



# 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: 2020  
Responsible: Faculty of Mathematics and Computer Science  
Responsible: Institute of Computer Science

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## The subject is divided into

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## 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 tiefere 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)):

**18-Dec-2019 (2019-61)**

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

(114 ECTS credits)



# **Aerospace Science and Engineering**

(26 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Introduction to Aviation Systems		10-I-LFS-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Physical foundations of aircraft aerodynamics, flight stability, airplane technology and structure of aircraft, foundations of aviation propulsion and suitable material.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (1)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Orientierungsstudien (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		

<b>Module title</b>		<b>Abbreviation</b>
Introduction to Space Systems		10-I-RFS-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (1)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		

<b>Module title</b>		<b>Abbreviation</b>
Spacecraft Operations		10-I-LRFB-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)		
written examination (approx. 180 to 240 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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
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<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Orientierungsstudien (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Measurement Technique		10-I-LMT-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>Definitions of terms, units of measurement, fundamental measurement techniques, sensitivity of analogue and digital measurement devices, measurement errors and measurement uncertainty, error kinds, error propagation, measurement uncertainty, measurement of electric values, voltage and current measurement, power measurement, resistance measurement (effective resistance and reactance), measurement bridge, influence of ground and stray capacitance, noise effects, dynamic behaviour of electrical systems, sensors and measurement techniques for: pressure, length, angle, temperature, sensors for optical measurements, force and acceleration, angular acceleration, measurement amplifier, measurement signal processing, AD-converter, digital measurements, frequency and time measurement, display of time dependence of electrical signals, computer-aided measurement recording, inertial navigation with inertial sensors, acceleration sensors, rotation (gyroscope), Coriolis angular sensor, position measurement using satellite navigation (GPS/GALILEO).</p>		
<b>Intended learning outcomes</b>		
The students master the fundamentals of measurement for aerospace systems and for applications in robotics and automation.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (3) + Ü (2)		
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)		
<p>written examination (approx. 180 to 240 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</p>		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
180 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
<p>Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Orientierungsstudien (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020)</p>		

# Informatics

(49 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Algorithms and data structures		10-I-ADS-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
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<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
Teaching cycle: only in winter semester		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 a) § 69 I Nr. 1 a)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Economathematics (2015) Bachelor's degree (1 major) Human-Computer Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 15 / 93

Bachelor's degree (1 major) Computer Science (2019)  
Bachelor's degree (1 major) Aerospace Computer Science (2020)  
Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
Bachelor's degree (1 major) Mathematics (2023)



<b>Module title</b>		<b>Abbreviation</b>
Fundamentals of Programming		10-I-GdP-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science II		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 b) § 69 I Nr. 1 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Business Information Systems (2020) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Business Information Systems (2021) Bachelor's degree (1 major) Mathematical Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 17 / 93

Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
Bachelor's degree (1 major) Mathematics (2023)  
Bachelor's degree (1 major) Business Information Systems (2023)  
Bachelor's degree (1 major) Business Information Systems (2024)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)  
Bachelor's degree (1 major) Econometrics (2025)

<b>Module title</b>		<b>Abbreviation</b>
Fundamentals and Programming of Avionics		10-I-MEC-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VIII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Fundamental principles of data processing, especially for aerospace applications. What is information? Guidance for reliable systems, analogue, digital, FPGAs, radiation effects, micro programming, CPUs, DMAs, memory, memory organisation, system architecture, input and output, sensors and actuators, energy systems, reliability, fault tolerance. Programming of embedded systems in C++.		
<b>Intended learning outcomes</b>		
Understanding of analogue and digital data processing in embedded systems. Structure of hardware and programming. Embedded programming in C++, knowledge about common sensors and actuators as well as input and output systems.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2) + P (2)		
<b>Method of assessment</b> (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 (approx. 6 programming exercises approx. 4 hours each), weighted 1:1 creditable for bonus		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		

<b>Module title</b>		<b>Abbreviation</b>
On board data processing		10-I-BDV-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VIII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Tasks of onboard data handling systems (ODHS), components of ODHS, interfaces to other subsystems, division into hardware and software tasks, system architecture, topologies, reliable systems, fault tolerance, real-time programming, real-time operating systems, typical onboard software applications, implementing of example applications, hardware support.		
<b>Intended learning outcomes</b>		
The students understand what the tasks of ODHS are and how they are implemented. They understand the connections and dependencies with and from other subsystems. They are able to implement and control such systems themselves.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
240 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Automation and Control Technology		10-I-AR-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
The students master the fundamentals of automation and control.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus</p>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
240 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
<p>Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Mathematics (2023) Bachelor's degree (1 major) Games Engineering (2025)</p>		

<b>Module title</b>		<b>Abbreviation</b>
Practical Measurement and Control System Engineering		10-I-HMR-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VI		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Practical experiments of control aspects (hardware and software), for example implementation of linear and non-linear controllers in robotics or aerospace information technology.		
<b>Intended learning outcomes</b>		
Students understand closed loop systems and are able to implement and set controllers.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
P (6)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
240 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Computer Science (2019) Bachelor's degree (1 major) Aerospace Computer Science (2020) Module studies (Bachelor) Aerospace Computer Science (2021)		

# Mathematics

(20 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Mathematics 1 for students of Space- and Aerospace Computer Science		10-M-LR1-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (5) + Ü (2) Module taught in: Ü: German or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		



<b>Module title</b>		<b>Abbreviation</b>
Mathematics 2 for students of Space- and Aerospace Computer Science		10-M-LRI2-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Eigenvalue theory, differential and integral calculus in several variables, differential equations, Fourier analysis, integral theorems.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (5) + Ü (2) Module taught in: Ü: German or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

# 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		
<p>1. Principles: Physical quantities, prefactors, derived quantities, dimensional analysis, time / length / mass (definition, measurement procedures, SI), importance of metrology;</p> <p>2. Point Mechanics: Kinematics, motion in 2D and 3D / vectors, special cases: Uniform and constant accelerated motion, free fall, slant litter; circular motion in polar coordinates;</p> <p>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;</p> <p>4. Work and energy: (Kinetic) performance, examples;</p> <p>5. Elastic, inelastic and super-elastic collision: Energy and momentum conservation, surges in centre of mass and balance system, rocket equation;</p> <p>6. Conservative and non-conservative force fields: Potential, potential energy; law, weight scale, field strength and potential of gravity (general relations);</p> <p>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;</p> <p>8. Tidal forces: Inertial system, reference systems, apparent forces, Foucault pendulum, Coriolis force, centrifugal force;</p> <p>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;</p> <p>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;</p> <p>11. Friction: Static and dynamic friction, stick-slip motion, rolling friction, viscous friction, laminar flow, eddy formation;</p> <p>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;</p> <p>13. Coupled vibrations: Eigenvalues and eigenfunctions, double pendulum, deterministic vs. chaotic motion, non-linear dynamics and chaos;</p> <p>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;</p> <p>15. Elastic deformation of solid bodies: Elastic modulus, general Hooke's law, elastic waves;</p> <p>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;</p> <p>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</p>		

<b>Intended learning outcomes</b>
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.
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)
V (4) + Ü (2) Module taught in: Ü: German or English
<b>Method of assessment</b> (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
<b>Allocation of places</b>
--
<b>Additional information</b>
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.
<b>Workload</b>
210 h
<b>Teaching cycle</b>
--
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
--
<b>Module appears in</b>
Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Mathematics (2023)

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		
<ol style="list-style-type: none"> <li>1. Thermodynamics (linked to 11-E-M); temperature and quantity of heat, thermometer, Kelvin scale;</li> <li>2. Heat conduction, heat transfer, diffusion, convection, radiant heat;</li> <li>3. Fundamental theorems of thermodynamics, entropy, irreversibility, Maxwell's demon;</li> <li>4. Heat engines, working diagrams, efficiency, example: Stirling engine;</li> <li>5. Real gases and liquids, states of matter (also solids), van der Waals, critical point, phase transitions, critical phenomena (opalescence), coexistence region, Joule-Thomson;</li> <li>6. Electrostatics, basic concepts: Electrical charge, forces; electric field, reps. field concept, field lines, field of a point charge;</li> <li>7. Gaussian sentence, related to Coulomb's law, definition of "river"; Gaussian surface, divergence theorem; special symmetries; divergence and GS in differential form;</li> <li>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;</li> <li>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;</li> <li>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;</li> <li>11. Electricity, introduction, current density, drift velocity, conduction mechanisms;</li> <li>12. Resistance and conductivity, resistivity, temperature dependence; Ohm's law; realisations (resistive and non-ohmic, NTC, PTC);</li> <li>13. Circuits, electrical networks, Kirchhoff's rules (meshes, nodes); internal resistance of a voltage source, measuring instruments; Wheatstone bridge;</li> <li>14. Power and energy in the circuit; Capacitor charge; galvanic element; thermovoltage;</li> <li>15. Transfer mechanisms, conduction in solids: Band model, semiconductor; line in liquids and gases;</li> <li>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;</li> <li>17. Vector potential, formal derivation, analogous to electric scalar potential; calculation of fields, examples, Helmholtz coils;</li> <li>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: <math>e / m</math> determination;</li> <li>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;</li> <li>20. induction, Faraday's law of induction, Lenz's rule, flux change, eddy electric field, Waltenhofen's pendulum; inductance, self-induction; applications: Transformer, generator;</li> <li>21. Maxwell's displacement current, choice of integration area, displacement current; Maxwell's extension, wave equation; Maxwell equations;</li> <li>22. AC: Fundamentals, sinusoidal vibrations, amplitude, period and phase; power and RMS value, ohmic resistance; Capacitive &amp; inductive resistor, capacitor and coil, phase shift and frequency dependence; impedance: Complex resistance; performance of the AC;</li> </ol>		
Bachelor's with 1 major Aerospace Computer Science (2020)		JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020
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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 appears in**

Bachelor's degree (1 major) Mathematics (2015)  
Bachelor's degree (1 major) Computational Mathematics (2015)  
Bachelor's degree (1 major) Aerospace Computer Science (2015)  
Bachelor's degree (1 major) Functional Materials (2015)  
Bachelor's degree (1 major) Aerospace Computer Science (2017)  
Bachelor's degree (1 major) Aerospace Computer Science (2020)  
Bachelor's degree (1 major) Mathematics (2023)

<b>Module title</b>		<b>Abbreviation</b>
Laboratory Course Physics A (Mechanics, Heat, Electromagnetism)		11-P-PA-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
3	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (2)		
<b>Method of assessment</b> (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.		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
90 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Mathematical Physics (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Physics (2020)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 31 / 93

Bachelor's degree (1 major) Nanostructure Technology (2020)  
Bachelor's degree (1 major) Mathematical Physics (2020)  
Bachelor's degree (1 major) Aerospace Computer Science (2020)  
Bachelor's degree (1 major) Quantum Technology (2021)  
Bachelor's degree (1 major) Mathematics (2023)  
exchange program Physics (2023)  
Bachelor's degree (1 major) Mathematical Physics (2024)



<b>Module title</b>		<b>Abbreviation</b>
Data and Error Analysis		11-P-FR1-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
2	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
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.
<b>Contents</b>		
Types of errors, error approximation and propagation, graphic representations, linear regression, mean values and standard deviation.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (1) + Ü (1) Module taught in: Ü: German or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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.		
<b>Workload</b>		
60 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 53 I Nr. 1 c) § 77 I Nr. 1 d)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 33 / 93

Bachelor's degree (1 major) Mathematical Physics (2015)  
 Bachelor's degree (1 major) Computational Mathematics (2015)  
 Bachelor's degree (1 major) Aerospace Computer Science (2015)  
 Bachelor's degree (1 major) Functional Materials (2015)  
 Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)  
 First state examination for the teaching degree Grundschule Physics (2015)  
 First state examination for the teaching degree Realschule Physics (2015)  
 First state examination for the teaching degree Gymnasium Physics (2015)  
 First state examination for the teaching degree Mittelschule Physics (2015)  
 Bachelor's degree (1 major) Mathematical Physics (2016)  
 Bachelor's degree (1 major) Aerospace Computer Science (2017)  
 First state examination for the teaching degree Grundschule Physics (2018)  
 First state examination for the teaching degree Realschule Physics (2018)  
 First state examination for the teaching degree Gymnasium Physics (2018)  
 First state examination for the teaching degree Mittelschule Physics (2018)  
 Bachelor's degree (1 major) Physics (2020)  
 Bachelor's degree (1 major) Nanostructure Technology (2020)  
 Bachelor's degree (1 major) Mathematical Physics (2020)  
 Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 First state examination for the teaching degree Grundschule Physics (2020)  
 First state examination for the teaching degree Gymnasium Physics (2020)  
 First state examination for the teaching degree Realschule Physics (2020)  
 First state examination for the teaching degree Mittelschule Physics (2020)  
 Bachelor's degree (1 major) Functional Materials (2021)  
 Bachelor's degree (1 major) Quantum Technology (2021)  
 Bachelor's degree (1 major) Mathematics (2023)  
 exchange program Physics (2023)  
 Bachelor's degree (1 major) Mathematical Physics (2024)  
 Bachelor's degree (1 major) Functional Materials (2025)

## Compulsory Electives

(34 ECTS credits)

# Numerical Mathematics and Programming

(10 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Practical Course in Programming		10-I-PP-191-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
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.
<b>Contents</b>		
The programming language Java. Independent creation of small to middle-sized, high-quality Java programs.		
<b>Intended learning outcomes</b>		
The students are able to independently develop small to middle-sized, high-quality Java programs.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (6)		
<b>Method of assessment</b> (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).		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 c) § 69 I Nr. 1 d)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Computer Science (2019) Module studies (Bachelor) Orientierungsstudien (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Mathematics (2023)		

<b>Module title</b>		<b>Abbreviation</b>
Numerical Mathematics 1 for students of other subjects		10-M-NUM1af-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 38 / 93

Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
Bachelor's degree (1 major) Quantum Technology (2021)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)  
Bachelor's degree (1 major) Functional Materials (2025)

<b>Module title</b>		<b>Abbreviation</b>
Numerical Mathematics 2 for students of other subjects		10-M-NUM2af-152-mo1
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Eigenvalue problems, linear programming, methods for initial value problems for ordinary differential equations, boundary value problems.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Functional Materials (2025)		



## Other topics

(24 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Computer Networks and Information Transmission		10-I-RIÜ-191-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science III		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<ul style="list-style-type: none"> <li>• Computer networks and the Internet: Structure and Mechanisms of Telecommunication</li> <li>• Communication Protocols: Basic Principles and the Layer Model</li> <li>• Computer and Communication Systems: Network Systems, Data Traffic in Distributed Systems and inter-network Communication</li> <li>• The Internet: Important Protocols and Routing</li> <li>• Architecture and Structure of Computer Networks: Network Architecture, Access Mechanisms, Flow Control and Traffic Management</li> <li>• Coding Theory: Mechanisms for Error Detection and Error Correction</li> <li>• Information Theory: Entropy of Data</li> <li>• Digital Communication Systems: Signal Modulation</li> </ul>		
<b>Intended learning outcomes</b>		
Students command the technical, theoretical as well as practical knowledge to understand the structure of computer networks, the Internet and communication systems for telecommunication.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b), § 69 I Nr. 1 c)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 42 / 93

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

<b>Module title</b>		<b>Abbreviation</b>
Algorithmic Graph Theory		10-I-AGT-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science I		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (type, scope, language – if other than German, examination offered – if not every semester, information on whether module is creditable for bonus)		
<p>written examination (approx. 60 to 120 minutes). If announced by the lecturer at the beginning of the course, the written examination may be replaced by an oral examination of one candidate each (approx. 20 minutes) or an oral examination in groups of 2 candidates (approx. 15 minutes per candidate). Language of assessment: German and/or English creditable for bonus</p>		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
<p>Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)</p>		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 44 / 93

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

<b>Module title</b>		<b>Abbreviation</b>
Knowledge-based Systems		10-I-WBS-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VI		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Foundations in the following areas: knowledge management systems, knowledge representation, solving methods, knowledge acquisition, learning, guidance dialogue, semantic web.		
<b>Intended learning outcomes</b>		
The students possess theoretical and practical knowledge for the understanding and design of knowledge-based systems including knowledge formalisation and have acquired experience in a small project.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Business Information Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 46 / 93

Bachelor's degree (1 major) Computer Science (2019)  
 Bachelor's degree (1 major) Business Information Systems (2019)  
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Bachelor's degree (1 major) Business Information Systems (2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
 Bachelor's degree (1 major) Business Information Systems (2021)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
 Bachelor's degree (1 major) Mathematics (2023)  
 Bachelor's degree (1 major) Business Information Systems (2023)  
 Bachelor's degree (1 major) Business Information Systems (2024)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)  
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)  
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)  
 Bachelor's degree (1 major) Games Engineering (2025)

<b>Module title</b>		<b>Abbreviation</b>
Data Mining		10-I-DM-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VI		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Business Information Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 48 / 93



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

<b>Module title</b>		<b>Abbreviation</b>
Theoretical Informatics		10-I-TIV-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Computability, decidability, countability, finite automata, regular sets, generative grammars, context-free languages, context-sensitive languages, complexity of calculations, P-NP problem, NP completeness.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4)		
<b>Method of assessment</b> (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).		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 a) § 69 I Nr. 1 a)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 50 / 93

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

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

<b>Module title</b>		<b>Abbreviation</b>
Digital computer systems		10-I-RAL-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Introduction to digital technologies, Boolean algebras, combinatory circuits, synchronous and asynchronous circuits, hardware description languages, structure of a simple processor, machine programming, memory hierarchy.		
<b>Intended learning outcomes</b>		
The students possess a knowledge of the fundamentals of digital technologies up to the design and programming of easy microprocessors as well as knowledge for the application of hardware description languages for the design of digital systems.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Orientierungsstudien (2020) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 53 / 93

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

<b>Module title</b>		<b>Abbreviation</b>
Computer Architecture		10-I-RAK-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Instruction set architectures, command processing through pipelining, statical and dynamic instruction scheduling, caches, vector processors, multi-core processors.		
<b>Intended learning outcomes</b>		
The students master the most important techniques to design fast computers as well as their interaction with compilers and operating systems.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b) § 69 I Nr. 1 c): Rechnerarchitektur		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's degree (1 major) Physics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 55 / 93

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



<b>Module title</b>		<b>Abbreviation</b>
Software Technology		10-I-ST-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Object-oriented software development with UML, development of graphical user interfaces, foundations of databases and object-relational mapping, foundations of web programming (HTML, XML), software development processes, unified process, agile software development, project management, quality assurance.		
<b>Intended learning outcomes</b>		
The students possess a fundamental theoretical and practical knowledge on the design and development of software systems.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
Teaching cycle: only in summer semester		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 b) § 69 I Nr. 1 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Economathematics (2015) Bachelor's degree (1 major) Human-Computer Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Bachelor's degree (1 major) Business Information Systems (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 57 / 93

Bachelor's degree (1 major) Economathematics (2017)  
 Bachelor's degree (1 major) Computer Science (2017)  
 Bachelor's degree (1 major) Computer Science (2019)  
 Bachelor's degree (1 major) Business Information Systems (2019)  
 Module studies (Bachelor) Orientierungsstudien (2020)  
 Bachelor's degree (1 major) Business Information Systems (2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
 Bachelor's degree (1 major) Business Information Systems (2021)  
 Bachelor's degree (1 major) Economathematics (2021)  
 Bachelor's degree (1 major) Economathematics (2022)  
 Bachelor's degree (1 major) Mathematics (2023)  
 Bachelor's degree (1 major) Business Information Systems (2023)  
 Bachelor's degree (1 major) Economathematics (2023)  
 Bachelor's degree (1 major) Business Information Systems (2024)  
 Bachelor's degree (1 major) Economathematics (2024)  
 Bachelor's degree (1 major) Digital Business & Data Science (2024)

<b>Module title</b>		<b>Abbreviation</b>
Control Principles of Modern Communication Systems		10-I-SKS-191-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science III		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<ul style="list-style-type: none"> <li>• Control Mechanisms of Modern Communication Systems</li> <li>• Multimedia Networking</li> <li>• Broadband Access Networks</li> <li>• Mobile Communication Systems</li> <li>• Home Access Networks</li> <li>• Current trends such as Internet of Things (IoT)</li> <li>• Software Defined Networking (SDN)</li> <li>• Control mechanisms implemented and deployed on the Internet</li> <li>• Introduction of analytical performance evaluation</li> </ul>		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
240 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 59 / 93

Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
Bachelor's degree (1 major) Mathematics (2023)

<b>Module title</b>		<b>Abbreviation</b>
Practical course in hardware		10-I-HWP-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Practical experiments on hardware aspects, for example in communication technology, robots or the structure of a complete microprocessor.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (6)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Module studies (Bachelor) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 61 / 93

Bachelor's degree (1 major) Computer Science und Sustainability (2021)

Bachelor's degree (1 major) Mathematics (2023)

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

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

<b>Module title</b>		<b>Abbreviation</b>
Practical course in software for students of Space- and Aerospace Computer Science		10-I-SWP-LURI-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	(not) successfully completed	10-I-GdP, 10-I-MEC, 10-I-ST
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
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.
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
The students possess the practical skills for the design, development and execution of a software project in small teams.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
P (6)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Ordinary Differential Equations for students of other subjects		10-M-DGLaf-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023) Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 64 / 93



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

<b>Module title</b>		<b>Abbreviation</b>
Numerical Mathematics 1 for students of other subjects		10-M-NUM1af-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 66 / 93

Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
Bachelor's degree (1 major) Quantum Technology (2021)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)  
Bachelor's degree (1 major) Functional Materials (2025)

<b>Module title</b>		<b>Abbreviation</b>
Numerical Mathematics 2 for students of other subjects		10-M-NUM2af-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Eigenvalue problems, linear programming, methods for initial value problems for ordinary differential equations, boundary value problems.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Functional Materials (2021) Bachelor's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Functional Materials (2025)		

<b>Module title</b>		<b>Abbreviation</b>
Control Theory		10-M=ARTH-161-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	graduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
300 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Master's degree (1 major) Mathematics (2016) Master's degree (1 major) Economathematics (2016) Master's degree (1 major) Mathematical Physics (2016) Master's degree (1 major) Computational Mathematics (2016) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Master's degree (1 major) Computational Mathematics (2019)		
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Master's degree (1 major) Mathematics (2019)  
 Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020)  
 Master's degree (1 major) Mathematical Physics (2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 Master's degree (1 major) Economathematics (2021)  
 Master's degree (1 major) Computational Mathematics (2022)  
 Master's degree (1 major) Mathematics (2022)  
 Master's degree (1 major) Mathematical Physics (2022)  
 Master's degree (1 major) Economathematics (2022)  
 exchange program Mathematics (2023)

<b>Module title</b>		<b>Abbreviation</b>
Selected Chapters of Aerospace Science and Engineering		10-I-AKLR-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Selected Chapters of Computer Science		10-I-AKI-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Selected topics in computer science.		
<b>Intended learning outcomes</b>		
The students are able to understand the solutions to complex problems in computer science and to transfer them to related questions.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		



<b>Module title</b>		<b>Abbreviation</b>
3D Point Cloud Processing		10-I-3D-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science XVII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Computer Science (2017)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 73 / 93

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

<b>Module title</b>		<b>Abbreviation</b>
Operating Systems		10-I-BS-191-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science II		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
The students possess knowledge and practical skills in building and using essential parts of operating systems.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2) Module taught in: English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2019) Master's degree (1 major) Nanostructure Technology (2020) Master's degree (1 major) Physics (2020) Bachelor's degree (1 major) Business Information Systems (2020) Master's degree (1 major) Physics International (2020) Master's degree (1 major) Quantum Engineering (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020) Bachelor's degree (1 major) Computer Science und Sustainability (2021) Master's degree (1 major) Quantum Technology (2021) Bachelor's degree (1 major) Business Information Systems (2021)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 75 / 93

Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
Bachelor's degree (1 major) Mathematics (2023)  
Bachelor's degree (1 major) Business Information Systems (2023)  
Master's degree (1 major) Quantum Engineering (2024)  
Master's degree (1 major) Physics International (2024)  
Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)

<b>Module title</b>		<b>Abbreviation</b>
Databases		10-I-DB-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Relational algebra and complex SQL statements; database planning and normal forms; transaction management.		
<b>Intended learning outcomes</b>		
The students possess knowledge about database modelling and queries in SQL as well as transactions.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 49 I Nr. 1 b) § 69 I Nr. 1 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Business Information Systems (2015) Bachelor's degree (1 major) Computational Mathematics (2015) Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Functional Materials (2015) First state examination for the teaching degree Realschule Computer Science (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's degree (1 major) Physics (2016) Bachelor's degree (1 major) Business Information Systems (2016) Bachelor's degree (1 major) Aerospace Computer Science (2017)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 77 / 93

Bachelor's degree (1 major) Computer Science (2017)  
 Bachelor's degree (1 major) Computer Science (2019)  
 Bachelor's degree (1 major) Business Information Systems (2019)  
 Bachelor's degree (1 major) Business Information Systems (2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 Bachelor's degree (1 major) Functional Materials (2021)  
 Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
 Bachelor's degree (1 major) Business Information Systems (2021)  
 Bachelor's degree (1 major) Mathematical Data Science (2022)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2022)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2023)  
 Bachelor's degree (1 major) Mathematics (2023)  
 Bachelor's degree (1 major) Business Information Systems (2023)  
 Bachelor's degree (1 major) Business Information Systems (2024)  
 Bachelor's degree (1 major) Artificial Intelligence and Data Science (2024)  
 Bachelor's degree (1 major) Functional Materials (2025)  
 Bachelor's degree (1 major) Games Engineering (2025)

<b>Module title</b>		<b>Abbreviation</b>
Logic for informatics		10-I-LOG-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Syntax and semantics of propositional logic, equivalence and normal forms, Horn formulas, SAT, resolution, infinite formula sets, syntax and semantics of predicate logic.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + Ü (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 3 b)		
<b>Module appears in</b>		
Bachelor's degree (1 major) Computer Science (2015) Bachelor's degree (1 major) Mathematics (2015) Bachelor's degree (1 major) Computational Mathematics (2015) First state examination for the teaching degree Gymnasium Computer Science (2015) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2016) Bachelor's degree (1 major) Computer Science (2017) Bachelor's degree (1 major) Computer Science (2019) Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2020) Bachelor's degree (1 major) Aerospace Computer Science (2020)		
Bachelor's with 1 major Aerospace Computer Science (2020)	JMU Würzburg • generated 19-Apr-2025 • exam. reg. data record Bachelor (180 ECTS) Luft- und Raumfahrtinformatik - 2020	page 79 / 93

Bachelor's degree (1 major) Computer Science und Sustainability (2021)  
Bachelor's degree (1 major) Mathematics (2023)  
Master's teaching degree Gymnasium MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)  
Supplementary course MINT Teacher Education PLUS, Elite Network Bavaria (ENB) (2025)  
Bachelor's degree (1 major) Games Engineering (2025)



<b>Module title</b>		<b>Abbreviation</b>
Astrophysics		11-AP-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Theoretical Physics and Astrophysics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + R (2) Module taught in: German or English		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
180 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
§ 22 II Nr. 1 h) § 22 II Nr. 2 f) § 22 II Nr. 3 f)		
<b>Module appears in</b>		

Bachelor's degree (1 major) Physics (2015)  
 Bachelor's degree (1 major) Mathematical Physics (2015)  
 Bachelor's degree (1 major) Aerospace Computer Science (2015)  
 Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015)  
 First state examination for the teaching degree Grundschule Physics (2015)  
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2015)  
 First state examination for the teaching degree Realschule Physics (2015)  
 First state examination for the teaching degree Gymnasium Physics (2015)  
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2015)  
 First state examination for the teaching degree Mittelschule Physics (2015)  
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2015)  
 Bachelor's degree (1 major) Mathematical Physics (2016)  
 Master's degree (1 major) Nanostructure Technology (2016)  
 Bachelor's degree (1 major) Aerospace Computer Science (2017)  
 First state examination for the teaching degree Grundschule Physics (2018)  
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2018)  
 First state examination for the teaching degree Realschule Physics (2018)  
 First state examination for the teaching degree Gymnasium Physics (2018)  
 First state examination for the teaching degree Mittelschule Physics (2018)  
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2018)  
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2018)  
 Master's degree (1 major) Nanostructure Technology (2020)  
 Bachelor's degree (1 major) Physics (2020)  
 Bachelor's degree (1 major) Mathematical Physics (2020)  
 Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020)  
 Bachelor's degree (1 major) Aerospace Computer Science (2020)  
 First state examination for the teaching degree Grundschule Didactics in Physics (Primary School) (2020)  
 First state examination for the teaching degree Grundschule Physics (2020)  
 First state examination for the teaching degree Gymnasium Physics (2020)  
 First state examination for the teaching degree Realschule Physics (2020)  
 First state examination for the teaching degree Sonderpädagogik Didactics in Physics (Middle School) (2020)  
 First state examination for the teaching degree Mittelschule Didactics in Physics (Middle School) (2020)  
 First state examination for the teaching degree Mittelschule Physics (2020)  
 Master's degree (1 major) Quantum Technology (2021)  
 exchange program Physics (2023)  
 Bachelor's degree (1 major) Mathematical Physics (2024)

<b>Module title</b>		<b>Abbreviation</b>
Laboratory Course Physics B for Space and Aerospace Computer Science		11-P-LRB-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
4	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
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.
<b>Contents</b>		
Physical laws of optics, vibrations and waves, science of electricity and circuits with electric components.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (2)		
<b>Method of assessment</b> (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.		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
120 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Laboratory Course Physics C for Space and Aerospace Computer Science		11-P-LRC-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
4	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1-2 semester	undergraduate	Students are highly recommended to complete module 11-P-LRB prior to completing module 11-P-LRC.
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (2)		
<b>Method of assessment</b> (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.		
<b>Allocation of places</b>		
--		
<b>Additional information</b>		
--		
<b>Workload</b>		
120 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

## **Key Skills Area**

(20 ECTS credits)

## General Key Skills

(5 ECTS credits)

All modules offered as part of the pool of general transferable skills (ASQ) that do not come from the area of Informatik (Computer Science) may be accredited.

## **Subject-specific Key Skills**

(15 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Aerospace Laboratory		10-I-LRLA-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VIII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
V (2) + P (2)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
--		
<b>Workload</b>		
180 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
--		
<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Computer Science (2019) Bachelor's degree (1 major) Aerospace Computer Science (2020) Module studies (Bachelor) Aerospace Computer Science (2021)		



<b>Module title</b>		<b>Abbreviation</b>
Seminar for students of Space- and Aerospace Computer Science 1		10-I-LRS1-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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).		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
S (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
--		
<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Seminar for students of Space- and Aerospace Computer Science 2		10-I-LRS2-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Computer Science VII		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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).		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
S (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
150 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		

<b>Module title</b>		<b>Abbreviation</b>
Practical work Space Technology		10-I-PLR-172-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
4	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Completion of a practical task.		
<b>Intended learning outcomes</b>		
The practical allows participants to work on a problem in space information technology in teams.		
<b>Courses</b> (type, number of weekly contact hours, language – if other than German)		
P (2)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
120 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2017) Module studies (Bachelor) Computer Science (2019) Bachelor's degree (1 major) Aerospace Computer Science (2020) Module studies (Bachelor) Aerospace Computer Science (2021)		

# Thesis

(12 ECTS credits)

<b>Module title</b>		<b>Abbreviation</b>
Bachelor's Thesis Space- and Aerospace Computer Science		10-I-LRI-BA-152-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Informatik (Computer Science)		Institute of Computer Science
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
12	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
The students are able to research and write on a defined problem in aerospace information technology, adhering to the principles of good scientific practice.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
No courses assigned to module		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
Time to complete: 12 weeks		
<b>Workload</b>		
360 h		
<b>Teaching cycle</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor's degree (1 major) Aerospace Computer Science (2015) Bachelor's degree (1 major) Aerospace Computer Science (2017) Bachelor's degree (1 major) Aerospace Computer Science (2020)		