Julius-Maximilians-
UNIVERSITÄT
WÜRZBURG

Module Catalogue

for the Subject

Aerospace Computer Science

as a Bachelor's with 1 major

with the degree "Bachelor of Science"

(180 ECTS credits)

Examination regulations version: 2025
Responsible: Faculty of Mathematics and Computer Science
Responsible: Institute of Computer Science

Contents

The subject is divided into 4
Learning Outcomes 5
Abbreviations used, Conventions, Notes, In accordance with 7
Compulsory Courses 8
Aerospace Science and Engineering 9
Introduction to Aviation Systems 10
Introduction to Space Systems 11
Spacecraft Operations 12
Measurement Technique 13
Introduction to Flight Mechanics 14
Digital Signal processing 15
Computer Science 16
Algorithms and data structures 17
Fundamentals of Programming 18
Hardware-oriented programming and Fundamentals Avionics 19
Digital Computer Systems for Aerospace Computer Science 20
Automation and Control Technology 21
Practical Measurement and Control System Engineering 22
Mathematics 23
Mathematics 1 for students of Space- and Aerospace Computer Science 24
Mathematics 2 for students of Space- and Aerospace Computer Science 25
Basics of Physics 26
Classical Physics 1 for Students of Physics related Disciplines 27
Classical Physics 2 for Students of Physics related Disciplines 29
Laboratory Course Physics A (Mechanics, Heat, Electromagnetism) 31
Data and Error Analysis 32
Compulsory Electives 33
Numerical Mathematics and Programming 34
Practical Course in Programming 35
Numerical Mathematics 1 for students of other subjects 36
Numerical Mathematics 2 for students of other subjects 37
Other topics 38
Computer Networks and Information Transmission 39
Algorithmic Graph Theory 40
Data Science 41
Theory of Computation 42
Computer Architecture 43
Software Engineering 44
Model-based Systems Engineering 45
Control Principles of Modern Communication Systems 46
Practical course in hardware 47
Practical course in software for students of Space- and Aerospace Computer Science 48
Ordinary Differential Equations for students of other subjects 49
Numerical Mathematics 1 for students of other subjects 50
Numerical Mathematics 2 for students of other subjects 51
Mathematical Control Theory 52
Selected Chapters of Aerospace Science and Engineering 53
Selected Chapters of Computer Science 54
3D Point Cloud Processing 55
Operating Systems 56
Databases 57
Logic for informatics 58

Astrophysics 59
Laboratory Course Physics B for Space and Aerospace Computer Science 60
Laboratory Course Physics C for Space and Aerospace Computer Science 61
Key Skills Area 62
Subject-specific Key Skills 63
Aerospace Laboratory 64
Seminar for students of Space- and Aerospace Computer Science 1 65
Seminar for students of Space- and Aerospace Computer Science 2 66
Practical work Space Technology 67
General Key Skills 68
Thesis 69
Bachelor's Thesis Space- and Aerospace Computer Science 70

The subject is divided into

section / sub-section	ECTS credits	starting page
Compulsory Courses	125	8
Aerospace Science and Engineering	36	9
Computer Science	50	16
Mathematics	20	23
Basics of Physics	19	26
Compulsory Electives	25	33
Numerical Mathematics and Programming	10	34
Other topics	15	38
Key Skills Area	20	62
Subject-specific Key Skills	15	63
General Key Skills	5	68
Thesis	10	69

Learning Outcomes

German contents and learning outcome available but not translated yet.

Wissenschaftliche Befähigung

- Die Absolventinnen und Absolventen können die mathematischen, technischen, theoretischen und praktischen Grundlagen der Luft- und Raumfahrtinformatik anwenden.
- Die Absolventinnen und Absolventen verstehen die wesentlichen Zusammenhänge und Konzepte der einzelnen Teilgebiete der Luft- und Raumfahrtinformatik.
- Die Absolventinnen und Absolventen können tiefergehende Kenntnisse in mindestens einem Teilgebiet abrufen.
- Die Absolventinnen und Absolventen können unter Anleitung hard- und/oder softwaregetriebene Experimente durchführen, analysieren, auswerten und die erhaltenen Ergebnisse darstellen.
- Die Absolventinnen und Absolventen sind in der Lage, sich mit Hilfe von Fachliteratur in neue Aufgabengebiete einzuarbeiten und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen besitzen Abstraktionsvermögen, analytisches Denken, Problemlösungskompetenz und die Fähigkeit, Zusammenhänge zu strukturieren.
- Die Absolventinnen und Absolventen sind in der Lage, Methoden der Luft- und Raumfahrtinformatik unter Anleitung auf konkrete praktische oder theoretische Aufgabenstellungen anzuwenden, Lösungswege zu entwickeln und die Ergebnisse zu interpretieren und zu bewerten.
- Die Absolventinnen und Absolventen setzen die erlernten theoretischen und praktischen Methoden in geschlossener Form unter Anleitung ein, um zu zeigen, dass sie zur Anwendung der Grundlagen wissenschaftlichen Arbeitens befähigt sind.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.

Befähigung zur Aufnahme einer Erwerbstätigkeit

- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.
- Die Absolventinnen und Absolventen sind in der Lage, konstruktiv und zielorientiert in einem Team zusammenzuarbeiten und auftretende Konflikte zu lösen (Teamfähigkeit).
- Die Absolventinnen und Absolventen können ihre erworbenen Kompetenzen in unterschiedlichen interkulturellen Kontexten und in international zusammengesetzten Teams anwenden.
- Die Absolventinnen und Absolventen kennen wichtige Anforderungen und Arbeitsweisen im gewerblichen Umfeld sowie in Forschung und Entwicklung.
- Die Absolventinnen und Absolventen sind befähigt, Probleme zu analysieren und zu lösen und sich in weniger vertraute Themenkomplexe einzuarbeiten.

Persönlichkeitsentwicklung

- Eigenverantwortlichkeit, Selbstständigkeit, Zeitmanagement, Teamfähigkeit
- Die Absolventinnen und Absolventen kennen die Regeln guter wissenschaftlicher Praxis und beachten sie.
- Die Absolventinnen und Absolventen können ihr Wissen und ihre Erkenntnisse einem Fachpublikum gegenüber darstellen und vertreten.

Befähigung zum gesellschaftlichen Engagement

- Die Absolventinnen und Absolventen können naturwissenschaftliche Entwicklungen kritisch reflektieren und deren Auswirkungen auf die Wirtschaft, Gesellschaft und die Umwelt in Ansätzen erfassen, zum Beispiel Technikfolgenabschätzung, Ethik, IT-Recht oder Datenschutz.
- Die Absolventinnen und Absolventen haben ihr Wissen bezüglich wirtschaftlicher, gesellschaftlicher, naturwissenschaftlicher, kultureller etc. Fragestellungen erweitert und können begründet Position beziehen.

- Die Absolventinnen und Absolventen entwickeln die Bereitschaft und Fähigkeit, ihre Kompetenzen in partizipative Prozesse einzubringen und aktiv an Entscheidungen mitzuwirken.

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)):

21-May-2025 (2025-64)

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.

Compulsory Courses

(125 ECTS credits)

Aerospace Science and Engineering

(36 ECTS credits)

Module title			Abbreviation
Introduction to Aviation Systems			10-I-LFS-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	undergraduate	--	

Contents

Physical foundations of aircraft aerodynamics, flight stability, airplane technology and structure of aircraft, foundations of aviation propulsion and suitable material.

Intended learning outcomes

The students possess the theoretical and practical knowledge necessary to correctly classify aerospace systems, correctly identify the most important system relationships, formulate requirements for new systems and do calculations for selected basic system elements.

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 is creditable for 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. 30 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)

§ 22 II Nr. 3 b)

Module title			Abbreviation
Introduction to Space Systems			10-I-RFS-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	undergraduate	--	

Contents

History of space flight, carrier rockets, orbits of spacecraft, environment conditions in space, special aspects of space applications, foundations of subsystems of spacecraft. Introduction to aviation systems.

Intended learning outcomes

The students possess the theoretical and practical knowledge necessary to correctly classify aerospace systems, correctly identify the most important system relationships, formulate requirements for new systems and do calculations for selected basic system elements.

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 is creditable for 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. 30 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)

§ 22 II Nr. 3 b)

Module title			Abbreviation
Spacecraft Operations			10-I-LRFB-252-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

Basic functionalities and basic elements of the operation of air and space vehicles, ground station, structure of control centres, communication methods and systems, transmission path balance, transmission and operating standards, planning systems, operating procedures, flight manuals, telemetry and telecommando systems.

Intended learning outcomes

The students possess the theoretical and practical knowledge necessary to correctly classify systems to operate systems in air and space vehicles, identify the most important system relationships, formulate requirements for new systems and develop the complete system as well as individual system elements for the operation of air and space vehicles in the ground segment.

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 is creditable for 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. 30 minutes).
creditable for bonus

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: every year, summer semester

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

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Module title			Abbreviation
Measurement Technique			10-LURI-LMT-252-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)**	
6	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Brief history of units of measurement, SI units, classification, measuring chain, properties of sensors, characteristic curves and adjustment, linearization of characteristic curves, measurement of: Direct current, direct voltage, internal resistance of sources; characteristic values of alternating quantities, measurement of alternating current and alternating voltage, diodes, rectification, measuring transformer, comparison with reference resistance, Wheatstone bridges, adjustment measuring bridge, deflection measuring bridge, complex alternating current calculation, impedance measurement, alternating voltage measuring bridges, measurement of electrical power, power factor, reactive power, apparent power, operational amplifiers (op amps), characteristics of op amps, basic op amp circuits, special measuring amplifiers, various methods for analog-to-digital conversion (including successive approximation, parallel conversion, parallel conversion, etc.). Successive approximation, parallel converter, dual-slope converter, delta-sigma ADU, physical effects and realization of sensors (e.g. piezoelectric effect, piezoresistive effect, Hall effect, inductance effect, capacitance effect, MEMS sensors, magnetoresistive effects), practical experiments in the lecture

Intended learning outcomes

Students master the basics of measurement techniques, are familiar with the problems of sensor design and know the principles of selected sensors.

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 is creditable for 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

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Additional information

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Workload

180 h

Teaching cycle

Teaching cycle: every year, summer semester

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

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Module title			Abbreviation
Introduction to Flight Mechanics			10-LURI-FD-252-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

Introduction to the fundamentals of flight mechanics and coordinate systems used
Derivation of various flight motion models for fixed-wing aircraft

- Nonlinear equations of motion with 6 degrees of freedom (translation and rotation)
- Simplified models with 3 degrees of freedom (translation only)
- Criteria for selecting appropriate models depending on analysis goals
- Structure, initialization, and parameterization of flight simulations
- Computation of steady-state flight conditions
- Linearization of 6-DOF equations of motion
- Time-domain analysis of flight dynamics (stability, eigenmotions)
- Contextualization of flight mechanics with system theory, aerodynamics, and control theory

Intended learning outcomes

Students will understand the dynamic behavior of fixed-wing aircraft in atmospheric flight. They will be able to characterize, linearize, and analyze flight motion models with 3 and 6 degrees of freedom. They will compute steady flight conditions and assess their stability. Students will also be capable of building and interpreting simple flight simulations with regard to flying qualities.

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 is creditable for 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

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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 title			Abbreviation
Digital Signal processing			10-LURI-DS-252-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

- Introduction
- Discrete-Time Signals
- Linear Time-Invariant Discrete-Time Systems
- z-Transform
- Digital Filters as Non-Recursive and Recursive Systems
- Stochastical Signal Processing
- Discrete Fourier Transform

Intended learning outcomes

Students are able to

- analyse discrete-time signals and linear time-invariant (LTI) systems in both time and frequency domain,
- apply and interpret the z-transform and Discrete Fourier Transform (DFT) for system and spectral analysis,
- design and evaluate digital filters (FIR and IIR) with respect to stability, causality, and frequency response,
- formulate and solve minimum mean square error (MMSE) estimation problems and implement adaptive filtering algorithms such as LMS and RLS and
- solve practical digital signal processing problems using mathematical tools and computational 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 is creditable for 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

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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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Computer Science

(50 ECTS credits)

Module title			Abbreviation
Algorithms and data structures			10-I-ADS-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

Design and analysis of algorithms, recursion vs. iteration, sort and search methods, data structures, abstract data types, lists, trees, graphs, basic graph algorithms, programming in Java.

Intended learning outcomes

Students are proficient in independently designing, precisely describing and analyzing algorithms. The students know the basic paradigms for the design of algorithms and can implement them in practical programs. Students are able to estimate the runtime behavior of algorithms and prove the correctness of algorithms.

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 is creditable for 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

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: once a year, winter semester

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

§ 49 I Nr. 1 a)
§ 69 I Nr. 1 a)

Module title			Abbreviation
Fundamentals of Programming			10-I-GdP-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

Data types, control structures, foundations of procedural programming, selected topics of C, introduction to object orientation in Java, selected topics of C++, further Java concepts, digression: scripting languages.

Intended learning outcomes

The students possess a fundamental knowledge about programming languages (in particular Java, C and C++) and are able to independently develop average to high level Java programs.

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 is creditable for 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

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Additional information

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Workload

150 h

Teaching cycle

Teaching cycle: once a year, winter semester

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

§ 49 I Nr. 1 b)
§ 69 I Nr. 1 b)

Module title			Abbreviation
Hardware-oriented programming and Fundamentals Avionics			10-LURI-HWZ-252-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

Fundamentals of data processing for aerospace applications. Analog technology, digital technology, programming, MCU, memory, memory organization, system architecture, communication interfaces, input/output, sensors and actuators, energy system, reliability, fault tolerance. Programming of embedded systems with C.

Intended learning outcomes

Understanding of analog and digital data processing in embedded systems. Hardware design and programming. Hardware-related programming in C, knowledge of common sensors and actuators as well as input/output devices and communication interfaces.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2) + P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 120 minutes) and practical examination in form of approx. 6 programming exercises (approx. 4 hours each), weighted 1:1
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)

§ 22 II Nr. 3 b)

Module title			Abbreviation
Digital Computer Systems for Aerospace Computer Science			10-LURI-DT-252-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)**	
9	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 assembler 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 is creditable for bonus)

written examination (approx. 120 minutes) and approx. 6 practical exercises (approx. 4 hours each), weighted 1:1 creditable for bonus

Allocation of places

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Additional information

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Workload

270 h

Teaching cycle

Teaching cycle: every year, summer semester

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

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Module title			Abbreviation
Automation and Control Technology			10-I-AR-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	undergraduate	--	

Contents

Overview of automation systems, foundations of control technology, simple design methods, model creation, differential equations, nomenclature, transfer function, step response and realising of easy linear controllers, structure images and structure image reduction, locus curves and Bode diagrams, frequency characteristic, persistent control deviation, controller design through parameter optimisation, basics of fuzzy control, scanning systems, eigenvalue based system analysis, classification of automation and control systems, examples.

Intended learning outcomes

The students master the fundamentals of automation and control.

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 is creditable for 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

240 h

Teaching cycle

Teaching cycle: every year, summer semester

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

§ 22 II Nr. 3 b)

Module title			Abbreviation
Practical Measurement and Control System Engineering			10-I-HMR-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)**	
8	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.

Intended learning outcomes

Students understand closed loop systems and are able to implement and set controllers.

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 is creditable for bonus)

project with presentation (approx. 15 minutes) and written elaboration (approx. 12 to 15 pages)

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

Teaching cycle: every semester

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

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Mathematics

(20 ECTS credits)

Module title			Abbreviation
Mathematics 1 for students of Space- and Aerospace Computer Science			10-M-LRI1-152-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

Basics on numbers and functions, sequences and series, elementary functions, differential and integral calculus in one variable, vector calculus, linear maps and systems of linear equations, matrix calculus.

Intended learning outcomes

The student gets acquainted with fundamental concepts and methods of advanced mathematics. He/She learns to apply these methods to problems in natural and engineering sciences, in particular in computer science, and is able to interpret the results.

Courses (type, number of weekly contact hours, language — if other than German)

V (5) + 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 is creditable for 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 and/or English
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 title			Abbreviation
Mathematics 2 for students of Space- and Aerospace Computer Science			10-M-LRI2-152-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

Eigenvalue theory, differential and integral calculus in several variables, differential equations, Fourier analysis, integral theorems.

Intended learning outcomes

The student gets acquainted with fundamental concepts and methods of advanced mathematics. He/She learns to apply these methods to problems in natural and engineering sciences, in particular in computer science, and is able to interpret the results.

Courses (type, number of weekly contact hours, language — if other than German)

V (5) + 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 is creditable for 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 and/or English
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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Basics of Physics

(19 ECTS credits)

Module title			Abbreviation
Classical Physics 1 for Students of Physics related Disciplines			11-ENNF1-152-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)**	
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

1. Principles: Physical quantities, prefactors, derived quantities, dimensional analysis, time / length / mass (definition, measurement procedures, SI), importance of metrology;
2. Point Mechanics: Kinematics, motion in 2D and 3D / vectors, special cases: Uniform and constant accelerated motion, free fall, slate litter; circular motion in polar coordinates;
3. Newton's laws: Forces and momentum definition, weight vs. mass forces on the pendulum, forces on an atomic scale, isotropic and anisotropic friction. Preparation of the equations of motion and solutions;
4. Work and energy: (Kinetic) performance, examples;
5. Elastic, inelastic and super-elastic collision: Energy and momentum conservation, surges in centre of mass and balance system, rocket equation;
6. Conservative and non-conservative force fields: Potential, potential energy; law, weight scale, field strength and potential of gravity (general relations);
7. Rotational motion: Angular momentum, angular velocity, torque, rotational energy, moment of inertia, analogies to linear translation, applications, satellites (geostationary and interstellar), escape velocities, trajectories in the central potential;
8. Tidal forces: Inertial system, reference systems, apparent forces, Foucault pendulum, Coriolis force, centrifugal force;
9. Galilean transformation: Brief digression to Maxwell's equations, ether, Michelson interferometer, Einstein's postulates, problem of simultaneity, Lorentz transformation, time dilation and length contraction, relativistic impulse;
10. Rigid body and gyroscope: Determining the centre of mass, inertia tensor and -ellipsoid, principal axes and their stability, tensor on the example of the elasticity tensor, physics of the bike; gyroscope: Precession and nutation, the Earth as a spinning top;
11. Friction: Static and dynamic friction, stick-slip motion, rolling friction, viscous friction, laminar flow, eddy formation;
12. Vibration: Representation by means of complex e-function, equation of motion (DGL) on forces, torque and power approach, Taylor expansion, harmonic approximation; spring and pendulum, physical pendulum, damped vibration (resonant case, Kriechfall, aperiodic limit), forced vibration, Fourier analysis;
13. Coupled vibrations: Eigenvalues and eigenfunctions, double pendulum, deterministic vs. chaotic motion, non-linear dynamics and chaos;
14. Waves: Wave equation, transverse and longitudinal waves, polarisation, principle of superposition, reflection at the open and closed end, speed of sound; interference, Doppler effect; phase and group velocity, dispersion relation;
15. Elastic deformation of solid bodies: Elastic modulus, general Hooke's law, elastic waves;
16. Fluids: Hydrostatic pressure and buoyancy, surface tension and contact angle, capillary forces, steady flows, Bernoulli equation; Boyle-Mariotte, gas laws, barometric height formula, air pressure, compressibility and compressive modulus;
17 . Kinetic theory of gases: ideal and real gas, averages, distribution functions, equipartition theorem, Brownian motion, collision cross section, mean free path, diffusion and osmosis, degrees of freedom, specific heat

Intended learning outcomes
The students understand the basic contexts and principles of mechanics, vibration, waves and kinetic theory of gases. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.
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 is creditable for 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 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 title			Abbreviation
Classical Physics 2 for Students of Physics related Disciplines			11-ENNF2-152-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)**	
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

1. Thermodynamics (linked to 11-E-M); temperature and quantity of heat, thermometer, Kelvin scale;
2. Heat conduction, heat transfer, diffusion, convection, radiant heat;
3. Fundamental theorems of thermodynamics, entropy, irreversibility, Maxwell's demon;
4. Heat engines, working diagrams, efficiency, example: Stirling engine;
5. Real gases and liquids, states of matter (also solids), van der Waals, critical point, phase transitions, critical phenomena (opalescence), coexistence region, Joule-Thomson;
6. Electrostatics, basic concepts: Electrical charge, forces; electric field, reps. field concept, field lines, field of a point charge;
7. Gaussian sentence, related to Coulomb's law, definition of "river"; Gaussian surface, divergence theorem; special symmetries; divergence and GS in differential form;
8. Electrical potential, working in the E-box, electric. potential, potential difference, voltage; potential equation, equipotential surfaces; several important examples: Sphere, hollow sphere, capacitor plates, electric dipole; lace effects, Segner wheel;
9. Matter in the E-field, charge in a homogeneous field, Millikan experiment, Braun tube; electron: Field emission, thermionic emission, dipole in homogeneous and inhomogeneous field; induction, Faraday cage;
10. Capacitor, mirror charge, definition, capacity; plate and spherical capacitor; combination of capacitors; media in the capacitor; electrical polarisation, displacement and orientation polarisation, microscopic image; dielectric displacement; electrolytic capacitor; Piezoelectric effect;
11. Electricity, introduction, current density, drift velocity, conduction mechanisms;
12. Resistance and conductivity, resistivity, temperature dependence; Ohm's law; realisations (resistive and non-ohmic, NTC, PTC);
13. Circuits, electrical networks, Kirchhoff's rules (meshes, nodes); internal resistance of a voltage source, measuring instruments; Wheatstone bridge;
14. Power and energy in the circuit; Capacitor charge; galvanic element; thermovoltage;
15. Transfer mechanisms, conduction in solids: Band model, semiconductor; line in liquids and gases;
16. Magnetostatics, fundamental laws; permanent magnet, field properties, definitions and units; Earth's magnetic field; Amper's Law, analogous to e-box, magn. river, swirl;
17. Vector potential, formal derivation, analogous to electric scalar potential; calculation of fields, examples, Helmholtz coils;
18. Moving charge in the static magnetic field, current balance, Lorentz force, right-hand rule, electric motor; dipole field; movement paths, mass spectrometer, Wien filters, Hall effect; electron: e / m determination;
19. matter in the magnetic field, effects of the field on matter, relative permeability, susceptibility; para-, dia-, ferromagnetism; magn. moment of the electron, behaviour at interfaces;
20. induction, Faraday's law of induction, Lenz's rule, flux change, eddy electric field, Waltenhofen's pendulum; inductance,self-induction; applications: Transformer, generator;
21. Maxwell's displacement current, choice of integration area, displacement current; Maxwell's extension, wave equation; Maxwell equations;
22. AC: Fundamentals, sinusoidal vibrations, amplitude, period and phase; power and RMS value, ohmic resistance; Capacitive & inductive resistor, capacitor and coil, phase shift and frequency dependence; impedance: Complex resistance; performance of the AC;

23. Resonant circuits, combinations of RLC; series and parallel resonant circuit; forced vibration, damped harmonic oscillator (related to 11-E-M);
24: Hertz dipole, characteristics of irradiation, near field, far field; Rayleigh scattering; accelerated charge, synchrotron radiation, X-rays; 25. Electromagnetic waves: Principles, Maxwell's determination to electromagnetism, radiation pressure (Poynting vector, radiation pressure).

Intended learning outcomes

The students understand the basic principles and contexts of thermodynamics, science of electricity and magnetism. They know relevant experiments to observe and measure these principles and contexts. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks.

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 is creditable for 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 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 title			Abbreviation
Laboratory Course Physics A (Mechanics, Heat, Electromagnetism)			11-P-PA-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)**	
3	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Measurement tasks in mechanics, thermodynamics and electricity theory, e.g. measurement of voltages and currents, heat capacity, calorimetry, density of bodies, dynamic viscosity, elasticity, surface tension, spring constant, drafting of graphics and drafting of measurement protocols.

Intended learning outcomes

The students know and have mastered physical measuring methods and experimenting techniques. They are able to independently plan and conduct experiments, to cooperate with others, and to document the results in a measuring protocol.

Courses (type, number of weekly contact hours, language — if other than German)

P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical assignment with talk (approx. 30 minutes)
Preparing, performing and evaluating (record of readings or lab report) the experiments will be considered successfully completed if a Testat (exam) is passed. Exactly one experiment that was not successfully completed can be repeated once. After completion of all experiments, talk (with discussion; approx. 30 minutes) to test the candidate's understanding of the physics-related contents of the module. Talks that were not successfully completed can be repeated once. Both components of the assessment have to be successfully completed.

Allocation of places

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Additional information

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Workload

90 h

Teaching cycle

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

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Module title			Abbreviation
Data and Error Analysis			11-P-FR1-152-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)
2	(not) successfully completed	--

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

Types of errors, error approximation and propagation, graphic representations, linear regression, mean values and standard deviation.

Intended learning outcomes

The students are able to evaluate measuring results on the basis of error propagation and of the principles of statistics and to draw, present and discuss the conclusions.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)
Module taught in: Excercises in: German or English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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 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

60 h

Teaching cycle

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

§ 53 I Nr. 1 c)
§ 77 I Nr. 1 d)

Compulsory Electives

(25 ECTS credits)

Numerical Mathematics and Programming

(10 ECTS credits)

Module title			Abbreviation
Practical Course in Programming			10-I-PP-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)**	
10	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1-2 semester	undergraduate	Intended learning outcomes of the following module are required: 10-I-GdP. It is therefore strongly recommended to complete this before.	

Contents

The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.

Intended learning outcomes

The students are able to independently develop small to middle-sized, high-quality Java programs.

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 is creditable for bonus)

practical examination (programming exercises, approx. 240 hours) and 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

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: every semester

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

§ 49 I Nr. 1 c)
§ 69 I Nr. 1 d)

Module title			Abbreviation
Numerical Mathematics 1 for students of other subjects			10-M-NUM1af-152-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

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.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.

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 is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 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

300 h

Teaching cycle

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

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Module title			Abbreviation
Numerical Mathematics 2 for students of other subjects			10-M-NUM2af-152-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

Eigenvalue problems, linear programming, methods for initial value problems for ordinary differential equations, boundary value problems.

Intended learning outcomes

The student is able to draw a distinction between the different concepts of numerical mathematics and knows about their advantages and limitations concerning the possibilities of application in different fields of natural and engineering sciences and economics.

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 is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 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

300 h

Teaching cycle

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

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Other topics

(15 ECTS credits)

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

- 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 is creditable for 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

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: once a year, winter semester

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

§ 22 II Nr. 3 b), § 69 I Nr. 1 c)

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 is creditable for 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

Teaching cycle: every year, summer semester

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

§ 22 II Nr. 3 b)

Module title			Abbreviation
Data Science			10-I-DM-242-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science X		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 is creditable for 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

Teaching cycle: every year, summer semester

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

§ 22 II Nr. 3 b)

Module title			Abbreviation
Theory of Computation			10-I-TI-242-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

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) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: every year, summer semester

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

§ 49 I Nr. 1 a)
§ 69 I Nr. 1 a)

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 is creditable for 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

Teaching cycle: every year, summer semester

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

§ 22 II Nr. 3 b)
§ 69 I Nr. 1 c): Rechnerarchitektur

Module title			Abbreviation
Software Engineering			10-I-SE-252-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

Overview of software engineering, software process models with focus on the Unified Process, agile software development, requirements analysis,software architecture, object-oriented analysis and design with UML, design patterns, software testing and quality assurance, distributed systems and cloud computing

Intended learning outcomes

The students possess a fundamental theoretical and practical knowledge on the design and development of software 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 is creditable for 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

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Additional information

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Workload

150 h

Teaching cycle

Teaching cycle: every year, summer semester

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

§ 49 I Nr. 1 b)
§ 69 I Nr. 1 b)

Module title			Abbreviation
Model-based Systems Engineering			10-I-MSE-252-m01
Module coordinator		**Module offered by**	
holder of the Chair of Computer Science XI		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

Practical teaching of basic concepts of system modeling and development.

Intended learning outcomes

Students have theoretical knowledge of widely used model types (e.g. state machines) and are able to model real systems with UML and implement the models as software.

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 is creditable for 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

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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 title			Abbreviation
Control Principles of Modern Communication Systems			10-I-SKS-242-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	undergraduate	--	

Contents

- Control Mechanisms of Modern Communication Systems
- Multimedia Networking
- Broadband Access Networks
- Mobile Communication Systems
- Home Access Networks
- Current trends such as Internet of Things (IoT)
- Software Defined Networking (SDN)
- Control mechanisms implemented and deployed on the Internet
- Introduction of analytical performance evaluation

Intended learning outcomes

The students possess advanced knowledge regarding the structure, architecture and control mechanisms of modern communication systems and are able to apply it to evaluate systems and protocols within simulations and measurement setups. In addition, students have gathered insights of the basic methodologies in the field of analytical performance evaluation.

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 is creditable for 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

Teaching cycle: once a year, winter semester

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

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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 is creditable for 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

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: every semester

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

§ 22 II Nr. 3 b)

Module title			Abbreviation
Practical course in software for students of Space- and Aerospace Computer Science			10-I-SWP-LURI-252-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	10-I-GdP, 10-LURI-HWZ	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	In addition, the knowledge and skills acquired in module 10-I-ADS are required. Prior attendance of this module is therefore highly recommended.	

Contents

Completion of a project assignment in groups, problem analysis, creation of requirements specifications, specification of solution components (e. g. UML) and milestones, user manual, programming documentation, presentation and delivery of the runnable software product in a colloquium.

Intended learning outcomes

The students possess the practical skills for the design, development and execution of a software project in small 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 is creditable for bonus)

practical project (completion of a larger software project in groups (approx. 300 hours per person) and final presentation (approx. 10 minutes per group)

Allocation of places

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Additional information

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Workload

300 h

Teaching cycle

Teaching cycle: every semester

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

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Module title			Abbreviation
Ordinary Differential Equations for students of other subjects			10-M-DGLaf-152-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

Existence and uniqueness theorem; continuous dependence of solutions on initial values; systems of linear differential equations; matrix exponential series; linear differential equations of higher order.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of the theory of ordinary differential equations. He/she is able to apply these methods to practical problems.

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 is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 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

300 h

Teaching cycle

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

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Module title			Abbreviation
Numerical Mathematics 1 for students of other subjects			10-M-NUM1af-152-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

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.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods in numerical mathematics, applies them to practical problems and knows about their typical fields of application.

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 is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 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

300 h

Teaching cycle

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

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Module title			Abbreviation
Numerical Mathematics 2 for students of other subjects			10-M-NUM2af-152-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

Eigenvalue problems, linear programming, methods for initial value problems for ordinary differential equations, boundary value problems.

Intended learning outcomes

The student is able to draw a distinction between the different concepts of numerical mathematics and knows about their advantages and limitations concerning the possibilities of application in different fields of natural and engineering sciences and economics.

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 is creditable for bonus)

a) written examination (approx. 90 to 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 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

300 h

Teaching cycle

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

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Module title			Abbreviation
Mathematical Control Theory			10-M=ARTH-242-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 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 is creditable for 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 title			Abbreviation
Selected Chapters of Aerospace Science and Engineering			10-I-AKLR-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

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.

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 is creditable for 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

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Workload

150 h

Teaching cycle

Teaching cycle: if announced

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

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Module title			Abbreviation
Selected Chapters of Computer Science			10-I-AKI-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

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 (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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

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Workload

150 h

Teaching cycle

Teaching cycle: if announced

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

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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 is creditable for 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)

§ 22 II Nr. 3 b)

Module title			Abbreviation
Operating Systems			10-I-BS-242-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

Introduction to computer systems, development of operating systems, architecture principles, interrupt processing in operating systems, processes and threads, CPU scheduling, synchronisation and communication, memory management, device and file management, operating system virtualisation.

Intended learning outcomes

The students possess knowledge and practical skills in building and using essential parts of 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 is creditable for 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)

§ 22 II Nr. 3 b), § 69 I Nr. 1 c)

Module title			Abbreviation
Databases			10-I-DB-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

Relational algebra and complex SQL statements; database planning and normal forms; transaction management.

Intended learning outcomes

The students possess knowledge about database modelling and queries in SQL as well as transactions.

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 is creditable for 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

Teaching cycle: once a year, winter semester

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

§ 49 I Nr. 1 b)
§ 69 I Nr. 1 b)

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 is creditable for 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

Teaching cycle: once a year, winter semester

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

§ 22 II Nr. 3 b)

Module title			Abbreviation
Astrophysics			11-AP-152-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	undergraduate	--	

Contents

History of astronomy, coordinates and time measurement, the Solar System, exoplanets, astronomical scales, telescopes and detectors, stellar structure and atmospheres, stellar evolution and end stages, interstellar medium, molecular clouds, structure of the milky way, the local universe, the expanding universe, galaxies, active galactic nuclei, large-scale structures, cosmology.

Intended learning outcomes

The students are familiar with the modern world view of Astrophysics. They know methods and tools for astrophysical observations and evaluations. They are able to use these methods to plan and analyse own observations. They are familiar with the physics and development of the main astrophysical objects such as stars and galaxies.

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 is creditable for 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)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)

Module title			Abbreviation
Laboratory Course Physics B for Space and Aerospace Computer Science			11-P-LRB-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)**	
4	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1-2 semester	undergraduate	Students are highly recommended to complete modules 11-P-PA and 11-P-FR1 prior to completing module 11-P-LRB.	

Contents

Physical laws of optics, vibrations and waves, science of electricity and circuits with electric components.

Intended learning outcomes

The students know and have mastered physical measuring methods and experimenting techniques. They are able to independently plan and conduct experiments, to cooperate with others, and to document the results in a measuring protocol. They are able to evaluate the measuring results on the basis of error propagation and of the principles of statistics and to draw, present and discuss the conclusions.

Courses (type, number of weekly contact hours, language — if other than German)

P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical assignment with talk (approx. 30 minutes)
Preparing, performing and evaluating (record of readings or lab report) the experiments will be considered successfully completed if a Testat (exam) is passed. Exactly one experiment that was not successfully completed can be repeated once. After completion of all experiments, talk (with discussion; approx. 30 minutes) to test the candidate's understanding of the physics-related contents of the module. Talks that were not successfully completed can be repeated once. Both components of the assessment have to be successfully completed.

Allocation of places

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Additional information

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Workload

120 h

Teaching cycle

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

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Module title			Abbreviation
Laboratory Course Physics C for Space and Aerospace Computer Science			11-P-LRC-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)**	
4	(not) successfully completed	--	
Duration	**Module level**	**Other prerequisites**	
1-2 semester	undergraduate	Students are highly recommended to complete module 11-P-LRB prior to completing module 11-P-LRC.	

Contents

Physical laws of wave optics, Molecular, Atomic and Nuclear Physics and modern measuring methods using special computerised devices with examples from optics and Solid-State Physics.

Intended learning outcomes

The students are able to build and almost independently operate advanced experimental setups. They are able to record measuring results in a structured manner, even in case of huge data traffic, and to analyse the results by using error propagation and statistics. They are able to evaluate results, to draw conclusions and to present and discuss them in a scientific paper and a presentation.

Courses (type, number of weekly contact hours, language — if other than German)

P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical assignment with talk (approx. 30 minutes)
Preparing, performing and evaluating (record of readings or lab report) the experiments will be considered successfully completed if a Testat (exam) is passed. Exactly one experiment that was not successfully completed can be repeated once. After completion of all experiments, talk (with discussion; approx. 30 minutes) to test the candidate's understanding of the physics-related contents of the module. Talks that were not successfully completed can be repeated once. Both components of the assessment have to be successfully completed.

Allocation of places

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Additional information

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Workload

120 h

Teaching cycle

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

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Key Skills Area

(20 ECTS credits)

Subject-specific Key Skills

(15 ECTS credits)

Module title			Abbreviation
Aerospace Laboratory			10-I-LRLA-252-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	undergraduate	--	

Contents

Structure and control of satellites and airplanes, control and (very little) regulation of physical/mechanical systems, sensors and actuators, energy, structure (construction) of a satellite model/simulator, construction of a ground segment for different components and systems of air and space flight, structure of simplified subsystems of air and space flight. Life cycle of a complex development consisting of software, hardware, electronics and mechanics. Selection of suitable components.

Intended learning outcomes

The students will be able to construct and integrate prototypical subsystems consisting of software, hardware, electronics and mechanics by themselves as well as to operate, test and document these. The whole life cycle of a development will be tested: capture of requirements, rudimentary design, detailed design, modelling, implementation (software, hardware, mechanics), test design, inspection, maintenance, transfer to the successor model.

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 is creditable for bonus)

Completion of approx. 6 practical exercises (approx. 4 hours each)

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

Teaching cycle: every semester

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

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Module title			Abbreviation
Seminar for students of Space- and Aerospace Computer Science 1			10-I-LRS1-152-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)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Independent review of a current topic in aerospace information technology based on literature and, if applicable, software with written and oral presentation or video. The topics in modules 10-I-LRS1 and 10-I-LRS2 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 aerospace information technology, 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 is creditable for bonus)

written elaboration (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion (approx. 20 minutes) on a topic from the field of aerospace information technology

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

Teaching cycle: every semester

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

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Module title			Abbreviation
Seminar for students of Space- and Aerospace Computer Science 2			10-I-LRS2-152-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)**	
5	numerical grade	--	
Duration	**Module level**	**Other prerequisites**	
1 semester	undergraduate	--	

Contents

Independent review of a current topic in aerospace information technology based on literature and, if applicable, software with written and oral presentation or video. The topics in modules 10-I-LRS1 and 10-I-LRS2 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 aerospace information technology, 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 is creditable for bonus)

written elaboration (10 to 15 pages) and presentation (30 to 45 minutes) with subsequent discussion (approx. 20 minutes) on a topic from the field of aerospace information technology

Allocation of places

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Additional information

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Workload

150 h

Teaching cycle

Teaching cycle: every semester

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

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Module title			**Abbreviation**
Practical work Space Technology			10-I-PLR-252-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

Completion of a practical task.

Intended learning outcomes

The practical allows participants to work on a problem in space information technology in teams.

Courses (type, number of weekly contact hours, language — if other than German)

P (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

report (5 to 10 pages) and presentation (approx. 15 minutes) on practical work

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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General Key Skills

(5 ECTS credits)

All modules offered as part of the pool of general transferable skills (ASQ) may be accredited.

Thesis

(10 ECTS credits)

Module title			Abbreviation
Bachelor's Thesis Space- and Aerospace Computer Science			10-I-LRI-BA-252-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

Researching and writing on a defined problem in aerospace information technology within a given time frame and adhering to the principles of good scientific practice.

Intended learning outcomes

The students are able to research and write on a defined problem in aerospace information technology, adhering to the principles of good scientific practice.

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 is creditable for bonus)

Bachelor's thesis (approx. 30 to 60 pages)
Language of assessment: German or English

Allocation of places

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Additional information

Time to complete: 10 weeks.

Workload

300 h

Teaching cycle

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

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