reserves and policy values, expenses, bonus, recursive methods, Thiele's differential equation.</p> <p>Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of statistics or stochastics is required. In case of doubt, it is recommended to consult the lecturer.</p>		
Intended learning outcomes		
The student is acquainted with the fundamental notions and methods of life insurance mathematics and can apply them to practical problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 442 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Time Series Analysis 1		10-M=AZRA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Additive model, linear filters, autocorrelation, moving average, autoregressive processes, Box-Jenkins method. Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.		
Intended learning outcomes		
The student is acquainted with the fundamental methods of time series analysis and can apply them to practical problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)

Module title		Abbreviation
Number Theory		10-M=AZTH-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Number-theoretic functions and their associated Dirichlet series resp. Euler products, their analytic theory with applications to prime number distribution and diophantine equations; discussion of the Riemann hypothesis, overview of the development of modern number theory.</p> <p>Recommended previous knowledge: Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introduction to Algebra", „Introduction to Number Theory“ and "Applied Algebra".</p>		
Intended learning outcomes		
The student is acquainted with the fundamental methods of analytics number theory, can deal with algebraic structures in number theory and knows methods for the solution of diophantine equations. He/She has insight into modern developments in number theory.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Applied Differential Geometry		10-M=GADG-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Selected modern topics in Applied Differential Geometry.</p> <p>Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Introduction to Topology", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.</p>		
Intended learning outcomes		
The student gains insight into contemporary research problems in Applied Differential Geometry. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: in the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 448 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Algebra		10-M=GALG-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in algebra (e. g. ring theory, commutative algebra, differential algebra, local fields, computer algebra, algebras, division rings, quadratic forms).		
Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".		
Intended learning outcomes		
The student gains insight into contemporary research problems in algebra. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		

Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Complex Analysis		10-M=GCOA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in complex analysis (e. g. in approximation theory, potential theory, complex dynamics, geometric complex analysis, value distribution theory).		
Recommended previous knowledge: Depending on the current focus of the course, knowledge from different areas of analysis is required. Consultation with the lecturer at the beginning of the course is recommended.		
Intended learning outcomes		
The student gains insight into contemporary research problems in complex analysis. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Control Theory of Quantum Mechanical Systems		10-M=GCQS-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in control theory of quantum mechanical systems.		
Intended learning outcomes		
The student gains insight into contemporary research problems in control theory of quantum mechanical systems. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023)		

Module title			Abbreviation
Research in Groups - Deformation Quantization			10-M=GDFQ-161-m01
Module coordinator		Module offered by	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Selected modern topics in deformation quantization.			
Recommended previous knowledge: Knowledge of the contents of the modules "Differential Geometry" and "Geometric Mechanics" is recommended.			
Intended learning outcomes			
The student gains insight into contemporary research problems in Deformation Quantization. He/She masters advanced techniques in this field and can apply them to complex problems.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023)			
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Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Differential Geometry		10-M=GDGE-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in differential geometry.		
Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Applied Differential Geometry", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Differential Geometry. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Discrete Mathematics		10-M=GDIM-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in discrete mathematics.		
Intended learning outcomes		
The student gains insight into contemporary research problems in discrete mathematics. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Dynamical Systems and Control Theory		10-M=GDSC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in dynamical systems and control theory.		
Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.		
Intended learning outcomes		
The student gains insight into contemporary research problems in dynamical systems and control theory. He/ She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)

Module title		Abbreviation
Research in Groups - Geometry and Topology		10-M=GGMT-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in geometry and topology.		
Intended learning outcomes		
The student gains insight into contemporary research problems in geometry and topology. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Research in Groups - Lie Theory			10-M=GLIE-192-m01
Module coordinator		Module offered by	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Selected modern topics in Lie Theory.			
Recommended previous knowledge: Knowledge of the contents of the module "Lie theory" is required.			
Intended learning outcomes			
The student gains insight into contemporary research problems in Lie Theory. He/She masters advanced techniques in this field and can apply them to complex problems.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + S (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: in the semester in which the course is offered and in the subsequent semester			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Module title		Abbreviation
Research in Groups - Measure and Integral		10-M=GMAI-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Aspects of measure and integration theory: sigma algebras and Borel sets, volume and measure, measurable functions and Lebesgue integrals, selected applications, e. g. product measures (with Fubini's theorem and the transformation rule), Lp spaces and absolute continuity, measures on topological spaces.		
Intended learning outcomes		
The student gains insight into contemporary research problems in measure and integration theory. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 466 / 739

Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Research in Groups - Mathematical Physics		10-M=GMAP-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in Mathematical Physics.		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis and/or differential geometry is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Mathematical Physics. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: in the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 468 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Mathematics in Context		10-M=GMCX-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Reflection on mathematics in a cultural context, for example by discussing part of the history of mathematics, given by a historical period, a geographic region or a particular field of mathematics. Other possibilities arise from the connection of mathematics with literature, language, music, art or the media.		
Intended learning outcomes		
The student realises the cultural dimension of mathematics and its relation to other cultural fields.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Mathematics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Mathematics in the Sciences		10-M=GMSC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in mathematics in the sciences.</p> <p>Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis.</p>		
Intended learning outcomes		
The student gains insight into contemporary research problems in mathematics in the sciences. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)		
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Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Non-linear Analysis		10-M=GNLA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in non-linear analysis.		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Non-linear Analysis. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Research in Groups - Numerical Mathematics and Applied Analysis		10-M=GNMA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in numerical mathematics, applied analysis or scientific computing.		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis and/or numerical mathematics is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student gains insight into a contemporary research problems in numerical mathematics or applied analysis. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 476 / 739

Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Research in Groups - Number Theory		10-M=GNTN-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in number theory (e. g. algebraic number theory, modular forms, diophantine analysis).		
Recommended previous knowledge: Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introduction to Algebra", „Introduction to Number Theory“ and "Applied Algebra".		
Intended learning outcomes		
The student gains insight into contemporary research problems in number theory. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Operator Algebras		10-M=GOPA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in operator algebras.		
Recommended previous knowledge: Knowledge of the contents of the modules "Functional Analysis" and "Algebra and Dynamics of Quantum Systems" is recommended.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Operator algebras. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		

exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups - Robotics, Optimization and Control Theory		10-M=GROC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in robotics, optimisation and control theory.		
Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.		
Intended learning outcomes		
The student gains insight into contemporary research problems in robotics, optimization and control theory. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Research in Groups - Statistics		10-M=GSTA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in statistics.		
Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended. Depending on the content of the course, other prior knowledge may also be helpful; consultation with the lecturer is recommended.		
Intended learning outcomes		
The student gains insight into contemporary research problems in statistics. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Research in Groups - Time Series Analysis		10-M=GTSA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in time series analysis.		
Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.		
Intended learning outcomes		
The student gains insight into contemporary research problems in time series analysis. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022)		
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Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Analysis and Geometry of Classical Systems		10-M=MP1-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Modern analytic methods (such as partial differential equations) and geometric methods (such as differential geometry) for the description of classical physics. Examples include movements of deformable bodies as reaction to outer load (deformation of elastic bodies, flow of a fluid, stream of a gas). Additional examples include geometric mechanics and symplectic geometry, classical field theory and classical gauge theory, general relativity theory.</p> <p>Recommended previous knowledge: Basic knowledge from the modules "Differential Geometry", "Introduction to Topology" and "Geometric Analysis" is recommended. Furthermore, basic knowledge of classical field theory is useful.</p>		
Intended learning outcomes		
The student gains insight into modern methods in mathematics, which are applied in classical physics. He/She masters advanced techniques in this field and is able to apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 488 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Algebra and Dynamics of Quantum Systems		10-M=MP2-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Modern algebraic methods for dynamics of quantum systems, e. g. operator algebras with applications in algebraic quantum field theory, spectral theory, symmetries and representation theory.</p> <p>Recommended previous knowledge: Basic knowledge from the modules "Functional Analysis", "Introduction to Topology" and "Introduction to Complex Analysis" is recommended. Basic knowledge of quantum mechanics is also useful.</p>		
Intended learning outcomes		
The student gains insight into modern methods in mathematics, which are applied in quantum physics. He/She masters advanced techniques in this field and is able to apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		

Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Seminar in Applied Differential Geometry		10-M=SADG-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in applied differential geometry.</p> <p>Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Applied Differential Geometry", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p>		
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Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Seminar in Algebra		10-M=SALG-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in algebra.</p> <p>Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p> <p>Master's degree (1 major) Mathematical Physics (2022)</p>		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Seminar Applied Mathematics		10-M=SAMA-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in applied mathematics.</p> <p>Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer.</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: in the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Computational Mathematics (2019)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Economathematics (2021)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p> <p>Master's degree (1 major) Mathematical Physics (2022)</p> <p>Master's degree (1 major) Economathematics (2022)</p> <p>exchange program Mathematics (2023)</p>		
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Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Econometrics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Econometrics (2025)

Module title		Abbreviation
Seminar in Complex Analysis		10-M=SCOA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in complex analysis.</p> <p>Recommended previous knowledge: Basic knowledge of the contents of the modules "Introduction to Complex Analysis" and "Complex Analysis" is recommended.</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p> <p>Master's degree (1 major) Mathematical Physics (2022)</p>		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Seminar in Dynamical Systems and Control		10-M=SDSC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in dynamical systems and control.		
Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)

Module title		Abbreviation
Seminar in Financial and Insurance Mathematics		10-M=SFIM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in financial and insurance mathematics. Recommended previous knowledge: Familiarity with the contents of the modules "Introduction to Stochastic Financial Mathematics" and "Stochastics 1" is strongly recommended.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Economathematics (2022)		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Econometrics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Econometrics (2025)

Module title		Abbreviation
Giovanni Prodi Seminar (Master)		10-M=SGPC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in the research expertise of the current holder of the Giovanni Prodi Chair.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) exchange program Mathematics (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Seminar in Geometry and Topology		10-M=SGTO-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in geometry and topology.</p> <p>Recommended previous knowledge: Basic knowledge of the contents of the modules "Introduction to Differential Geometry" and "Introduction to Topology" is recommended.</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p> <p>Master's degree (1 major) Mathematical Physics (2022)</p>		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Interdisciplinary Seminar		10-M=SIDC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in mathematics with interdisciplinary aspects.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
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Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar Mathematics in the Sciences		10-M=SMSC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in mathematics in the sciences.		
Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 509 / 739

Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar in Non-linear Analysis		10-M=SNLA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A modern topic in non-linear analysis.</p> <p>Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.</p>		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>S (2)</p> <p>Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>talk (60 to 120 minutes)</p> <p>Language of assessment: German or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Economathematics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Economathematics (2021)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p>		
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Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar in Numerical Mathematics and Applied Analysis		10-M=SNMA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in numerical mathematics or applied analysis. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis and/or numerical mathematics is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 513 / 739

Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar in Optimization		10-M=SOPT-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in optimisation.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
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Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Seminar in Statistics		10-M=SSTA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in statistics. Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended. Depending on the content of the course, other prior knowledge may also be helpful; consultation with the lecturer is recommended.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
talk (60 to 120 minutes) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021)		
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Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Applied Differential Geometry		10-M=VADG-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The module builds on the topics covered in module 10-M=ADGM and discusses selected applications of differential geometry, e. g. at the interface of control theory and mechanics (subriemannian geometry), in the smooth optimisation on manifolds or applications in physics.</p> <p>Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Applied Differential Geometry", "Geometric Mechanics", "Pseudo-Riemannian and Riemannian Geometry" and "Lie Theory" is also recommended.</p>		
Intended learning outcomes		
The student is acquainted with selected advanced applications of differential geometry. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus</p>		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Algebraic Geometry		10-M=VAGE-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Affine and projective space, affine and projective varieties, morphisms and rational maps; function fields, divisors and Riemann-Roch theorem for curves; genus, singularities and Plücker formula; dual curve, dual surface; Bezout's theorem; Grassmann and flag varieties; 27 lines in a cubic surface.</p> <p>Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".</p>		
Intended learning outcomes		
The student is acquainted with fundamental concepts, methods and results in algebraic geometry, is able to classify these results within more general theories and knows about the connections of algebraic geometry with other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 521 / 739

Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Selected Topics in Analysis		10-M=VANA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth discussion of a specialised topic in analysis taking into account recent developments and interrelations with other mathematical concepts. Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student is acquainted with advanced results in a selected topic in analysis, and is able to apply these to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 523 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Algebraic Topology		10-M=VATP-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Homology, homotopy invariance, exact sequences, cohomology, application to the topology of Euclidean spaces.		
Recommended previous knowledge: Basic knowledge of topology is assumed, such as can be acquired in the module "Introduction to Topology".		
Intended learning outcomes		
The student is acquainted with advanced results in algebraic topology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 525 / 739

Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Algorithmic Number Theory		10-M=VAZT-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Binary numbers, computation of the greatest common divisor, pseudoprime tests, computation of primitive roots. Primality tests for Fermat and Mersenne numbers, factorisation methods (Pollard-Rho, (p-1)-method, elliptic curve method, quadratic sieve method), discrete logarithm.</p> <p>Recommended previous knowledge: Basic knowledge of algebra and number theory is assumed, such as can be acquired in the modules "Introduction to Algebra", „Introduction to Number Theory“ and "Applied Algebra".</p>		
Intended learning outcomes		
The student knows about the theoretical foundations and the possible applications of several methods in algorithmic number theory.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 527 / 739

Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computer Algebra		10-M=VCAL-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fast multiplication of numbers, polynomials and matrices, fast chinese remainder theorem; factorisation of polynomials over finite fields; lattices, lattice basis reduction and LLL-algorithm; factorisation of rational polynomials, symbolic integration of rational functions; exact arithmetic with algebraic numbers; multivariate polynomials, Gröbner basis, Buchberger's algorithm, algorithms for permutation groups.		
Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".		
Intended learning outcomes		
The student knows about the theoretical foundations and the possible applications of several methods in computer algebra.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 529 / 739

Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Discrete Mathematics		10-M=VDIM-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced methods and results in a selected field of discrete mathematics (e. g. coding theory, cryptography, graph theory or combinatorics)		
Recommended previous knowledge: Basic knowledge of the contents of the module "Introduction to Discrete Mathematics" is required.		
Intended learning outcomes		
The student is acquainted with advanced results in a selected topic in discrete mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020)		

Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Dynamical Systems		10-M=VDSY-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamentals of dynamical systems, e. g. stability theory, ergodic theory, Hamiltonian systems.		
Recommended previous knowledge: Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.		
Intended learning outcomes		
The student masters the mathematical methods in the theory of dynamic systems, and is able to analyse their quality.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Selected Topics in Financial Mathematics		10-M=VFNM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Selected topics in financial mathematics, e. g. conditional expectation and martingales, fundamental theorem of asset pricing in discrete time for finite spaces, American put, Snell envelope, stopping time, optimal stopping, stochastic integration, stochastic differential equations and Ito calculus, Black-Merton-Scholes model.</p> <p>Recommended previous knowledge: Familiarity with the contents of the modules "Introduction to Stochastic Financial Mathematics" and "Stochastics 1" is strongly recommended.</p>		
Intended learning outcomes		
The student is acquainted with advanced results in financial mathematics. He/She gains the ability to work on contemporary research questions in financial mathematics and can apply his/her skills to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Groups and their Representations		10-M=VGDS-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Finite permutation groups and character theory of finite groups, interrelations and special techniques such as the S-rings of Schur. Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".		
Intended learning outcomes		
The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in group theory and representation theory and can apply his/her skills to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 537 / 739

Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Geometrical Mechanics		10-M=VGEM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The module builds on the topics covered in module 10-M=ADGM and discusses these in more detail: symplectic geometry, cotangent bundles and other examples of symplectic manifolds, symmetries and Noether theorem, phase space reduction, normal forms, introduction to Poisson geometry.</p> <p>Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the module "Introduction to Topology" is also recommended. Knowledge of theoretical mechanics can also be useful.</p>		
Intended learning outcomes		
<p>The student is acquainted with selected advanced applications of differential geometry to geometric mechanics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (4) + Ü (2) Module taught in: German and/or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus</p>		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>		
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Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Aspects of Geometry		10-M=VGEO-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth discussion of a special type of geometry taking into account recent developments and interrelations with other mathematical structures, e. g. topological geometries, diagram geometries.		
Recommended previous knowledge: Basic knowledge from the modules "Differential Geometry" and "Introduction to Topology" is recommended.		
Intended learning outcomes		
The student is acquainted with advanced results in a selected field of geometry and can apply his/her skills to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		

Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Geometric Complex Analysis		10-M=VGFT-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced methods and results in geometric complex analysis (e.g. conformal maps, conformal Riemannian metrics, quasiconformal maps, harmonic functions, biholomorphic maps).		
Recommended previous knowledge: Basic knowledge of the contents of the module "Introduction to Complex Analysis" is recommended.		
Intended learning outcomes		
The student is acquainted with fundamental concepts, methods and results in geometric complex analysis, is able to classify these results within more general theories and knows about the connections of geometric complex analysis with other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022)		
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exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Giovanni Prodi Lecture Advanced Topics (Master)		10-M=VGPA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to a specialised topic in mathematics by an international expert.		
Intended learning outcomes		
The student is acquainted with the fundamental concepts and methods of a contemporary research topic in mathematics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) exchange program Mathematics (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Giovanni Prodi Lecture Modern Topics (Master)		10-M=VGPM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to a specialised topic in mathematics by an international expert.		
Intended learning outcomes		
The student is acquainted with the fundamental concepts and methods of a contemporary research topic in mathematics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) exchange program Mathematics (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Giovanni Prodi Lecture Selected Topics (Master)		10-M=VGPS-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Introduction to a specialised topic in mathematics by an international expert.		
Intended learning outcomes		
The student is acquainted with the fundamental concepts and methods of a contemporary research topic in mathematics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and applications in other subjects.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) exchange program Mathematics (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Inverse Problems		10-M=VIPR-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Linear operator equations, ill-posed problems, regularisation theory, Tikhonov regularisation, iterative regularisation methods, examples of ill-posed problems.</p> <p>Recommended previous knowledge: Basic knowledge of functional analysis, such as that taught in the module "Functional Analysis", is recommended.</p>		
Intended learning outcomes		
The student can judge whether a given problem is well posed or ill posed. He/She can apply regularisation methods and examine them regarding stability and convergence, and is familiar with selected inverse problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Economathematics (2021)

Module title		Abbreviation
Industrial Statistics 2		10-M=VIST-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Linear models, regression analysis, nonlinear regression, experimental design, basics in time series modeling, basics in empirical time series analysis, methods of exponential smoothing, predictions and prediction domains, statistical process monitoring.		
Intended learning outcomes		
The student masters advanced statistical methods for industrial applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
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Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Field Arithmetics		10-M=VKAR-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Combination of Galois theory, group theory and the theory of function fields with the aim of application in number theory, e. g. topics around Hilbert's irreducibility theorem, permutation polynomials (e. g. Calitz-Wan-conjecture) and the inverse problem in Galois theory.</p> <p>Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".</p>		
Intended learning outcomes		
The student masters advanced algebraic concepts and methods. He/She gains the ability to work on contemporary research questions in algebra and can apply his/her skills to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 552 / 739

Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Complex Geometry		10-M=VKGE-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The module builds on the topics covered in module 10-M=ADGM and discusses these in more detail: Wirtinger calculus, complex structures and complex manifolds, metrics on complex manifolds (e. g. conformal, hermitian, Kähler), differential operators on complex manifolds, classification of complex manifolds.</p> <p>Recommended previous knowledge: Basic knowledge of the contents of the modules "Introduction to Complex Analysis" and "Complex Analysis" or "Geometric Complex Analysis" is recommended.</p>		
Intended learning outcomes		
The student knows and masters advanced methods and notions in complex differential geometry. He is familiar with the central concepts in this field and is able to apply the fundamental proof methods independently.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Mathematical Continuum Mechanics		10-M=VKOM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Partial differential equations and/or variational methods in the context of continuum mechanics. Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis.		
Intended learning outcomes		
The student masters the mathematical methods in mathematical continuum mechanics and knows about their main fields of application.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Cryptography/Coding Theory		10-M=VKRY-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Error detection and error correction, linear codes, channel coding theorems of Shannon, classical and contemporary codes, bounds, network codes, connections to cryptography.		
Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".		
Intended learning outcomes		
The student is acquainted with fundamental concepts, methods and results in coding theory and cryptography, is able to classify these results within more general theories and knows about the connections of coding theory and cryptography with other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
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Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Mathematical Imaging		10-M=VMBV-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Mathematical fundamentals of image processing and computer vision such as elementary projective geometry, camera models and camera calibration, rigid and non-rigid registration, reconstruction of 3D objects from camera pictures; algorithms; module might also include an introduction to geometric methods and tomography.</p> <p>Recommended previous knowledge: Basic knowledge of functional analysis, such as that taught in the module "Functional Analysis", is recommended.</p>		
Intended learning outcomes		
The student masters the mathematical methods in the theory of image processing and knows about their main fields of application.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus</p>		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)</p>		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Selected Topics in Mathematical Physics		10-M=VMPH-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in mathematical physics, for example continuum mechanics, fluid dynamics, mathematical material sciences, geometric field theory, advanced topics in quantum theory.		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of analysis is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student is acquainted with an advanced topic in mathematical physics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 562 / 739

Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Module Theory		10-M=VMTH-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Basics in module theory: modules and module spaces, canonical decomposition and representations, simple, semi-simple and complex modules, module trees and their defibrations, distorsion theorems, reduction theorems.</p> <p>Recommended previous knowledge: Basic knowledge of algebra is assumed, such as can be acquired in the modules "Introduction to Algebra" and "Applied Algebra".</p>		
Intended learning outcomes		
The student masters mathematical methods in module theory and is able to analyse their quality.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 564 / 739

Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Selected Topics in Numerical and Applied Mathematics		10-M=VNAM-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth discussion of a specialised topic in numerical or applied mathematics taking into account recent developments and interrelations with other mathematical concepts.		
Recommended previous knowledge: Depending on the content, basic and advanced knowledge from different areas of applied mathematics is required. In case of doubt, it is recommended to consult the lecturer.		
Intended learning outcomes		
The student is acquainted with advanced results in a selected topic in numerical or applied mathematics, and is able to apply these to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Economathematics (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 566 / 739

Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Non-linear Analysis		10-M=VNAN-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Methods in nonlinear analysis (e. g. topological methods, monotony and variational methods) with applications. Recommended previous knowledge: We recommend basic knowledge of functional analysis and partial differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Applied Analysis".		
Intended learning outcomes		
The student is acquainted with the concepts of non-linear analysis, can compare them and assess their applicability on practical problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Numeric of Partial Differential Equations		10-M=VNPE-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Types of partial differential equations, qualitative properties, finite differences, finite elements, error estimates (numerical methods for elliptic, parabolic and hyperbolic partial differential equations; finite elements method, discontinuous Galerkin finite elements method, finite differences and finite volume methods).		
Recommended previous knowledge: We recommend basic knowledge of functional analysis and partial differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Applied Analysis".		
Intended learning outcomes		
The student is acquainted with advanced methods for discretising partial differential equations.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
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Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Economathematics (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Economathematics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's degree (1 major) Economathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)
 Master's degree (1 major) Economathematics (2025)

Module title			Abbreviation
Selected Topics in Optimization			10-M=VOPT-161-mo1
Module coordinator		Module offered by	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Selected topics in optimization, e. g. inner point methods, semidefinite programs, non-smooth optimization, game theory, optimization with differential equations.			
Intended learning outcomes			
The student is acquainted with advanced methods in continuous optimization. He gains the ability to work on contemporary research questions in continuous optimization.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (4) + Ü (2) Module taught in: German and/or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus			
Allocation of places			
--			
Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Optimal Control		10-M=VOST-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Basics in optimal control of ordinary and partial differential equations, theory of optimal control, conditions for optimality, methods for numerical solution.</p> <p>Recommended previous knowledge: We recommend basic knowledge of functional analysis and ordinary differential equations, such as can be acquired in the modules "Introduction to Functional Analysis" and "Ordinary Differential Equations". Knowledge of the contents of the module "Basics in Optimization" may also be useful.</p>		
Intended learning outcomes		
The student is acquainted with advanced methods in optimal control. He gains the ability to work on contemporary research questions in continuous optimization.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 574 / 739

Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Partial Differential Equations of Mathematical Physics		10-M=VPDP-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Elliptic, parabolic, and hyperbolic equations; Laplace equation, heat equation and wave equation as standard examples; initial and boundary value problems; well-posed and ill-posed problems; solution methods; extensions and generalisations; Hilbert space methods; Sobolev spaces and Fourier transforms.</p> <p>Recommended previous knowledge: Basic knowledge from the modules "Ordinary Differential Equations" and "Introduction to Partial Differential Equations" is recommended, as well as basic knowledge of functional analysis.</p>		
Intended learning outcomes		
The student is acquainted with fundamental concepts and solution methods in the theory of partial differential equations, as well as standard examples from mathematical physics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 576 / 739

Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Pseudo Riemannian and Riemannian Geometry		10-M=VPRG-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The module builds on the topics covered in module 10-M=ADGM and discusses these in more detail: Riemannian and pseudo-Riemannian manifolds, Levi-Civita connection and curvature, geodesics and the exponential map, Jacobi fields, comparison theorems in Riemannian geometry, submanifolds, integration, d'Alembert and Laplace operators, causal structure of Lorenz manifolds, Einstein equations and applications in general relativity theory.</p> <p>Recommended previous knowledge: Advanced knowledge of differential geometry is required, such as can be acquired in the module "Differential Geometry". Knowledge of the contents of the modules "Introduction to Topology", "Geometric Mechanics" and "Lie Theory" is also recommended.</p>		
Intended learning outcomes		
The student is acquainted with advanced topics in differential geometry on Riemannian and pseudo-Riemannian manifolds. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016)		
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Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Mathematics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Statistical Analysis		10-M=VSTA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Contingency tables, categorical regression, one-factorial variance analysis, two-factorial variance analysis, discriminant function analysis, cluster analysis, principal component analysis, factor analysis.		
Recommended previous knowledge: Basic knowledge of stochastics is required, such as that acquired in the "Stochastics 1" module. Knowledge of the contents of the module "Stochastics 2" is also recommended.		
Intended learning outcomes		
The student is acquainted with the fundamental methods in statistical analysis and can apply them to practical problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 580 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)

Module title		Abbreviation
Selected Topics in Control Theory		10-M=VTRT-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected topics in linear and non-linear control theory, e. g. networked linear control systems, controllability of bilinear systems.		
Recommended previous knowledge: Knowledge of the contents of the module "Mathematical Control Theory" or "Control Theory" is required.		
Intended learning outcomes		
The student gains insight into contemporary research problems in control theory. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019)		

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)

Module title		Abbreviation
Insurance Mathematics 2		10-M=VVSM-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This module discusses modern valuation approaches and multiple decrement models regarding one life or two lives: modern valuation in life insurance mathematics, axiomatic derivation of the product measure approach, Markov chain models, Kolmogorov's differential equations, Thiele's differential equations, numerical applications, joint life policies.</p> <p>Recommended previous knowledge: Familiarity with the contents of the modules "Insurance Mathematics 1" and "Selected Topics in Financial Mathematics" is strongly recommended.</p>		
Intended learning outcomes		
The student is acquainted with advanced methods in insurance mathematics. He gains the ability to work on contemporary research questions in insurance mathematics and can apply his/her skills to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Econometrics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
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Master's degree (1 major) Mathematics (2019)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Economathematics (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Economathematics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's degree (1 major) Economathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Economathematics (2025)

Module title		Abbreviation
Networked Systems		10-M=VVSY-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Contemporary topics in networked linear and non-linear dynamical systems (homogenous and non-homogenous systems); analysis of control-theoretical aspects (controllability, accessibility, etc.).		
Recommended previous knowledge: Basic knowledge of the contents of the module "Ordinary Differential Equations" is useful.		
Intended learning outcomes		
The student is acquainted with advanced methods in the field of networked systems. He gains the ability to work on contemporary research questions in networked systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 60 to 90 minutes, usually chosen) or b) oral examination of one candidate each (approx. 15 minutes) or c) oral examination in groups (groups of 2, approx. 10 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
--		
Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Mathematics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Mathematical Data Science (2025)

Module title		Abbreviation
Time Series Analysis 2		10-M=VZRA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
State-space models, Kalman filter, frequency spaces, Fourier analysis, periodograms, characterisation of autocovariance functions.		
Intended learning outcomes		
The student is acquainted with advanced methods in time series analysis. He gains the ability to work on contemporary research questions in this field.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German or English Assessment offered: In the semester in which the course is offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020)		
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Module title			Abbreviation
Overview Algebra and Geometry (Differential Geometry or Projective Geometry) for Teaching Degree (German Gymnasium)			10-M-HAG-Ü-162-m01
Module coordinator		Module offered by	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	Method of grading	Only after succ. compl. of module(s)	
10	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
Algebra (fundamental algebraic structures: groups, rings, fields; Galois theory) and either Differential Geometry (curves in Euclidean spaces, curvature, Frenet equations, local classification, submanifolds in Euclidean spaces, in particular hypersurfaces, curvature of hypersurfaces, geodesics, isometries, main theorem on local surface theory, special classes of surfaces) or Projective Geometry (projective and affine planes, theorem of Desargues, fundamental theorems for projective spaces, dualities and polarities of projective spaces).			
Intended learning outcomes			
The student is acquainted with fundamental concepts and methods in algebra and geometry (differential geometry or projective geometry). He/She is able to relate these concepts with one another, and realises the advantages of thinking across the borders of different branches in mathematics.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (4) + Ü (2)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
oral examination of one candidate each (20 to 40 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
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Workload			
300 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			

Module title		Abbreviation
Overview Higher Analysis for Teaching Degree (German Gymnasium) (Differential Equations and Complex Analysis, or Advanced Analysis and Complex Analysis)		10-M-HHA-Ü-162-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>Complex Analysis (complex differentiability and the Cauchy-Riemann differential equation, path integrals and Cauchy integral theorems, isolated singularities, meromorphic functions and Laurent series, residue theorem and applications, Weierstrass factorization theorem and Mittag-Leffler theorem, conformal maps) and either</p> <p>Advanced Analysis (advanced analysis in several variables, Lebesgue integration) or</p> <p>Ordinary Differential Equations (existence and uniqueness theorem, continuous dependence of solutions on initial data, systems of linear differential equations, matrix exponential series, higher order linear differential equations).</p>		
Intended learning outcomes		
The student is acquainted with fundamental concepts and methods in complex analysis and a further topic in higher analysis (theory of ordinary differential equations or Lebesgue integration). He/She is able to relate these concepts with one another, and realises the advantages of thinking across the borders of different branches in mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
oral examination of one candidate each (20 to 40 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
--		
Workload		
300 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title			Abbreviation
Overview Stochastics and Applied Mathematics (Numerical Mathematics 1 or Discrete Mathematics) for Teaching Degree (German Gymnasium)			10-M-HSA-Ü-162-m01
Module coordinator		Module offered by	
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics	
ECTS	Method of grading	Only after succ. compl. of module(s)	
8	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	
Contents			
Stochastics (discrete stochastics, in particular stochastic modelling, motivation of conceptualisation and discussion of basic assumptions: basic notions of descriptive statistics, discrete probability spaces, random variables, important discrete distributions, elements of combinatorics, principle of inclusion and exclusion, multistage experiments, conditional probability, stochastic independence, common distributions, expected value and variance, covariance and correlation, waiting time problems, law of the large numbers, central limit theorem, confidence intervals and statistical tests in binomial models, stochastic paradoxes) and either			
Numerical Mathematics 1 (solution of systems of linear equations and curve fitting problems, nonlinear equations and systems of equations, interpolation with polynomials, splines and trigonometric functions, numerical integration) or			
Discrete Mathematics (techniques from combinatorics, introduction to graph theory including applications, cryptographic methods, error-correcting codes).			
Intended learning outcomes			
The student is acquainted with fundamental concepts and methods in stochastics and a further topic in applied mathematics (numerical mathematics or discrete mathematics). He/She is able to relate these concepts with one another, and realises the advantages of thinking across the borders of different branches in mathematics.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (4) + Ü (2)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
oral examination of one candidate each (20 to 40 minutes) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
--			
Workload			
240 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			

Module title		Abbreviation
Cosmology		11-AKM-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Expanding space-time, Friedmannian cosmology, basics of general relativity, the early universe, inflation, dark matter, primordial nucleosynthesis, cosmic microwave background, structure formation, galaxies and galaxy clusters, intergalactic medium, cosmological parameters.		
Intended learning outcomes		
The students have basic knowledge of cosmology. They know the theoretical methods of cosmology and are able to relate them to observations. They have gained insights into current research topics and are able to process scientific questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Selected Topics of Theoretical Solid State Physics		11-AKTF-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In this lecture, selected topics of condensed matter theory are addressed. We intend to present new developments to bring the students in touch with actual research topics. Possible subjects are many-body localization and dynamic quantum matter.		
Intended learning outcomes		
The students learn how to describe condensed matter systems in presence of disorder and interactions from a theoretical point of view. This happens on the basis of analytical and numerical methods. Therefore, we envisage a smooth crossover of these students to the next step of becoming a researcher.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Mathematical Physics (2022)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
High Energy Astrophysics		11-APL-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Radiative processes, interaction of light with matter, particle acceleration processes, pair creation, nuclear processes, pion production, astrophysical shock waves, kinetic equations		
Intended learning outcomes		
The student gains knowledge in fundamentals of High-Energy Astrophysics, such as particle acceleration and non-thermal radiative processes in astrophysical objects		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Methods of Observational Astronomy			11-ASM-161-m01
Module coordinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	Method of grading	Only after succ. compl. of module(s)	
6	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Methods of observational astronomy across the electromagnetic spectrum. Evaluation of observational data from radio, optical, X-ray and gamma-ray telescopes.			
Intended learning outcomes			
Overview of the methods used in observational astronomy in various parts of the electromagnetic spectrum (radio, optical, X-ray and gamma-ray energies). Knowledge of principles and applications of these methods and ability to conduct astronomical observations.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) + R (1) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester			
Allocation of places			
--			
Additional information			
--			
Workload			
180 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 598 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Introduction to Space Physics		11-ASP-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Overview 2. Dynamics of charged particles in magnetic and electric fields 3. Elements of space physics 4. The sun and heliosphere 5. Acceleration and transport of energetic particles in the heliosphere 6. Instruments to measure energetic particles in extraterrestrial space		
Intended learning outcomes		
The students acquire basic knowledge of Space Physics, in particular regarding the characterisation of the dynamics of charged particles in space and the heliosphere. They know relevant parameters and theoretical concepts and corresponding measuring methods.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016)		
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Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Nanostructure Technology (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Theoretical Astrophysics		11-AST-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Topics in theoretical astrophysics such as e.g. white dwarfs, neutron stars and black holes, supernovae, pulsars, accretion and jets, shock waves, radiation transport, and gravitational lensing		
Intended learning outcomes		
Knowledge of basic processes and methods of Theoretical Astrophysics. Ability to formulate theoretical models.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
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Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Selected Topics of Theoretical Elementary Particle Physics		11-ATTP-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A selection of topics from the following fields will be covered in different years:</p> <ol style="list-style-type: none"> 1. Advanced techniques for precision calculations of scattering amplitudes 2. Phenomenology of particle accelerators 3. Higgs physics 4. Top quark physics 		
Intended learning outcomes		
<p>The students are familiar with the tests and limits of the standard model of Particle Physics, Higgs physics and neutrino physics. They are able to formulate extensions of the standard model. Furthermore, they know how to test these extensions in low energy experiments, at high energy colliders and in cosmology.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016)</p>		
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Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Biophysical Measurement Technology in Medical Science		11-BMT-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The lecture covers the physical principles of imaging techniques and their application in Biomedicine. The main topics are conventional X-ray technique, computer tomography, imaging techniques of nuclear medicine, ultrasound and MR-tomography. The lecture additionally addresses the systems theory of imaging systems and digital image processing.		
Intended learning outcomes		
The students know the physical principles of imaging techniques and their application in Biomedicine. They understand the principles of image generation and are able to explain different techniques and interpret simple images.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 606 / 739

Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Functional Materials (2022)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Models Beyond the Standard Model of Elementary Particle Physics		11-BSM-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<ol style="list-style-type: none"> 1. Principles of the standard model of Elementary Particle Physics 2. Tests of the standard model in low energy experiments and at high energy colliders 3. Neutrino physics 4. Higgs physics. <p>In addition, a selection of topics from the following fields will be covered in different years:</p> <ul style="list-style-type: none"> • Phenomenology of experiments at the LHC, • particle cosmology, • extended gauge theories, • models with extended Higgs sectors, • supersymmetry, • models with additional space-time dimensions 		
Intended learning outcomes		
The students are familiar with the tests and limits of the standard model of Particle Physics, Higgs physics and neutrino physics. They are able to formulate extensions of the standard model. Furthermore, they know how to test these extensions in low energy experiments, at high energy colliders and in cosmology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<ol style="list-style-type: none"> a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
--		
Additional information		
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Workload		
180 h		

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
<p>Master's degree (1 major) Mathematics (2016)</p> <p>Master's degree (1 major) Physics (2016)</p> <p>Master's degree (1 major) Mathematical Physics (2016)</p> <p>Master's degree (1 major) Computational Mathematics (2016)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p> <p>Master's degree (1 major) Computational Mathematics (2019)</p> <p>Master's degree (1 major) Mathematics (2019)</p> <p>Master's degree (1 major) Physics (2020)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)</p> <p>Master's degree (1 major) Mathematical Physics (2020)</p> <p>Master's degree (1 major) Computational Mathematics (2022)</p> <p>Master's degree (1 major) Mathematics (2022)</p> <p>Master's degree (1 major) Mathematical Physics (2022)</p> <p>exchange program Physics (2023)</p> <p>Master's degree (1 major) Computational Mathematics (2024)</p> <p>Master's degree (1 major) Mathematics (2024)</p> <p>Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p> <p>Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)</p>

Module title		Abbreviation
Image and Signal Processing in Physics		11-BSV-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Periodic and aperiodic signals; principles of discrete and exact Fourier transformation; principles of digital signal and image processing; discretisation of signals/sampling theorem (Shannon); homogeneous and linear filters, convolution product; tapering functions and interpolation of images; the Parseval theorem, correlation and energetic observation; statistical signals, image noise, moments, stationary signals; tomography: Hankel and Radon transformation.		
Intended learning outcomes		
The students have advanced knowledge of digital image and signal processing. They know the physical principles of image processing and are familiar with different methods of signal processing. They are able to explain different methods and to implement them, especially in the field of tomography.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016)		
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Master's degree (1 major) Computational Mathematics (2016)
 Master's degree (1 major) Functional Materials (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Functional Materials (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title			Abbreviation
Bosonisation and Interactions in One Dimension			11-BWW-161-m01
Module coordinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	Method of grading	Only after succ. compl. of module(s)	
6	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
<p>1.Instability of Fermi systems in one dimension (1D)</p> <p>2.Abelian bosonisation and Luttinger liquids (spinless fermions, correlation functions, models with spin, renormalization group, and the sine-Gordon model).</p> <p>The below mentioned topics will be presented in different years:</p> <p>3.Interacting fermions on a lattice (Hubbard model, t/J model, transport properties)</p> <p>4.Bethe ansatz</p> <p>5.Spin-1/2 chains</p> <p>6.Disordered systems</p> <p>7.Non-abelian bosonisation and the WZW model (Kac-Moody algebras, Sugawara construction, Knizhnik-Zamolodchikov equation, applications of the WZW model)</p>			
Intended learning outcomes			
The students become familiar with the peculiarities of one-dimensional (1D) electron systems and acquire the theoretical tools to understand phenomena relevant to experiments, including disorder effects and transport in 1D.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) + R (1) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
<p>a) written examination (approx. 90 to 120 minutes) or</p> <p>b) oral examination of one candidate each (approx. 30 minutes) or</p> <p>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</p> <p>d) project report (approx. 8 to 10 pages) or</p> <p>e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>			
Allocation of places			
--			
Additional information			
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Workload			
180 h			
Teaching cycle			
--			

Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Physics (2016)
Master's degree (1 major) Mathematical Physics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computational Materials Science (DFT)		11-CMS-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Density functional theory (DFT) 2. Wannier functions and localized basis functions 3. Numerical evaluation of topological invariants 4. Hartree-Fock and static mean-field theory 5. Many-body methods for solid state physics 6. Anderson impurity model (AIM) and Kondo physics 7. Dynamical mean-field theory (DMFT) 8. DFT + DMFT methods for realistic modeling of solids 9. Strongly correlated electrons		
Intended learning outcomes		
Aside from the theoretical discussion of these topics, the students carry out hands-on exercises from the CIP pool. The participants are introduced to the use of DFT software packages such as VASP or Wien2k and to the construction of maximally localised Wannier functions through the projection of DFT results on atom orbitals with the software wanniergo. Furthermore, the students learn how to construct many-particle solutions of AIM and observe border cases such as the Kondo regime. Impurity solvers such as exact diagonalisation or continuous-time quantum Monte Carlo are utilised to solve the self consistency equations of dynamic molecular field theory (DMFT). These steps are necessary to reach the peak of the lecture: a DFT-DMFT calculation of a strongly correlated transition metal oxide such as SrVO ₃ .		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
240 h		

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Functional Materials (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Renormalization Group and Critical Phenomena		11-CRP-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Phase transitions 2. Mean field theory 3. The concept of the renormalization group (RG) Phase diagrams and fixed points 4. Perturbation-theoretical renormalization group 5. Low-dimensional systems 6. Conformal symmetry		
Intended learning outcomes		
The students acquire profound knowledge of the principles of scale invariance and of the renormalisation group (RG) in Statistical Physics. They understand the concept of RG flow with respect to effective field theories in both statistical and quantum field theory.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016)		
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Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Advanced Topics in Astrophysics		11-CSAM-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
In-depth study of particular current topics of Astrophysics. The concepts of Astrophysics which will be discussed include: Stellar structure, formation and development, radiation transport, gas dynamics, heating and cooling processes of the interstellar medium, astrochemistry, accretion and jets, galaxy formation or similar topics.		
Intended learning outcomes		
The students have advanced knowledge of the subdisciplines of Astrophysics and are able to work on current scientific questions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Advanced Topics in Solid State Physics		11-CSFM-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
This module will enable the lecturers of Condensed Matter Physics to teach advanced courses on topics not covered in any of the other modules. These topics may relate either to recent research developments or to subjects not included in the regular curriculum.		
Intended learning outcomes		
The students advance their knowledge and understanding of an advanced topic of Condensed Matter Physics and acquire insights into the connections between research and teaching.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Module studies (Master) Quantum Technology (2021)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Introduction to Plasma Physics			11-EPP-161-m01
Module coordinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	Method of grading	Only after succ. compl. of module(s)	
6	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
Plasma Astrophysics: Dynamics of charged particles in electric and magnetic fields, magnetohydrodynamics, transport equations for energetic particles, properties of magnetic turbulence, propagation of solar particles within the solar wind, particle acceleration via shock waves and via interaction with plasma turbulence, particle acceleration and transport in galaxies and other astrophysical objects, cosmic radiation.			
Intended learning outcomes			
The students have knowledge of the basic processes of Plasma Astrophysics.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + R (2) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester			
Allocation of places			
--			
Additional information			
--			
Workload			
180 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Physics (2020)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Experimental Physics		11-EXE5-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in experimental physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental Physics of the Master's programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + R (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Experimental Physics		11-EXE6-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in experimental physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental Physics of the Master's programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 626 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Experimental Physics		11-EXE6A-161-mo1
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in experimental physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental Physics of the Master's programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 628 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Experimental Physics		11-EXE7-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
7	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Experimental Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental Physics of the Master's programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 630 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Experimental Physics		11-EXE8-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in experimental physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental Physics of the Master's programme. They have knowledge of a current subdiscipline of Experimental Physics and understand the measuring and/or evaluation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 632 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Physik		11-EXP6-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in experimental or theoretical physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 634 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Module studies (Master) Quantum Technology (2021)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics in Physik		11-EXP6A-161-mo1
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Experimental or Theoretical Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Experimental or Theoretical Physics of the Master's programme of Nanostructure Technology. They have knowledge of a current subdiscipline of Physics and understand the measuring and/or calculation methods necessary to acquire this knowledge. They are able to classify the subject-specific contexts and know the application areas.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 636 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Module studies (Master) Quantum Technology (2021)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics of Theoretical Physics		11-EXT5-161-mo1
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Theoretical Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Theoretical Physics of the Master's programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems of Theoretical Physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + R (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 638 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics of Theoretical Physics		11-EXT6-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in theoretical physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Theoretical Physics of the Master's programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems of Theoretical Physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
--		
Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 640 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics of Theoretical Physics		11-EXT6A-161-mo1
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Theoretical Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Theoretical Physics of the Master's programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems of Theoretical Physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics of Theoretical Physics		11-EXT7-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
7	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Theoretical Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Theoretical Physics of the Master's programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems of Theoretical Physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 644 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Current Topics of Theoretical Physics		11-EXT8-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
Current topics in Theoretical Physics. Credited academic achievements, e.g. in case of change of university or study abroad.		
Intended learning outcomes		
The students have advanced competencies corresponding to the requirements of a module of Theoretical Physics of the Master's programme. They have advanced specialist knowledge of a subdiscipline of Theoretical Physics and have mastered the required methods. They are able to apply the acquired methods to current problems of Theoretical Physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Module studies (Master) Physics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Field Theory in Solid State Physics		11-FFK-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This will usually be a course on quantum many particle physics approached by the perturbative methods using Green's functions</p> <p>An outline could be:</p> <ol style="list-style-type: none"> 1. Single-particle Green's function 2. Review of second quantization 3. Diagrammatic method using many particle Green's functions at temperature $T=0$ 4. Diagrammatic method for finite T 5. Landau theory of Fermi liquids 6. Superconductivity 7. One-dimensional systems and bosonization 		
Intended learning outcomes		
Working knowledge of the methods of quantum field theory in a non-relativistic context. Ability to study properties of Fermi liquids (and bosonic systems) beyond the one-particle picture. Acquisition of methods which are essential for the understanding the effects of interactions, including superconductivity and the Kondo effect.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or</p> <p>b) oral examination of one candidate each (approx. 30 minutes) or</p> <p>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</p> <p>d) project report (approx. 8 to 10 pages) or</p> <p>e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Solid State Physics 2		11-FK2-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
<ol style="list-style-type: none"> 1. Electrons in a periodic potential - the band structure <ol style="list-style-type: none"> a. Electrical and thermal transport b. Bloch theorem c. Electrons 2. Semi-classical models of dynamic processes <ol style="list-style-type: none"> a. Electrical transport in partially and completely filled bands b. Fermi surfaces; measurement techniques c. Electrical transport in external magnetic fields d. Boltzmann-equations of transport 3. The dielectric function and ferroelectrics <ol style="list-style-type: none"> a. Macroscopic electrodynamics and microscopic theory b. Polarizability of solids, of lattices, of valence electrons and quasi-free electrons; optical phonons, polaritons, plasmons, inter-band transitions, Wannier-Mott excitons c. Ferromagnetism 4. Semiconductors <ol style="list-style-type: none"> a. Characteristics b. Intrinsic semiconductors c. Doped semiconductors d. Physics and applications of p-n junctions e. Heterostructures 5. Magnetism <ol style="list-style-type: none"> a. Atomic dia- and paramagnetism b. Dia- and paramagnetism in metals c. Ferromagnetism 6. Superconductivity <ol style="list-style-type: none"> a. Phenomena b. Models of superconductivity c. Tunnel experiments und applications 		
Intended learning outcomes		
Knowledge of effects, concepts and models in advanced solid state physics. Familiarity with the theoretical principles and with applications of experimental methods.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<ol style="list-style-type: none"> a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method</p>		
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of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Nanostructure Technology (2020)

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Quantum Technology (2021)

Master's degree (1 major) Computational Mathematics (2022)

Master's degree (1 major) Functional Materials (2022)

Master's degree (1 major) Mathematics (2022)

exchange program Physics (2023)

Master's degree (1 major) Computational Mathematics (2024)

Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Solid State Spectroscopy		11-FKS-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Single- and many-particle pictures of electrons in solids, light-matter interaction, optical spectroscopy, electron microscopy, X-ray spectroscopy.		
Intended learning outcomes		
The students have specific and advanced knowledge in the field of solid-state spectroscopy. They know different types of spectroscopy and their fields of application. They understand the theoretical principles and the current developments in research.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
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Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Visiting Research		11-FPA-161-m01
Module coordinator		Module offered by
chairperson of examination committee		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
	graduate	Approval from examination committee required.
Contents		
Independent work on a current research topic of Experimental and Theoretical Physics. Implementation of scientific experiments including analysis and documentation of the results, especially in the context of research visits to other universities or research institutes.		
Intended learning outcomes		
The students are able to independently work on a current research area of Experimental or Theoretical Physics, to conduct and analyse scientific experiments and to document the results.		
Courses (type, number of weekly contact hours, language — if other than German)		
R (o)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
project report (10 to 20 pages) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Quantum Technology (2021) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title		Abbreviation
Introduction to Gauge/Gravity Duality		11-GGD-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<ol style="list-style-type: none"> 1. Elements of quantum field theory: <ul style="list-style-type: none"> • Quantisation of the free field • Interactions • Renormalisation Group • Gauge Fields • Conformal Symmetry • Large N expansion • Supersymmetry 2. Elements of gravity <ul style="list-style-type: none"> • Manifolds, coordinate covariance and metric • Riemann curvature • Maximally symmetric spacetimes • Black holes 3. Elements of string theory <ul style="list-style-type: none"> • Open and closed strings • Strings in background fields • Type IIB String Theory • D-Branes 4. The AdS/CFT correspondence <ul style="list-style-type: none"> • Statement of the correspondence • Near-horizon limit of D3-Branes • Field-operator correspondence • Tests of the correspondence: Correlation functions • Tests of the correspondence: Conformal anomaly • Holographic principle 5. Extensions to non-conformal theories <ul style="list-style-type: none"> • Holographic renormalisation group • Holographic C-Theorem 6. Applications I: Thermo- and hydrodynamics <ul style="list-style-type: none"> • Quantum field theory at finite temperature • Black holes • Holographic linear response formalism • Transport coefficients: Shear viscosity and conductivities 7. Applications II: Condensed matter physics <ul style="list-style-type: none"> • Finite charge density and Reissner-Nordström black holes • Quantum critical behaviour • Holographic fermions • Holographic superconductors • Entanglement entropy 8. Applications III: Particle physics <ul style="list-style-type: none"> • Gravity dual of confinement • Gravity dual of chiral symmetry breaking • Quark-gluon plasma 		

Intended learning outcomes		
The students acquire a thorough understanding of the foundations of gauge/gravity duality and the ability to carry out basic tests. Depending on the pre-existing knowledge and interests of the students, the module addresses a selection of the aforementioned topics. Knowledge of quantum mechanics and classical electrodynamics is a prerequisite for this course. Knowledge of quantum field theory and general relativity is useful, but not a prerequisite.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024)		
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Master's degree (1 major) Mathematics (2024)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Group Theory		11-GRTM-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
German contents available but not translated yet. Gruppentheorie. Endliche Gruppen. Lie-Gruppen. Lie-Algebren. Darstellungen. Tensoren. Klassifikationstheorem. Anwendungen		
Intended learning outcomes		
German intended learning outcomes available but not translated yet. Die Studierenden beherrschen die Grundlagen der Gruppentheorie, insbesondere der Lie-Gruppen. Sie sind in der Lage, Problemstellungen der Gruppentheorie zu erkennen und mit Hilfe der erlernten Methoden zu lösen. Sie können die Gruppentheorie zur Formulierung und Bearbeitung physikalischer Probleme anwenden.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Optical Properties of Semiconductor Nanostructures		11-HNS-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Semiconductor nanostructures are frequently referred to as "artificial materials". In contrast to atoms, molecules or macroscopic crystals, their electronic, optical and magnetic properties can be systematically tailored by changing their size. The lecture addresses technological challenges in the preparation of semiconductor nanostructures of varying dimensions (2D, 1D, 0D). It provides the basic theoretical concepts to describe their properties, with a focus on optical properties and light-matter coupling. Moreover, it discusses the challenges and concepts of novel optoelectronic and quantum photonic devices based on such nanostructures, including building blocks for quantum communication and quantum computing architectures.		
Intended learning outcomes		
The students know the theoretical principles and characteristics of semiconductor nanostructures. They have knowledge of the technological methods to fabricate such structures, and of their applications to novel photonic devices. They are able to apply their knowledge to problems in this field of research.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016)		
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Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Nanostructure Technology (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's degree (1 major) Functional Materials (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Functional Materials (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Semiconductor Physics		11-HPH-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The lecture deals with the fundamental properties of semiconductors. It begins with an analysis of the crystal structure, leading to methods for describing band structures. These form a basis for discussing optical and electronic properties of monolithic semiconductors. It then turns to examining semiconductor heterostructures, and studies how these can be used to modify and design optical and electrical properties, especially in the case of lowered dimensionality systems. Examples are selected from current research activities.		
Intended learning outcomes		
To provide the student with a working knowledge semiconductors pertaining to crystal structure, symmetries, and band structures, as well as electrical and optical properties. This establishes a solid basis preparing him for the more targeted specially lectures in the program.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
--		
Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 662 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Functional Materials (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Conformal Field Theory		11-KFT-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Conformal field theory (CFT) was developed in the 1980s and found immediate application in string theory and two-dimensional statistical mechanics, where critical exponents and correlation functions for many models (Ising, tricritical Ising, 3-state Potts, etc.) could be exactly calculated. The physical idea is that the principle of scale invariance is elevated from a global to a local invariance, which, for reasons of consistency, amounts to invariance under conformal transformations. This, in turn, yields a rich and fascinating mathematical structure for two dimensional systems (either two space dimensions or one time and one space dimension). CFT has become relevant to many interesting areas of condensed matter physics, including Abelian and non-Abelian bosonisation, quantised Hall states (where the bulk wave function is described in terms of conformal correlators, and the edge in terms of 1+1 dimensional CFTs), the two-channel Kondo effect, fractional topological insulators, and in particular fault-tolerant topological quantum computers involving non-Abelian anyons (Ising and Fibonacci anyons, for example, owe their names to the fusion rules of the associated conformal fields.) A potential syllabus for the first term of the course is:</p> <ol style="list-style-type: none"> 0. Introduction (scale and conformal invariance, critical exponents, the transverse Ising model at the self-dual point) 1. Conformal theories in D dimensions (conformal group, conformal algebra in 2D, constraints on correlation functions) 2. Conformal theories in D=2 (primary fields and correlation functions, quantum field theory, canonical quantisation and Noether's theorem, radial quantisation and Polyakov's theorem, time ordering and functional integration, the free boson and vertex operators, conformal Ward identities) 3. Central charge and Virasoro algebra (central charge, the Schwarzian derivative, free fermion, (Abelian) bosonisation, mode expansions and Virasoro algebra, cylinder geometry and Casimir effect, in- and out-states, highest weight states, descendant fields and operator product expansions, conformal blocks, duality and bootstrap) 4. Kac determinant and unitarity (Verma modules and null states, Kac determinant formula, non-unitarity proof, conformal grids, minimal models in general). 		
Intended learning outcomes		
<p>The students acquire practical and conceptional familiarity with the methods of conformal field theory. As the completion of "Quantum Mechanics II" (11-QM2) is the only prerequisite to take part in this course, the students also acquire basic knowledge of critical phenomena, quantum field theory and functional integrals. The course is primarily addressed to students of Theoretical Physics and aims to increase their general level of knowledge by becoming acquainted with a sophisticated subdiscipline with applications in many subdisciplines of Condensed Matter Physics.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p>		
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If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Language of assessment: German and/or English

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Allocation of places

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Additional information

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Workload

180 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Physics (2016)
Master's degree (1 major) Mathematical Physics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Conformal Field Theory 2		11-KFT2-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>5. Minimal models (critical statistical mechanics models (Ising, tricritical Ising, 3 state Potts model, restricted solid-on-solid models), correlation functions of the critical Ising model, fusion rules and Verlinde algebra, Landau-Ginzburg description of minimal models, modified Coulomb gas method and its application to the Ising model, superconformal models)</p> <p>6. Free bosons and fermions (mode expansions, twist fields, fermionic zero modes and fermion parity)</p> <p>7. Free fermions on the torus (operator implementation of the partition function, vacuum energies, representations of Virasoro algebra, modular group and fermionic spin structures, Virasoro characters, critical Ising model on the torus, Jacobi theta function identities)</p> <p>8. Free bosons on the torus (Lagrangian formulation of the partition function, fermionisation, orbifolds in general, S_1/Z_2 orbifold, Gaussian and Ashkin-Teller models, duality between original and orbifold theories, marginal operators, the space of $c=1$ theories)</p>		
Intended learning outcomes		
<p>The students acquire practical and conceptional familiarity with the methods of conformal field theory. As the completion of "Quantum Mechanics II" (11-QM2) is the only prerequisite to take part in this course, the students also acquire basic knowledge of critical phenomena, quantum field theory and functional integrals. The course is primarily addressed to students of Theoretical Physics and aims to increase their general level of knowledge by becoming acquainted with a sophisticated subdiscipline with applications in many subdisciplines of Condensed Matter Physics.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1)</p> <p>Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or</p> <p>b) oral examination of one candidate each (approx. 30 minutes) or</p> <p>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</p> <p>d) project report (approx. 8 to 10 pages) or</p> <p>e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
180 h		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		<p>JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020</p> <p>page 666 / 739</p>

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
General Concepts of Physics		11-L-GKP-152-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>This module focuses on important concepts and applications that constitute interconnections between the sub-disciplines of Physics (and partly other Natural Sciences). When it comes to concepts, these interconnections are structural, they are elements of the physical terminology and belong to the mental structure of the subject. Applied Physics: synergetic interconnections between elements of knowledge of the corresponding subdiscipline and beyond which are necessary for the solution of many important problems. On both levels, the specific contents and the resulting interconnections have the same significance. Structures and concepts: Dimensional analysis, scaling, similitude theory; fields; interactions; symmetries and conserved quantities, wave equation, waves; multipoles among other mode analysis; non-linear dynamics, self-organisation, deterministic chaos; analogies of transport phenomena; Virial theorem as a structural element; microscopic modelling of macroscopic phenomena; scattering and structure determination; aspects of the history of ideas of important concepts and their controversies (e.g. atomism, determinism); Applied and Technical Physics: Physics and information/communication technology; rules and process technology, sensors; medical technology; climate and weather; Biophysics; ecology; energy; celestial mechanics, satellites, GPS; measuring devices; el. light sources; displays</p>		
Intended learning outcomes		
<p>Their understanding of important shared concepts enables the students to connect different subdisciplines of Physics, they know the similarities and differences of different usage contexts and therefore have in-depth knowledge of these concepts and are able to mathematically describe and process relevant problems on the level of Theoretical Physics; they understand complex systems of nature and engineering and are able to connect their own physical knowledge in a synergetic manner by analysing the solutions to selected, complex problems, they are able to explain the interactions of knowledge of different disciplines for the solution of complex problems on the basis of selected examples.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (2) + Ü (1) + S (2) Module taught in: Ü: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 minutes) or b) oral examination of one candidate each (approx. 20 minutes) Language of assessment: German and/or English</p>		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 77 I Nr. 1 b)		

Module appears in

First state examination for the teaching degree Gymnasium Physics (2015)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
First state examination for the teaching degree Gymnasium Physics (2018)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
First state examination for the teaching degree Gymnasium Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Modern Physics 3 (Nuclear, Particle and Astrophysics)		11-L-M3-152-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
2 semester	undergraduate	--
Contents		
Nuclear Physics: experimental methods, detectors, structure of the atomic nucleus, radioactivity, nuclear fission, technical and medical applications, radiation protection. Elementary Particle Physics: Particle accelerator, classification of elementary particles, fundamental interactions. Astrophysics: Stellar development, structure of the Sun, cosmology.		
Intended learning outcomes		
The students have structured knowledge of the aforementioned terms; they know relevant key concepts and experiments as well as measuring methods and dimensions of central values; they are able to work on simple relevant problems in a quantitative manner.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + Ü (1) Module taught in: Ü: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 90 to 120 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
§ 77 I Nr. 1 b)		
Module appears in		
First state examination for the teaching degree Gymnasium Physics (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		

Module title		Abbreviation
Theoretical Physics 1 for Pre Service Teachers		11-L-T1-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
7	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	Admission prerequisite to assessment: completion of exercises (approx. 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the semester.
Contents		
<p>Physical laws and elementary methods of Theoretical Physics. Mechanics: Newton's laws, physical values and conservation laws, systems of mass points, reference systems, one-dimensional motion, Lagrange equations, applications, Hamiltonian dynamics.</p> <p>Quantum mechanics: Schrödinger equation, one-dimensional quantum mechanics, abstract quantum mechanics (operator formalism), angular momentum, spin.</p> <p>Electrodynamics: Maxwell equations, electrostatics, magnetostatics, dynamics of electromagnetic fields, special relativity.</p> <p>Thermodynamics: Heat, entropy, thermal equilibrium, measurands, level of efficiency, thermodynamic potentials, phase transitions</p>		
Intended learning outcomes		
The students know the basic principles, contexts and elementary methods of Theoretical Physics, theoretical mechanics, quantum mechanics, thermodynamics, electrodynamics and Statistical Physics. They are able to discuss the acquired theoretical concepts and to attribute them to bigger physical contexts.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: Ü: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
written examination (approx. 120 minutes) Language of assessment: German and/or English		
Allocation of places		
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Additional information		
Registration: If a student registers for the exercises or the seminar and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment was not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.		
Workload		
210 h		

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Module title		Abbreviation
Theoretical Physics 2 for Pre Service Teachers - Exercises		11-L-T2-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
7	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	Admission prerequisite to assessment: completion of exercises (approx. 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the semester.
Contents		
Exercises in theoretical mechanics, quantum mechanics, Statistical Physics, thermodynamics and electrodynamics. Among others: Newton's laws, physical quantities and conservation laws, systems of mass points, reference systems, one-dimensional motion, Lagrange equations, applications, Hamiltonian dynamics; Schrödinger equation, one-dimensional quantum mechanics, abstract quantum mechanics (operator formalism), angular momentum, spin, Maxwell equations, electrostatics, magnetostatics, dynamic electromagnetic fields, special theory of relativity; heat, entropy, thermal equilibrium, measured variables, efficiency, thermodynamic potentials, phase transitions		
Intended learning outcomes		
The students are able to independently apply the methods of Theoretical Physics to the solution of problems of theoretical mechanics, quantum mechanics, thermodynamics, electrodynamics and Statistical Physics and to interpret the solutions.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: Ü: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
oral examination of one candidate each (approx. 30 minutes) Assessment will have reference to the contents of modules 11-L-T1 and 11-L-T2. Language of assessment: German and/or English		
Allocation of places		
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Additional information		
Registration: If a student registers for the exercises or the seminar and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment was not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered.		
Workload		
210 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Magnetism		11-MAG-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Dia- and paramagnetism, exchange interaction, ferromagnetism, antiferromagnetism, anisotropy, domain structure, nanomagnetism, superparamagnetism, experimental methods to measure magnetic properties, Kondo effect.		
Intended learning outcomes		
The students know basic terms, concepts and phenomena of magnetism and measuring methods for magnetic experiments; they are skilled in simple model building and in the formulation of mathematical-physical approaches and are able to apply them to tasks in the stated areas; they have competencies in independently working on problems of these areas; they are able to evaluate the accuracy of observations and analyses.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Multi-wavelength Astronomy		11-MAS-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Phenomenology of active galactic nuclei and extragalactic jets 2. Jet-emission processes 3. VLBI observations of jets 4. High-energy observations of jets 5. Multimessenger signatures of jets		
Intended learning outcomes		
The students acquire knowledge of multiwavelength astronomy by studying the observations of active galactic nuclei and their extragalactic jets. They gain insights into a special, not yet solved astrophysical question and practice writing an observational proposal.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 677 / 739

Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Advanced Magnetic Resonance Imaging		11-MRI-171-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Nuclear magnetic resonance (NMR) is a quantum mechanical phenomenon that, through magnetic resonance imaging (MRI), has played a major role in the revolution of medical imaging over the last 30 years. Based on the fundamental principles of nuclear magnetic resonance (resonance principle, relaxation times, chemical shift) this course covers:</p> <ol style="list-style-type: none"> 1) the NMR signal theory and signal evolution (Bloch equations), 2) the principles of spatial encoding, magnetic resonance imaging (MRI) and corresponding imaging sequences and measurement parameters, 3) the concept of k-space and Fourier imaging, and 4) the physical, methodological and technical possibilities and limits of MRI. As a last point, exemplary applications in fields of MRI of biomedical research, clinical imaging and non-destructive testing are introduced. 		
Intended learning outcomes		
The students have advanced knowledge of the mathematical-theoretical and physical principles of modern imaging magnetic resonance, image generation and processing. They gain a broad overview of the field of modern MRI and its interdisciplinary contexts and applications.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes)</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Nanostructure Technology (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 exchange program Physics (2023)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Computational Astrophysics		11-NMA-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Various methods used in astrophysical simulations with special emphasis on their applications. N-body algorithms (tree- and polynomial codes). Particle-mesh methods (particle-in-cell methods). Vlasov methods (e.g., Lattice-Boltzmann). Hyperbolic conservation laws (fluid dynamics, finite difference method, Riemann solver, ENO). Methods of high-performance computing. Message-passing interface (MPI). GPGPU programming (OPENCL).		
Intended learning outcomes		
The students are able to solve typical problems and equations of Astrophysics and other subdisciplines of Physics with the help of numerical simulations. They are especially capable of choosing adequate strategies to approach such problems and of validating the results.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 681 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Nano-Optics		11-NOP-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The lecture conveys theoretical fundamentals, experimental techniques, and applications of nano-optics starting from the discussion of the focusing of light. Based on this, the fundamentals of modern far-field optical microscopy are discussed. In the following, the near-field optical microscopy is introduced and discussed. As a further basis, quantum emitters are introduced and their light emission in nano-environments is derived. Plasmons in 2D, 1D and 0 dimensions are introduced and discussed in detail. This finally leads to the concept of optical antennas.</p>		
Intended learning outcomes		
<p>The students have specific and advanced knowledge in the field of nano-optics. They are familiar with the theoretical principles and application areas of nano-optics and with current developments in this field.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
<p>Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)</p>		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 683 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Organic Semiconductors		11-OHL-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Fundamentals of organic semiconductors, molecular and polymer electronics and sensor technology, applications.		
Intended learning outcomes		
The students have advanced knowledge of organic semiconductors.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 685 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Functional Materials (2022)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Physics of Complex Systems		11-PKS-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Theory of critical phenomena in thermal equilibrium 2. Introduction into the physics out of equilibrium 3. Entropy production and fluctuationst 4. Phase transitions away from equilibrium 5. Universality 6. Spin glassest 7. Theory of neural networks		
Intended learning outcomes		
The students acquire in-depth knowledge of a wide variety of concepts and methods essential for a thorough understanding of cooperative phenomena in complex many-particle systems. The main focus includes a thorough understanding of the concepts of entropy, entropy production and universality. The students are prepared for research activities in different areas of physics of complex systems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Mathematics (2016)
 Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Physics of Advanced Materials		11-PMM-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
General properties of various material groups such as liquids, liquid crystals and polymers; magnetic materials and superconductors; thin films, heterostructures and superlattices. Methods of characterising these material groups; two-dimensional layer materials.		
Intended learning outcomes		
The students know the properties and characterization methods of some modern materials.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's degree (1 major) Functional Materials (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 689 / 739

Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Functional Materials (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Master's degree (1 major) Functional Materials (2025)

Module title		Abbreviation
Phenomenology and Theory of Superconductivity		11-PTS-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics and Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Basic Properties of Superconductors and their Applications, Development of technological platforms, Methods of material science for calculating temperature profiles in superconductors. Overview of the phenomenology of conventional and unconventional superconductivity. Review of BCS theory and its applicability for different types of superconductors. Extension of Ginzburg-Landau theory to a quantum field theory formalism using Feynman diagrams and functional integrals. Theoretical formalism of Ward identities and response functions. Goldstone modes, phase fluctuations, and coupling to the electromagnetic field. Interpretation of the Meissner effect in terms of the Higgs mechanism. Interplay of magnetism and conventional/unconventional superconductivity. Discussion of current research topics and perspective on room-temperature superconductivity.		
Intended learning outcomes		
Acquisition of basic knowledge about superconductivity as a macroscopic quantum phenomenon. Profound understanding of unconventional superconductivity and its interplay with magnetism in the context of current research. Knowledge of BCS mean-field theory, the quantum-field theory methods necessary to extend BCS theory, as well as the Meissner effect and the Higgs mechanism. Basic understanding of unconventional superconductors and their fascinating connection with competing magnetic phases.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Quantum Field Theory I		11-QFT1-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
1. Symmetries. 2. Lagrange formalism for fields. 3. Field quantisation. 4. Asymptotic states, scattering theory and S-matrix 5. Gauge principle and interaction. 6. Perturbation theory. 7. Feynman rules. 8. Quantum elektrodynamical processes in Born approximation. 9. Radiative corrections (optional) 10. Renormalisation (optional).		
Intended learning outcomes		
The students have mastered the principles and underlying mathematics of relativistic quantum field theories. They know how to use perturbation theory and how to apply Feynman rules. They are able to calculate basics processes in the framework of quantum electrodynamics in leading order. Moreover, they have a basic understanding of radiative corrections and renormalisation.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Quantum Field Theory II		11-QFT2-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Generating Functionals 2. Path Integrals 3. Renormalization 4. Renormalization group 5. Gauge theories 6. Spontaneous Symmetry Breaking 7. Effective Field Theory (optional)		
Intended learning outcomes		
The students have advanced knowledge of the methods and concepts of quantum field theory. They have mastered the principles, especially of renormalisation and gauge theories. They are able to formulate and solve problems of quantum field theory by using the acquired calculation methods.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		

Master's degree (1 major) Mathematics (2016)
 Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Advanced Theory of Quantum Computing and Quantum Information			11-Q C-201-m01
Module coordinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	Method of grading	Only after succ. compl. of module(s)	
6	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
1. Brief summary of classical information theory 2. Quantum theory seen from the perspective of information theory 3. Composite systems and the Schmidt decomposition 4. Entanglement measures 5. Quantum operations, POVMs, and the theorems of Kraus and Stinespring 6. Quantum gates and quantum computers 7. Elements of the theory of decoherence			
Intended learning outcomes			
Comprehensive understanding of quantum states and identity matrix beyond the usual textbook interpretation. Knowledge of handling tensor products and dealing with quantum effects in multipartite quantum systems. In-depth understanding of the phenomenon of entanglement. Knowledge of the fundamental mathematical concepts of quantum information theory. Ability to assess the limitations of quantum computing arising from decoherence.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (3) + R (1) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester			
Allocation of places			
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Additional information			
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Workload			
180 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 697 / 739

Module appears in

Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Quantum Mechanics II		11-QM2-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	undergraduate	--
Contents		
<p>The contents of this lecture build upon and will be chosen in accordance with the topics of the Bachelor's degree course "Quantum Mechanics I". Topics might include:</p> <p>for QM:</p> <ol style="list-style-type: none"> 1. Historical introduction 2. Single-particle states in a central potential 3. Principles of quantum mechanics 4. Spin and angular momentum 5. Approximations of energy eigenvalues 6. Approximations for time-dependent problems 7. Second quantisation 8. Potential scattering 9. General scattering theory 10. Canonical formalism 11. Charged particles in electromagnetic fields 12. Quantum theory of radiation 13. Quantum entanglement 		
Intended learning outcomes		
<p>The students acquire in-depth knowledge of advanced quantum mechanics. This knowledge is highly relevant to most of the theoretical Master's degree courses in Astrophysics, Particle Physics and Condensed Matter Physics. The completion of this course is highly recommended.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (4) + R (2) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload
240 h
Teaching cycle
--
Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019) Master's degree (1 major) Mathematics (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Quantum Technology (2021) Master's degree (1 major) Computational Mathematics (2022) Master's degree (1 major) Mathematics (2022) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Quantum Transport		11-QTR-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The lecture addresses the fundamental transport phenomena of electrons in solids where Electron-electron interaction and the wave nature are the determining factors. This includes the diffusive and ballistic transport regime as well as the Coulomb blockade. Observations of electron interference effects, conductance quantization and the quantum Hall effect will be discussed. Thermoelectric properties of electronic system and the phenomenon of superconductivity will be examined as well. Low dimensional electron systems and its quantum mechanical description are the basis of this lecture. Relevant material systems are semiconductor heterostructures as well as topological insulators, topological semimetals, and topological superconductors. The content will be guided by actual research results.</p>		
Intended learning outcomes		
Working knowledge of basic transport experiments, its analysis and its interpretation which enables the student to discuss results critical.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Nanostructure Technology (2020)		
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Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Renormalization Group Methods in Field Theory		11-RMFT-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>This course is complementary to the discussion of Wilson's renormalisation group (RG) as covered in the course "Renormalisation Group and Critical Phenomena" (11-CRP). It focuses on the diagrammatic formulation of RG flow equations and its relation to diagrammatic perturbation expansions. This is of particular relevance for interacting fermion systems in the context of functional renormalisation groups. An outline of the course might be:</p> <ol style="list-style-type: none"> 1. Wilson's RG 2. Path integrals of interacting fermions 3. Bethe-Salpeter equation 4. RG flow equations for the one-particle and two-particle vertex 5. Comparison of flow equations with diagrammatic resummation schemes (such as the random phase approximation) 6. RG flow equations for spin systems. 		
Intended learning outcomes		
The students become familiar with the modern diagram-based description of many-particle systems. This knowledge serves as a theoretical basis for the examination of phenomena such as superconductivity, charge and spin density waves, and nematic instabilities.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes)</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Physics (2016)
Master's degree (1 major) Mathematical Physics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Theory of Relativity		11-RTT-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Mathematical Foundations 2. Differential forms 3. Brief Summary of the special relativity 4. Elements of differential geometry 5. Electrodynamics as an example of a relativistic gauge theory 6. Field equations of the fundamental structure of general relativity 7. Stellar equilibrium and other astrophysical applications 8. Introduction to cosmology		
Intended learning outcomes		
The students become familiar with the principal physical and mathematical concepts of general relativity. The main topics include modern formulation on the basis of differential forms. Furthermore, the similarities between electrodynamics as a gauge theory and general relativity are emphasised. The students learn to apply the theory to simple models of stellar equilibrium and are introduced to basic elements of cosmology.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Mathematics (2016)
 Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Black Holes		11-SLQ-232-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>PART 1 - Classical solutions</p> <ol style="list-style-type: none"> 1. Vacuum solutions of Einstein's equation - the Schwarzschild solution, Birkhoff's theorem, the Eddington-Finkelstein coordinates, Kruskal extension and eternal black holes, the Penrose diagram, conformal compactification and Carter-Penrose diagram 2. Gravitational collapse - the Oppenheimer-Snyder solution 3. Charged and rotating black holes - Cauchy horizons, ergosphere 4. ADM formalism - energy and angular momentum 5. Black hole thermodynamics <p>PART 2 - Astrophysical observations of black holes</p> <ol style="list-style-type: none"> 1. Spin and mass measurements of black holes 2. Black hole electromagnetism 3. Gravitational waves and their measurement <p>PART 3 – Quantum aspects of black hole</p> <ol style="list-style-type: none"> 1. Introduction to QFT on curved spacetime: Rindler spacetime, Unruh effect 2. Derivation of Hawking radiation 3. Hawking's original formulation of the information paradox 4. The “holography of information” - information paradox in AdS/CFT, the Page curve and Islands 5. Firewall, fuzzball, complementarity - possible resolutions of information paradox 6. Wormholes and the factorization puzzle 		
Intended learning outcomes		
<p>This course plays a bridging role joining the basics on GR learnt in the GR I course and the active research directions in the fields of Astronomy, Astrophysics, General Relativity, String Theory and Gauge/Gravity Duality. Through this course, the students will gain sufficient commands over the applications of general relativity in connection with research directions in this area. This in turn will motivate them to pursue careers as a researcher in the aforementioned directions and help them to successfully begin their Master and PhD projects.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p>		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 707 / 739

Assessment offered: In the semester in which the course is offered and in the subsequent semester
Allocation of places
--
Additional information
--
Workload
180 h
Teaching cycle
--
Referred to in LPO I (examination regulations for teaching-degree programmes)
--
Module appears in
Master's degree (1 major) Physics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's degree (1 major) Computational Mathematics (2024) Master's degree (1 major) Mathematics (2024) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Spintronics		11-SPI-161-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
This lecture covers the basic principles of spin transport, with a particular emphasis on the phenomena of giant magnetoresistance and tunnel magnetoresistance. As a last point, we discuss new phenomena from the field of spin dynamics and current-induced spin phenomena.		
Intended learning outcomes		
The students know the basic principles of spin transport models and the applications of spin transport in information technology. They have gained an overview of current findings in this field (giant magnetoresistance, tunnel magnetoresistance).		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 709 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Surface Science		11-SSC-172-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Relevance of surfaces and interfaces, distinction between bulk phases, classical description, continuum models. Atomic structure: Reconstructions and adsorbates, surface orientation and symmetries. Microscopic processes involving surfaces. Thermodynamics of surfaces, adsorption and desorption, equilibria, thermodynamic phases, experimental characterisation. Electronic structure of surfaces, chemical bonding, surface conditions, spin-orbit coupling: Rashba effect and topological insulators. Magnetism on surfaces.		
Intended learning outcomes		
The students have gained an overview of the diverse aspects of surface physics and especially know the causes and contexts of physical peculiarities of surfaces and interfaces. Additionally, they know the most important experimental techniques and their specific application possibilities in the context of surface physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Physics (2016) Master's degree (1 major) Nanostructure Technology (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 711 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Quantum Technology (2021)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
String Theory 1		11-STRG1-171-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Classical and quantum theory of the relativistic bosonic string, in particular the Nambu-Goto action and Polyakov action; quantisation of the closed bosonic string and emergent graviton; quantum Lorentz invariance and critical dimension; quantisation of the open bosonic string, D-Branes, Gauge Fields and Yang-Mills theories; relativistic conformal field theory, string path integral, BRST quantisation, string interactions, effective actions and gravity.		
Intended learning outcomes		
The students are familiar with classical and quantum theory of relativistic bosonic strings. They know the classical actions for relativistic bosonic strings, the Nambu-Goto action and Polyakov action, they have quantised the bosonic string and understand the emergence of the massless graviton in the spectrum of the closed string. They have calculated Lorentz anomaly on quantum level to deduce the critical dimension of the bosonic string. They understand the boundary conditions for the open string and its connection to D-branes. They have knowledge of open string quantisation and of the spectrum of massless gauge fields, as well as of Yang-Mills fields for coincident branes. They are familiar with relativistic conformal field theory, the string path integral, its BRST quantisation and the calculation of string interactions. They understand the low-energy effective actions in target space and the emergence of Einstein gravity.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (2) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Physics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
String Theory 2		11-STRG2-171-mo1
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>Superstring theories and M theory, in particular a short introduction to bosonic string theory, the theory of fermionic fields and representations of Clifford algebra in diverse dimensions, a review of supersymmetry in two and more dimensions, the classical and quantum version of the Ramond-Neveu-Schwarz superstring, type II A/B superstrings, the Gliozzi-Scherck-Olive projection and space-time supersymmetry in 10 dimensions, the type I superstring, heterotic string theories, anomaly cancellation and restrictions on gauge groups, dualities between the five superstring theories as well as their relation to M theory in 11D, D-Branes and supersymmetric gauge theories, supergravity and the AdS/CFT correspondence.</p>		
Intended learning outcomes		
<p>The students are familiar with supersymmetrical string theory and M theory. They know the basic characteristics of bosonic string theory and fermionic field theory as well as the depiction of Clifford algebra in different dimensions. They have studied the aspects of supersymmetry in two or more dimensions relevant to superstring theory. They are acquainted with classical and quantum theory of the Ramon-Neveu-Schwarz superstring, they understand the deduction of type IIA/B string theories and the ensuring of space-time supersymmetry on the basis of Gliozzi-Scherk-Olive projection. They have gained insights into type I and heterotic superstring theory and into the limiting effects of anomaly freedom on the permitted gauge groups of these theories. They have studied the dualities between the five superstring theories and their connections to M theory in 11 dimensions. They are familiar with the properties of supersymmetric D-branes in type I and II superstring theories and the corresponding supersymmetric gauge theories as well as the supergravity effects in 10 and 11 dimensions and the connection to AdS/CFT correspondence.</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (3) + R (1) Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes) If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload
180 h
Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module appears in
Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Physics (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's degree (1 major) Mathematical Physics (2020) Master's degree (1 major) Mathematical Physics (2022) exchange program Physics (2023) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Topological Effects in Solid State Physics		11-TEFK-201-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
1. Geometric phase in quantum systems 2. Mathematical basics of topology 3. Time-reversal symmetry 4. Hall conductance and Chern numbers 5. Bulk-boundary correspondence 6. Graphene (as a topological insulator) 7. Quantum Spin Hall insulators 8. Z ₂ invariants 9. Topological superconductors		
Intended learning outcomes		
In-depth theoretical understanding of the topological concepts in quantum physics related to solid state systems. Ability to connect their knowledge with different research activities at the Department of Physics and Astronomy at Würzburg University.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in

Master's degree (1 major) Nanostructure Technology (2020)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Quantum Technology (2021)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Theoretical Elementary Particle Physics			11-TEP-161-m01
Module coordinator		Module offered by	
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy	
ECTS	Method of grading	Only after succ. compl. of module(s)	
8	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
1. Fundamental particles and forces 2. Symmetries and groups 3. Quark model of hadrons 4. Quark parton model and deep inelastic scattering 5. Principles of quantum field theory 6. Gauge theories 7. Spontaneous symmetry breaking 8. Electroweak standard model 9. Quantum chromodynamics 10. Extensions of the standard model.			
Intended learning outcomes			
The students are familiar with the mathematical methods of Elementary Particle Physics. They understand the structure of the standard model based on symmetry principles and experimental observations. They know calculation methods for the processing of simple problems and processes of Elementary Particle Physics. Furthermore, they know the tests and limits of the standard model and the basics of extended theories.			
Courses (type, number of weekly contact hours, language — if other than German)			
V (4) + R (2) Module taught in: German or English			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester			
Allocation of places			
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Additional information			
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Workload			
240 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Physics (2016)
Master's degree (1 major) Mathematical Physics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Theoretical Solid State Physics		11-TFK-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The contents of this two-term course will depend on the choice of the lecturer, and may include parts of the syllabus which could alternatively be offered as "Quantum Many Body Physics" (11-QVTP).</p> <p>A possible syllabus may be:</p> <ol style="list-style-type: none"> 1 Band structure (Sommerfeld theory of metals, Bloch theorem, k.p approach and effective Hamiltonians for topological insulators (TIs), bulk-surface correspondence, general properties of TIs) 2 Electron-electron interactions in solids (path integral method for weakly interacting fermions, mean field theory, random phase approximation (RPA), density functional theory) 3 Application of mean field theory and the RPA to magnetism 4 BCS theory of superconductivity 		
Intended learning outcomes		
<p>During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying concepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Physics" and "Quantum Mechanics".</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (4) + R (2)</p> <p>Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or</p> <p>b) oral examination of one candidate each (approx. 30 minutes) or</p> <p>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</p> <p>d) project report (approx. 8 to 10 pages) or</p> <p>e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module appears in

Master's degree (1 major) Mathematics (2016)
Master's degree (1 major) Physics (2016)
Master's degree (1 major) Nanostructure Technology (2016)
Master's degree (1 major) Mathematical Physics (2016)
Master's degree (1 major) Computational Mathematics (2016)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
Master's degree (1 major) Computational Mathematics (2019)
Master's degree (1 major) Mathematics (2019)
Master's degree (1 major) Nanostructure Technology (2020)
Master's degree (1 major) Physics (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's degree (1 major) Mathematical Physics (2020)
Master's degree (1 major) Quantum Technology (2021)
Master's degree (1 major) Computational Mathematics (2022)
Master's degree (1 major) Mathematics (2022)
Master's degree (1 major) Mathematical Physics (2022)
exchange program Physics (2023)
Master's degree (1 major) Computational Mathematics (2024)
Master's degree (1 major) Mathematics (2024)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Theoretical Solid State Physics 2		11-TFK2-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
8	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>A continuation of the first semester (11-TFK) might be the following syllabus:</p> <p>5. Advanced topics of the theory of superconductivity (Bogoliubov-de Gennes equations, effective field theory, Anderson-Higgs description of the Meissner effect)</p> <p>6. Unconventional superconductors (e.G. copper-oxide high-T_c superconductors)</p> <p>7. Green's function methods and Feynman diagrammatic technique</p> <p>8. The Kondo Effect (Anderson's "poor mans scaling", renormalization group)</p>		
Intended learning outcomes		
<p>During the two-semester lecture, the students acquire a basic understanding of many topics of Solid-State Physics, which are addressed in classical textbooks, and thereby advance their knowledge of the underlying concepts and the methods of description. The course builds upon the courses "Experimental Condensed Matter Physics" and "Quantum Mechanics".</p>		
Courses (type, number of weekly contact hours, language — if other than German)		
<p>V (4) + R (2)</p> <p>Module taught in: German or English</p>		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>a) written examination (approx. 90 to 120 minutes) or</p> <p>b) oral examination of one candidate each (approx. 30 minutes) or</p> <p>c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or</p> <p>d) project report (approx. 8 to 10 pages) or</p> <p>e) presentation/talk (approx. 30 minutes).</p> <p>If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.</p> <p>Language of assessment: German and/or English</p> <p>Assessment offered: In the semester in which the course is offered and in the subsequent semester</p>		
Allocation of places		
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Additional information		
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Workload		
240 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		

Master's degree (1 major) Mathematics (2016)
 Master's degree (1 major) Physics (2016)
 Master's degree (1 major) Mathematical Physics (2016)
 Master's degree (1 major) Computational Mathematics (2016)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Mathematical Physics (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 Master's degree (1 major) Mathematical Physics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Experimental Particle Physics		11-TPE-161-m01
Module coordinator		Module offered by
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Physics with modern particle detectors at the LHC and at the Tevatron. Discovery of the Higgs boson. Search for supersymmetry and other physics beyond the standard model. Determination of the top quark mass and W mass as well as other parameters of the standard model. Introduction to modern methods of analysis and assessment of systematic errors.		
Intended learning outcomes		
The students are familiar with the principles of modern particle detector physics, especially with currently open questions of Particle Physics, which are examined by using these detectors. They know modern methods of analysis and are able to put results into context and to assess their systematic uncertainties.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
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Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Physics (2016) Master's degree (1 major) Computational Mathematics (2016)		
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)
 Master's degree (1 major) Computational Mathematics (2019)
 Master's degree (1 major) Mathematics (2019)
 Master's degree (1 major) Physics (2020)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
 Master's degree (1 major) Computational Mathematics (2022)
 Master's degree (1 major) Mathematics (2022)
 exchange program Physics (2023)
 Master's degree (1 major) Computational Mathematics (2024)
 Master's degree (1 major) Mathematics (2024)
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Particle Physics (Standard Model)		11-TPSM-201-m01
Module coordinator		Module offered by
Managing Directors of the Institute of Applied Physics and the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
ECTS	Method of grading	Only after succ. compl. of module(s)
6	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	Approval from examination committee required.
Contents		
<p>Theoretical description of the Standard Model Electroweak symmetry breaking through the Higgs mechanism parity Violation Bhabha scattering Z-Line Shape and forward / reverse asymmetry Higgs production and decay Experimental setup and results of key experiments to test the Standard Model and for determining its parameters Search for the Higgs boson</p>		
Intended learning outcomes		
Students know the theoretical fundamental laws of the standard model of particle and the key experiments that have established and confirmed the standard model. They have basic knowledge in order to interpret experimental or theoretical results in the framework of the standard model and knows its significance and limitations.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (3) + R (1) Module taught in: German or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes). If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest. Language of assessment: German and/or English Assessment offered: In the semester in which the course is offered and in the subsequent semester		
Allocation of places		
--		
Additional information		
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Workload		
180 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020

Module appears in

Master's degree (1 major) Physics (2020)

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)

Master's degree (1 major) Mathematical Physics (2020)

Module title		Abbreviation
Advanced Subject Didactics 1		MINT-B1-162-m01
Module coordinator		Module offered by
holder of the Chair of M!ND Center		M!nd-Center
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The students acquire subject-didactic competencies which exceed the requirements of the teaching degree programme. The module especially focuses on subject-didactic research methods and on the examination of current international subject-didactic research. Most of the lectures combine topics of various disciplines. In addition, they establish connections to scientific disciplines and educational sciences. Some exemplary topics might be: Qualitative and quantitative research methods in subject didactics; connections between subject didactics and educational sciences; interdisciplinary connections between subject didactics and scientific disciplines; closer connections between subject didactics and school practice; in-depth analyses of classes (e.g. video studies, "university classroom"); exploratory learning at extracurricular learning facilities (e.g. genetic engineering laboratory in Bayreuth, teaching-learning-laboratories (LLL); M!ND and SFZ (special needs centre), M!ND in Würzburg)</p>		
Intended learning outcomes		
In-depth study of subject didactics; interdisciplinary connections; in-depth analyses of classes; connection of scientific disciplines, subject didactics, school practice and educational sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 729 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Advanced Subject Didactics 2		MINT-B2-162-mo1
Module coordinator		Module offered by
holder of the Chair of M!ND Center		M!nd-Center
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
<p>The students acquire subject-didactic competencies which exceed the requirements of the teaching degree programme. The module especially focuses on subject-didactic research methods and on the examination of current international subject-didactic research. Most of the lectures combine topics of various disciplines. In addition, they establish connections to scientific disciplines and educational sciences. Some exemplary topics might be: Qualitative and quantitative research methods in subject didactics; connections between subject didactics and educational sciences; interdisciplinary connections between subject didactics and scientific disciplines; closer connections between subject didactics and school practice; in-depth analyses of classes (e.g. video studies, "university classroom"); exploratory learning at extracurricular learning facilities (e.g. genetic engineering laboratory in Bayreuth, teaching-learning-laboratories (LLL); M!ND and SFZ (special needs centre), M!ND in Würzburg)</p>		
Intended learning outcomes		
In-depth study of subject didactics; interdisciplinary connections; in-depth analyses of classes; connection of scientific disciplines, subject didactics, school practice and educational sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
--		
Additional information		
--		
Workload		
150 h		
Teaching cycle		
--		
Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 731 / 739

Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title		Abbreviation
Research in Groups		MINT-C1-162-m01
Module coordinator		Module offered by
holder of the Chair of M!ND Center		M!nd-Center
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
The students examine international research in an interdisciplinary manner and study current research areas of scientific disciplines and/or subject didactics in order to advance their competencies acquired in the module areas A and B. The module also includes courses offered by external guest researchers. The specific forms of teaching and the university-didactic concept of "exploratory learning" especially promote advanced professional skills and transferable skills for scientific work.		
Intended learning outcomes		
Participation in/implementation of qualitative and quantitative research projects; scientific work; interdisciplinary research		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)		

Module title			Abbreviation
Scientific Internship			MINT-C2-162-mo1
Module coordinator		Module offered by	
holder of the Chair of M!ND Center		M!nd-Center	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The students examine international research in an interdisciplinary manner and study current research areas of scientific disciplines and/or subject didactics in order to advance their competencies acquired in the module areas A and B. The module also includes courses offered by external guest researchers. The specific forms of teaching and the university-didactic concept of "exploratory learning" especially promote advanced professional skills and transferable skills for scientific work.			
Intended learning outcomes			
Research placements at university and non-university research institutions; scientific work; interdisciplinary research			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus			
Allocation of places			
--			
Additional information			
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Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
--			
Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			

Module title		Abbreviation
Key Competences for Teaching Professions 1		MINT-D1-162-m01
Module coordinator		Module offered by
holder of the Chair of M!ND Center		M!nd-Center
ECTS	Method of grading	Only after succ. compl. of module(s)
5	(not) successfully completed	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In the elite programme, the participants have the opportunity to improve key competencies which are of specific importance for occupations in the area of education and science. These competencies include: Intercultural competence (conscious approach to cultural differences); legal expertise and organisational competence (legal framework of educational institutions, sensitive approach to organisational problems); media competence (creating multimedia products for education processes, media analysis, evaluation of the effects of media); personal and social competence (personal qualities such as self-confidence, the ability to take criticism, a sense of responsibility and moral concepts); communication competence (especially communication in the educational and science system); ethical evaluation of science (moral standards of science, ethical framework conditions of science, philosophical aspects of STEM subjects)		
Intended learning outcomes		
Legal expertise and organisational competence; media competence; personal and social competence; personal qualities such as self-confidence, the ability to take criticism, a sense of responsibility and moral concepts; communication competence, ethical evaluation of science		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module appears in		
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	page 735 / 739

Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Key Competences for Teaching Professions 2			MINT-D2-162-mo1
Module coordinator		Module offered by	
holder of the Chair of M!ND Center		M!nd-Center	
ECTS	Method of grading	Only after succ. compl. of module(s)	
5	(not) successfully completed	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
In the elite programme, the participants have the opportunity to improve key competencies which are of specific importance for occupations in the area of education and science. These competencies include: Intercultural competence (conscious approach to cultural differences); legal expertise and organisational competence (legal framework of educational institutions, sensitive approach to organisational problems); media competence (creating multimedia products for education processes, media analysis, evaluation of the effects of media); personal and social competence (personal qualities such as self-confidence, the ability to take criticism, a sense of responsibility and moral concepts); communication competence (especially communication in the educational and science system); ethical evaluation of science (moral standards of science, ethical framework conditions of science, philosophical aspects of STEM subjects)			
Intended learning outcomes			
Legal expertise and organisational competence; media competence; personal and social competence; personal qualities such as self-confidence, the ability to take criticism, a sense of responsibility and moral concepts; communication competence, ethical evaluation of science			
Courses (type, number of weekly contact hours, language — if other than German)			
V (2) + Ü (1) Module taught in: German and/or English Course type: alternatively S (2) or P (2) instead of Ü (1)			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (20 to 40 minutes) or c) talk (30 to 60 minutes) or d) practical assignment including report (approx. 10 to 20 pages) and talk (approx. 15 minutes) or e) term paper (approx. 15 to 25 pages, usually chosen) Language of assessment: German and/or English creditable for bonus			
Allocation of places			
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Additional information			
--			
Workload			
150 h			
Teaching cycle			
--			
Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)			
MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Lehramt Gymnasien Master MINT-Lehramt PLUS im Elitenetzwerk Bayern (ENB) - 2020	
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Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)

Module title			Abbreviation
Master-Thesis			MINT-MA-162-m01
Module coordinator		Module offered by	
holder of the Chair of M!ND Center		Centre for Teacher Training and Educational Research (ZfL)	
ECTS	Method of grading	Only after succ. compl. of module(s)	
30	numerical grade	--	
Duration	Module level	Other prerequisites	
1 semester	graduate	--	
Contents			
The students carry out independent research to examine a complex question for their Master's thesis. In doing so, they are allowed to flexibly set their own priorities. All work groups of the subjects involved of both universities are available for the supervision of the Master's thesis. Therefore, the students can also write their Master's theses in an inter-university manner. They are integrated into research projects of the corresponding work groups. This enables them to experience how current research is almost always conducted in (inter-)national co-operation.			
Intended learning outcomes			
Writing and publishing scientific works; applied research; scientific examination of subject-specific, subject-didactic and/or educational-scientific topics			
Courses (type, number of weekly contact hours, language — if other than German)			
No courses assigned to module			
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)			
Master's thesis (approx. 60 pages) Language of assessment: German and/or English			
Allocation of places			
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Additional information			
Time to complete: 6 months.			
Workload			
900 h			
Teaching cycle			
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Referred to in LPO I (examination regulations for teaching-degree programmes)			
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Module appears in			
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)			