Technology
Arts Sciences
TH Köln

Faculty of Information, Media and Electrical Engineering

Bachelor Optometry 2020

Module Manual

Version: 1.4.2025-08-25-12-39-24

The most recent version of this handbook can be found here:
https://f07-studieninfo.web.th-koeln.de/mhb/current/en/BaOPT2021.html

1. Program Description

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

2. Graduate Profile

Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet. Lorem ipsum dolor sit amet, consetetur sadipscing elitr, sed diam nonumy eirmod tempor invidunt ut labore et dolore magna aliquyam erat, sed diam voluptua. At vero eos et accusam et justo duo dolores et ea rebum. Stet clita kasd gubergren, no sea takimata sanctus est Lorem ipsum dolor sit amet.

3. Fields of Action

Central fields of activity in the degree program are development and design, research and innovation, leadership and management as well as quality assurance and testing. The profile module matrix shows which fields of activity are addressed by which modules.

Research and development

This area covers the research and development of new technologies, algorithms, processes, devices, components and systems. This includes basic and industrial research as well as more specialized development such as in media technology, optometry, electrical engineering and technical computer science.

System and process management

This includes the planning, design, monitoring, operation and maintenance of systems and processes. This also includes the management of production processes, quality assurance and the coordination of working groups as well as IT administration and project management.

Innovation and application

The design, development and use of innovative applications and systems in technical disciplines. This also includes the creation and design of media content and products, the development of electronic, IT, media technology, acoustic or optical components and systems as well as the integration of IT solutions in technical applications.

Analysis, evaluation and quality assurance

The analysis and evaluation of procedures, systems, algorithms and devices to ensure the quality of products and processes. Includes the reflection and evaluation of media content and clinical studies as well as the investigation of visual and acoustic perception processes.

Interaction and communication

The ability for interdisciplinary collaboration and mediation between designers, technical actors, clients and users. Emphasizes the importance of soft skills such as teamwork and presentation skills in technical professions.

4. Competencies

The modules of the degree program train students in different competencies, which are described below. The profile module matrix shows which competencies are addressed by which modules.

Systems thinking and delimitation of system boundaries

Understanding and identifying the boundaries of different systems, including the delineation of relevant aspects from external, uninfluenceable factors.

Abstraction and modeling

Ability to simplify and generalize complex problems, develop and evaluate different models across disciplines.

Analyze natural and technical phenomena

Identification, naming and explanation of relevant phenomena in real-life scenarios, including scientific principles and technical contexts.

STEM competence

Knowledge and application of models and principles from mathematics, computer science, natural sciences and technology for problem solving.

Simulation and analysis of technical systems

Use of software and tools to simulate and analyze technical systems, including the development of simulation models.

Design and realization of systems and processes

Design and implementation of technical solutions and processes, taking into account technical, economic and ecological standards and principles.

Testing and evaluating systems and processes

Performing tests, including verification and validation, to ensure compliance with standards and the functionality of systems and economic aspects of processes.

Obtaining and evaluating information

Ability to systematically research, analyze and evaluate information including relevant contexts.

Communication and presentation

Effective presentation and explanation of complex technical content to different target groups in German and English.

Business and legal knowledge

Apply basic business and legal knowledge to technical and design projects and decisions.

Teamwork and interdisciplinary cooperation

Ability to work in teams, including effective communication and cooperation with professionals from other disciplines.

Decision-making in uncertain situations

Strategic decision making based on sound professional analysis, even under uncertainty.

Consideration of social and ethical values

Integration of ethical and social values in the design of systems and media and reflection on professional actions.

Learning competence and adaptability

Motivation and ability to engage in lifelong learning and to adapt to technological and methodological innovations.

Self-organization and self-reflection

Competence in the self-organization of professional and learning-related tasks as well as critical reflection of one's own actions.

Communicative and intercultural skills

Effective communication and cooperation in intercultural and international contexts as well as media skills.

Specific professional knowledge and skills

In-depth knowledge and skills tailored to the requirements and specifics of individual subject areas such as electrical engineering, media technology, optometry and computer engineering.

5. Study Plans

The following are studyable study plans. Other study plans are also possible. Please note, however, that each module is usually only offered once a year. Please also note that several modules may have to be selected in a particular semester and elective catalogs in order to obtain the total ECTS credit points shown.

5.1 Studienverlaufsplan

Sem.	Abbr.	Module Name	Mandatory (PF) Elective Catalog (WB)	ECTS	Prüfungslast	Examination Types with Weights
3	SGA	Anerkennung "Staatlich geprüfter Augenoptiker"	PF	90	0	
4	MA1	Mathematik	PF	10	2	▪ accompanying: exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
	PAT	Pathologie	PF	5	≤ 2	▪ selection dependend
	NO	Neuroophthalmologie	PF	5	≤ 2	▪ selection dependend
	SKL	Spezielle Kontaktlinsen	PF	5	≤ 2	▪ selection dependend
	WM1	Wahlmodul 1	WB	5	≤ 2	▪ selection dependend
5	BWR	Betriebswirtschaft und Recht	PF	5	2	▪ accompanying: project work [ungraded] and ▪ final: (digital) written exam [100%]
	LB	Licht- und Beleuchtungstechnik ergonomischer Arbeitsplätze	PF	5	2	▪ accompanying: term paper [40%] and ▪ final: (digital) written exam [60%]
	BMO	Bildgebende Verfahren der Optometrie	PF	5	2	▪ accompanying: term paper [ungraded] and ▪ final: oral examination or (digital) written exam [100%]
	TO	Technische Optik	PF	5	2	▪ accompanying: project work or exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
	PX1	Praxisphase 1	PF	5	≤ 2	▪ selection dependend
	WM2	Wahlmodul 2	WB	5	≤ 2	▪ selection dependend

Sem.	Abbr.	Module Name	Mandatory (PF) Elective Catalog (WB)	ECTS	Prüfungslast	Examination Types with Weights
6	PX2	Praxisphase 2	PF	5	≤ 2	▪ selection dependend
	OMT	Anwendungen optischer Messtechniken	PF	5	2	▪ accompanying: lab report [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
	MSS	Medizinische Statistik und Studienplanung	PF	5	≤ 2	▪ selection dependend
	PHA	Pharmakologie	PF	5	≤ 2	▪ selection dependend
	KOP	Kinderoptometrie	PF	5	≤ 2	▪ selection dependend
	WM3	Wahlmodul 3	WB	5	≤ 2	▪ selection dependend
7	VWA	Verfassen wissenschaftlicher Arbeiten	PF	3	2	▪ accompanying: term paper [ungraded] and ▪ accompanying: project work [ungraded]
	PXP	Praxisprojekt	PF	12	≤ 4.8	▪ selection dependend
	BAA	Bachelorarbeit	PF	12	1	▪ final: Thesis [100%]
	KOLL	Kolloquium zur Bachelorarbeit	PF	3	1	▪ final: Colloquium [100%]

5.2 Alternativer Studienverlaufsplan (verminderter Workload)

Sem.	Abbr.	Module Name	Mandatory (PF) Elective Catalog (WB)	ECTS	Prüfungslast	Examination Types with Weights
3	SGA	Anerkennung "Staatlich geprüfter Augenoptiker"	PF	90	0	
4	MA1	Mathematik	PF	10	2	▪ accompanying: exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
	PAT	Pathologie	PF	5	≤ 2	▪ selection dependend
	NO	Neuroophthalmologie	PF	5	≤ 2	▪ selection dependend
5	BWR	Betriebswirtschaft und Recht	PF	5	2	▪ accompanying: project work [ungraded] and ▪ final: (digital) written exam [100%]
	LB	Licht- und Beleuchtungstechnik ergonomischer Arbeitsplätze	PF	5	2	▪ accompanying: term paper [40%] and ▪ final: (digital) written exam [60%]
	BMO	Bildgebende Verfahren der Optometrie	PF	5	2	▪ accompanying: term paper [ungraded] and ▪ final: oral examination or (digital) written exam [100%]
	TO	Technische Optik	PF	5	2	▪ accompanying: project work or exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
6	OMT	Anwendungen optischer Messtechniken	PF	5	2	▪ accompanying: lab report [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
	SKL	Spezielle Kontaktlinsen	PF	5	≤ 2	▪ selection dependend
	PHA	Pharmakologie	PF	5	≤ 2	▪ selection dependend
	WM1	Wahlmodul 1	WB	5	≤ 2	▪ selection dependend

Sem.	Abbr.	Module Name	Mandatory (PF) Elective Catalog (WB)	ECTS	Prüfungslast	Examination Types with Weights
7	PX1	Praxisphase 1	PF	5	≤ 2	▪ selection dependend
	PX2	Praxisphase 2	PF	5	≤ 2	▪ selection dependend
	VWA	Verfassen wissenschaftlicher Arbeiten	PF	3	2	▪ accompanying: term paper [ungraded] and ▪ accompanying: project work [ungraded]
	WM2	Wahlmodul 2	WB	5	≤ 2	▪ selection dependend
8	MSS	Medizinische Statistik und Studienplanung	PF	5	≤ 2	▪ selection dependend
	KOP	Kinderoptometrie	PF	5	≤ 2	▪ selection dependend
	WM3	Wahlmodul 3	WB	5	≤ 2	▪ selection dependend
9	PXP	Praxisprojekt	PF	12	≤ 4.8	▪ selection dependend
	BAA	Bachelorarbeit	PF	12	1	▪ final: Thesis [100%]
	KOLL	Kolloquium zur Bachelorarbeit	PF	3	1	▪ final: Colloquium [100%]

6. Modules

The modules of the degree program are described below in alphabetical order.

6.1 ABT - Abbildungstheorie

Module ID	ABT_BaOPT2021
Module Name	Abbildungstheorie
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME

Learning Outcome(s)

Was:
Das Modul vermittelt Kompetenzen zur Konzepzionierung (K.5, K.9, K.11), Auslegung (K.5, K.9, K.11), Analyse (K.2, K.3, K.4, K6, K.11) und Überprüfung (K.10, K.11) optisch abbildender Systeme, wie das Auge eines ist (K6, K9, K.10), unter besonderer Berücksichtigung mathematisch-analytischer Modelle (K.5).

Vorlesungsbegleitend findet ein projektnahes (K.18) Praktikum statt, wobei die Aufgaben in Zweier-Teams zu bearbeiten sind (K.15). Sprachliche Kompetenzen (K.20) zur präzisen Darstellung technisch komplexer Zusammenhänge (K.13) werden durch verpflichtende schriftliche Vorbereitung und Ausarbeitung geschult. Die durchzuführende Fehleranalyse und -diskussion sowie Spiegelung an erwartbaren Ergebnissen, vermittelt Bewertungskompetenzen (K.12, K.13).

Feste Zeitvorgaben und Termine für Vorbereitung, Ausarbeitung, Protokoll-Abgabe und ggf. Überarbeitung befördern die Entscheidungsfähigkeit (K.16) und vor allem die Selbstorganisation (K.19).

Womit:
Der Dozent vermittelt neben Wissen und Basisfertigkeiten in einer Vorlesung mit integrierten kurzen Übungsteilen die Fertigkeit, sich in einem abstrakten, mathematisch-analytischen Modellierungssystem abbildender, optischer Systeme, wie das Auge eines ist, sicher zu bewegen. Weiterhin wird ein Praktikum durchgeführt, welches projektartigen Charakter hat: Neben einer schriftlichen Vorbereitung ist der optische Aufbau aus Einzelteilen selber zu gestalten, zu justieren und zu optimieren, bevor die eigentliche Messaufgabe erfolgen kann. Zu jedem Versuch ist eine schriftiche Ausarbeitung erforderlich.

Wozu:
Kompetenzen im Verständnis, des Entwurfes, der Entwicklung, der Analyse und der Überprüfung optisch abbildender Systeme sind essentiell für Personen die im Bereich der Photonik tätig sein wollen. Für Optometristen ist das wesentliche, optisch abbildende System das Auge. Alle Konzepte, die erarbeitet werden, lassen sich auf das Auge als optisches System anwenden. Aufgrund ihrer MINT-Lastigkeit sind die Konzpte dem Handlungsfeld HF.1 zuzuordnen, wobei sie aber letztlich HF.2 und HF.3 durch ihre Anwendbarkeit darin, gleichermaßen berühren.

Module Contents

Lecture

- Imaging errors
  - Be able to name the silk defects and differentiate between them using the dot images.
  - Be able to explain the causes of silk defects.
  - Know and be able to explain methods for avoiding or reducing imaging errors.
- Ray and wave fronts
  - Be able to make the transition from the description using rays and wavefronts.
  - Understand the description of silk defects using phase functions and be able to apply the phase functions.
  - Be able to explain the transition from the wavefront aberration function to the optical transfer function and describe the advantages.
  - Know and be able to apply measurement methods for phase transfer functions.
- Mathematics
  - confidently apply Fourier transforms and the theorems of the Fourier transform and master delta functionals and their application.
- Linear system theory
  - Recognize if and when a system is linear.
  - Be able to explain why coherent optical systems are linear in field strength and why incoherent optical systems are linear in intensities.
  - Recognize and be able to justify whether an optical system is coherent or incoherent. Be able to describe optical systems in spatial space and spatial frequency space and switch mathematically between these two spaces.
  - Know cut-off frequencies for optically coherent and incoherent systems.
  - Be able to explain why incoherent optical systems have a cut-off frequency that is twice as high.
  - Recognize and be able to justify whether the resolution limitation of optical systems is due to diffraction or aberration.
- Coherence
  - Understand mathematical representation as correlation functions, be able to apply the Wiener-Chintschin theorem for temporal coherence and apply the Van Cittert-Zernike theorem for spatial coherence.

Lab

- Plan and implement optical superstructures yourself
- Adjust optical superstructures
- with commercial software packages
  - Evaluate measurement data
  - Displaying data graphically
- Measure impulse responses and transfer functions
- Calculating the impulse response from the transfer function
- Calculating the transfer function from the impulse response function
- Set up a light source with a continuously adjustable degree of coherence
- Determine and discuss the transfer behavior of a lens as a function of the degree of coherence
- Measure and discuss the modulation transfer function of a lens as a function of the aperture
- Write a scientific report
  - Describe the task order
  - Present solution approach
  - Explain the experimental setup
  - Explain the processing of the measurement data
  - Carry out error calculation
  - Present and critically discuss results

Teaching and Learning Methods	▪ Lecture ▪ Lab
Examination Types with Weights	▪ accompanying: project work [ungraded] and ▪ final: oral examination [100%]
Workload	150 Hours

Contact Hours	34 Hours ≙ 3 SWS
Self-Study	116 Hours
Recommended Prerequisites	▪ Series developments ▪ Differential calculus ▪ Integral calculus of several variables ▪ Fundamentals of the Fourier transform ▪ Geometrical optics ▪ Fundamentals of wave optics
Mandatory Prerequisites	Lab requires attendance in the amount of: 4 Labortermine
Recommended Literature	▪ Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer) ▪ Hecht: Optik (Oldenbourg) ▪ Perez: Optik (Spektrum Akademischer Verlag) ▪ Goodman: Introduction to Fourier Optics (Roberts and Co. Publishers) ▪ Kurz, Lauterborn: Coherent Optics (Springer)
Use of the Module in Other Study Programs	▪ ABT in Bachelor Elektrotechnik 2020 ▪ ABT in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.2 AVW - Visuelle und auditive Wahrnehmung

Module ID	AVW_BaOPT2021
Module Name	Visuelle und auditive Wahrnehmung
Type of Module	Elective Modules
ECTS credits	3
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr.-Ing. Ulrich Reiter/Professor Fakultät IME
Lecturer(s)	Prof. Dr.-Ing. Ulrich Reiter/Professor Fakultät IME

Learning Outcome(s)

Was: Durch das Modul lernen die Studierenden grundlegende Phänomene der menschlichen visuellen, auditiven und audiovisuellen Wahrnehmung kennen und werden in die Lage versetzt, diese in einfachen Modellen und Kennziffern zu beschreiben.
Womit: Durch das Beobachten der in der Vorlesung präsentierten Versuche einschließlich einiger Selbstversuche erfahren die Studierenden unmittelbar sinnlich die Eigenschaften und Beschränkungen menschlicher Wahrnehmung. Durch die dazu vermittelten Inhalte können sie die beobachteten Effekte zu den entsprechenden Modellen und Kennziffern in Beziehung setzen.
Wozu: Die visuell aufgenommen Informationen werden vom menschlichen Betrachter in vielfältiger Weise verarbeitet. Die Grenzen der Wahrnehmbarkeit werden unter anderem durch die Leistungsfähigkeit des Auges beeinflusst. Die Kenntnisse der Zusammenhänge zwischen präsentierter ausiovisueller Information, deren Verarbeitung und der resultierenden Wahrnehmung erlauben daher eine bessere Beurteilung der Auswirkung von Beschränkungen der visuellen Reizverarbeitung.

Module Contents

Lecture

visual perception
structure of the visual system
perception of brightness
perception of contrast
spatial resolution
temporal resolution
colour perception
perception of spatial depth

auditory perception
human auditory system
loudness perception
pitch perception
spatial hearing
mechanisms of localisation
distance perception
cocktail-party effect
precedence effect / sum localisation
spectral and temporal masking

audiovisual interaction
audivisual precedence effect
Mc Gurk effect

specify requirements for audiovisual media systems

assess performance of audiovisual systems with respect to human perception

Lab

Teaching and Learning Methods	▪ Lecture ▪ Lab
Examination Types with Weights	▪ accompanying: single/multiple choice [100%] and ▪ accompanying: exercise lab [ungraded]
Workload	90 Hours
Contact Hours	34 Hours ≙ 3 SWS
Self-Study	56 Hours
Recommended Prerequisites	none
Mandatory Prerequisites	Lab requires attendance in the amount of: 1 Praktikumstermin
Recommended Literature	▪ Christoph von Campenhausen: „Die Sinne des Menschen“ ▪ David H. Hubel: „Auge und Gehirn – Neurophysiologie des Sehens“ ▪ Zwicker, E., Feldtkeller, R. (1967). „Das Ohr als Nachrichtenempfänger,“ S. Hirzel Verlag, Stuttgart. ▪ Blauert, J. (1999), „Spatial Hearing,” MIT Press, Cambridge, Mass. ▪ Blauert, J., Xiang, N. (2008).“Acoustic for Engineers – Troy Lectures,“ Springer Verlag, Heidelberg. ▪ Weinzierl, Stefan (2008). „Handbuch der Audiotechnik,“ Springer Verlag, Berlin.
Use of the Module in Other Study Programs	▪ AVW in Bachelor Medientechnologie 2020 ▪ AVW in Bachelor Medientechnologie 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.3 BAA - Bachelorarbeit

Module ID	BAA_BaOPT2021
Module Name	Bachelorarbeit
Type of Module	Mandatory Module
ECTS credits	12
Language	deutsch, englisch bei Bedarf
Duration of Module	1 Semester
Recommended Semester	7
Frequency of Offering	every term
Module Coordinator	Studiengangsleiter(in) Bachelor Optometrie
Lecturer(s)	verschiedene Dozenten*innen / diverse lecturers

Learning Outcome(s)

> Studierende sind in der Lage, eine umfangreiche, erkenntnistheoretische oder praxisbezogene optometrische oder ingenieurwissenschaftliche Problemstellung selbständig wissenschaftlich begründet zu bearbeiten, d. h. - die Problemstellung inhaltlich zu analysieren, abzugrenzen, zu strukturieren, zu ordnen und ein grundsätzliches Konzept zur Beurteilung der Qualiät einer nachfolgend erarbeiteten Lösung zu erstellen, - im Studium erworbene Kenntnisse, Fertigkeiten und Handlungskompetenzen zielgerichtet, effektiv und effizient zur Bearbeitung und Lösung der Problemstellung einzusetzen und - die Problemstellung, die wissenschaftliche Methodik zur Bearbeitung sowie die erarbeiteten Ergebnisse und deren Beurteilung dem Auftraggeber und einem Fachauditorium angemessen schriftlich und mündlich zu berichten und zu diskutieren.

Module Contents

Thesis

> The Bachlor's thesis is a written assignment. It should show that the student is capable of independently working on a topic from his or her subject area within a specified period of time, both in its technical details and in its interdisciplinary contexts, using scientific and practical methods. Interdisciplinary cooperation can also be taken into account in the final thesis.

Teaching and Learning Methods	Thesis
Examination Types with Weights	▪ final: Thesis [100%]
Workload	360 Hours
Contact Hours	0 Hours ≙ 0 SWS
Self-Study	360 Hours
Recommended Prerequisites	
Mandatory Prerequisites	See exam regulations §26 paragraph 1
Recommended Literature	
Use of the Module in Other Study Programs	▪ BAA in Bachelor Elektrotechnik 2020 ▪ BAA in Bachelor Elektrotechnik und Informationstechnik 2024 ▪ BAA in Bachelor Medientechnologie 2020 ▪ BAA in Bachelor Medientechnologie 2024 ▪ BAA in Bachelor Technische Informatik 2020 ▪ BAA in Bachelor Informatik und Systems-Engineering 2024
Specifics and Notes	See also examination regulations §24ff. Contact a professor of the faculty early on for the initial supervision of the thesis.

Last Update	25.8.2025, 12:39:14

6.4 BMO - Bildgebende Verfahren der Optometrie

Module ID	BMO_BaOPT2021
Module Name	Bildgebende Verfahren der Optometrie
Type of Module	Mandatory Module
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	5
Frequency of Offering	every summer term
Module Coordinator	Prof. Dr. Uwe Oberheide/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Uwe Oberheide/Professor Fakultät IME

Learning Outcome(s)

> Die Studierenden beherrschen Grundlagen optischer Prozesse für bildgebende Anwendungen in den Life Sciences (Biologie, Medizin), indem sie biologische Wechselwirkungsprozesse anhand physikalischer und technischer Grundlagen analysieren und klassifizieren, um geeignete diagnostische Verfahren für verschiedene Einsatzgebiete zielgerichtet auswählen zu können.

Module Contents

Lecture / Exercises

> Overview of imaging techniques (Ultrasound imaging, X-ray projection method / computer tomography, Magnetic resonance imaging, Posittron emission tomography, Optical (coherence) tomography, Hybrid process of optical and acoustic methods, Scheimpflug imaging)
> Interaction between radiation and matter (absorption, emission, dispersion, reflection, refractive index, ionization)
> Areas of application and limitations of individual methods (resolution, imaging vs. penetration depth, image reconstruction algorithms)

> Selection of the appropriate procedure by analysis of the advantages and disadvantages
> Transfer of processes to industrial areas (quality assurance, material testing)
> apply basic social and ethical values
> Finding meaningful system boundaries by abstracting the essential aspects of a technical problem

Seminar

> Presentation of a current publication of an english-language professional journal

> Procurement of suitable literature/information
> Familiarisation with new technical field of expertise
> Use of english technical literature
> Evaluation of available literature
> Checking the relevance of information
> Filtering out essential information and preparing it for the appropriate target group

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Seminar
Examination Types with Weights	▪ accompanying: term paper [ungraded] and ▪ final: oral examination or (digital) written exam [100%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours

Recommended Prerequisites	Physics: wave propagation, acoustics, thermodynamics Laser technology: laser types, coherence length, beam shaping light-matter interaction: absorption, scattering, refractive index Detection methods of electromagnetic radiation, simulation options for light propagation Mathematics: integral calculus, Fourier transformation
Mandatory Prerequisites	▪ Participation in final examination only after successful participation in Lecture / Exercises ▪ Seminar requires attendance in the amount of: 5 Termine ▪ Participation in final examination only after successful participation in Seminar
Recommended Literature	▪ Dössel - Bildgebende Verfahren in der Medizin, Springer ▪ Kaschke, Donnerhacke, Rill – Optical Devices in Ophthalmology and Optometrie
Use of the Module in Other Study Programs	▪ BMO in Bachelor Elektrotechnik 2020 ▪ BMO in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.5 BWR - Betriebswirtschaft und Recht

Module ID	BWR_BaOPT2021
Module Name	Betriebswirtschaft und Recht
Type of Module	Mandatory Module
ECTS credits	5
Language	deutsch, englisch bei Bedarf
Duration of Module	1 Semester
Recommended Semester	5
Frequency of Offering	every term
Module Coordinator	Prof. Dr. Stefan Kreiser/Professor Fakultät IME
Lecturer(s)	Dr. Diana Püplichhuysen/Lehrbeauftragte

Learning Outcome(s)

1. Fachkompetenzen (lernergebnisorientiert)

- Die Studierenden können eine eigene Business Idee generieren, mit Hilfe von Business Modelling entwickeln und validieren.
- Sie kennen die zentralen Inhaltsfelder der BWL und deren Bedeutung für Entre- und Intrapreneure.
- Sie wissen, was notwendig ist, um ein Unternehmen funktionsfähig aufzubauen und Ziel- und zukunftsorientiert zu betreiben.
- Sie kennen die für Unternehmensgründungen relevanten rechtlichen Rahmenbedingungen und können darauf aufbauend passende Entscheidungen treffen.
- Sie sind damit grundsätzlich in der Lage, betriebswirtschaftliche Problemstellungen zu analysieren, Lösungsvorschläge zu entwickeln und (theoretisch) auszuführen.

2. Fachübergreifende Kompetenzen

: Die Studierenden können im Team projektartig vorgegebene Ziele erreichen. Sie wenden hierzu erlerntes, theoretisches Wissen auf ein Praxisbeispiel an (Transferkompetenz). Sie können:

- die notwendige Literatur recherchieren, lesen und verstehen
- mit anderen Menschen zusammenzuarbeiten und gemeinsam Ziele erreichen,
- ein komplexes Arbeitsergebnis vor Publikum präsentieren sowie
- sich selbst reflektieren und Leistungen anderer bewerten.

Die Studierenden verfügen somit über

- methodisches Grundlagenwissen der Disziplinen BWL, Recht und Entrepreneurship,
- Selbst-, Sozial und Reflexionskompetenz,
- Präsentations- und Diskussionsfähigkeit.

Module Contents

Project

> Using a fictitious business start-up (business modeling), students acquire the relevant knowledge and skills from the disciplines of business administration, law and entrepreneurship in an application-oriented manner.

Lecture

> 1. business ideation
> 2. business modeling (continuous)
> 3. market analysis, customer group analysis, stakeholder analysis
> 4. operational management processes
> 5. legal framework, taxes
> 6. cost accounting, price calculation
> 7. external accounting
> 8. business model evaluation (SWOT analysis)
>
> Further, special teaching units on:
>
> 1. self- and team management
> 2. presentation techniques
> 3. experience report of an entrepreneur

Teaching and Learning Methods	▪ Project ▪ Lecture
Examination Types with Weights	▪ accompanying: project work [ungraded] and ▪ final: (digital) written exam [100%]
Workload	150 Hours
Contact Hours	34 Hours ≙ 3 SWS
Self-Study	116 Hours
Recommended Prerequisites	
Mandatory Prerequisites	
Recommended Literature	▪ Hölter, E. (2018): Betriebswirtschaft für Studium, Schule und Beruf. Stuttgart: Schäffer-Poeschel. ▪ Osterwalder, A. & Pigneur, Y. (2010): Business Model Generation. Hoboke, New Jersey: John Wiley & Sons.
Use of the Module in Other Study Programs	▪ BWR in Bachelor Elektrotechnik 2020 ▪ BWR in Bachelor Elektrotechnik und Informationstechnik 2024 ▪ BWR in Bachelor Medientechnologie 2020 ▪ BWR in Bachelor Medientechnologie 2024 ▪ BWR in Bachelor Medientechnologie 2024 ▪ BWR in Bachelor Medientechnologie 2024
Permanent Links to Organization	llu
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.6 EPR - Erstsemesterprojekt

Module ID	EPR_BaOPT2021
Module Name	Erstsemesterprojekt
Type of Module	Elective Modules
ECTS credits	2
Language	deutsch, englisch bei Bedarf
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Michael Gartz/Professor Fakultät IME
Lecturer(s)	▪ Prof. Dr. Michael Gartz/Professor Fakultät IME ▪ Prof. Dr. Uwe Oberheide/Professor Fakultät IME

Learning Outcome(s)

> Was: Die Studierenden können Verantwortung für sich und ihr Team übernehmen, da sie die Sozialisierung in einer Lerngruppe durchlebt haben. Die Studierenden können Projekte mit abstrakten Zielvorgaben und Arbeitsteilig zu bewältigendem Projektumfang im Team realisieren. Dazu können sie Aufgabe strukturieren, Teilziele und Schnittstellen definieren, Lösungskonzepte arbeitsteilig entwickeln, umsetzen, prüfen, optimieren und dokumentieren, Teillösungen integrieren, Produktprototypen gemeinsam bewerten und optimieren, zielorientiert und respektvoll kommunizieren verbindliche Absprachen treffen und einhalten. Die Studierenden können durch Selbstreflexion ihren eigenen Leistungsstand korrekt einschätzen und durch Selbständiges, zielgerichtetes Lernen Kompetenzlücken verkleinern und schließen. Die Studierenden haben die Einrichtungen der Fakultät kennengelernt und sind im Studium angekommen. Sie können nun Lern- und Arbeitsstrategien entwickeln, bewerten und anwenden. Sie können unter Laborbedingungen arbeiten und können erkennen, wann Ingenieurmässig, d.h. in geplante Arbeitsweise, vorgegangen wird und wann unstrukturiert, ineffizient gearbeitet wird. Womit: indem sie die Anleitungen, die Sie über die Projektleiter*innen, den Masterstudenten*innen aus dem gekoppelten Modul PLET, bekommen, verstehen und anwenden. Indem sie durch eigenständige Recherchen ihre Kenntnisse, Fertigkeiten und Kompetenzen erweitern. Indem sie durch Selbstreflexion der eigenen, bereits vorhandenen Kompetenzen, Stärken und Schwächen erkennen, bewerten und die Schwächen abbauen. Indem sie von den Projektleiter*innen unterstützt ein funktionsfähiges Team bilden, mit dem sie innerhalb der 2 wöchigen Projektphase ein herausforderndes Kreativ-Projekt realisieren. Wozu: um später ihre eigenen Kompetenzen besser einschätzen zu können. Um festzustellen, wie man durch Recherche, Einarbeitung und iteratives Verbessern ein zu Beginn unlösbar erscheinendes Projekt in begrenzter Zeit realisieren kann. Um diese Erkenntnisse und gewonnen Kompetenzen auf ihr eigenes Projekt, das Bachelorstudium, erfolgreich anzuwenden. Um direkt zu Beginn eine teamfähige Lerngruppe zu finden oder zu bilden, damit sie erfolgreich ihr Studium absolvieren.

Module Contents

Project

> Taking responsibility for themselfs and for their team;
> To realize projects with abstract objectives and to tackle a project scope in work-sharing manner by teamwork;
> To structure tasks, to define sub-goals and intersections,
> to develope implementation concept in work-sharing manner,
> to realize, check, optimize and document them;
> to integrate partial solutions, to evaluate and optimize together product prototypes
> to communicate in goal-oriented and regardful manner;
> to make binding arrangements and comply with them;
> With the help of self-reflection estimate the own proficiency level in correct manner and with the help of autonomous, goal-oriented learning close or diminish competence holes.
> They are able to develope, assess and exert learning- and working- strategies.
> The are able to work under laboratory conditions and can recognize if the work has been done in engineer manner, that means a planned operation, or if it was unstructured and inefficient.

> first programming knowledge and knowledge to one of the four themes: electric generator, labyrinth robot, remotely controlled robot or automatic updated telescope.
> The students got to know the infrastructure of the faculty
> and have arrived in the academic studies.

Teaching and Learning Methods	Project
Examination Types with Weights	▪ accompanying: project work [ungraded]
Workload	60 Hours
Contact Hours	12 Hours ≙ 1 SWS
Self-Study	48 Hours
Recommended Prerequisites	interest in electrical engineering intereset in industrial automation, power engineering, communications engineering or optical technology
Mandatory Prerequisites	Project requires attendance in the amount of: 8 von 10 Projekttagen
Recommended Literature	▪ Informationen zum µController auf www.aduino.cc
Use of the Module in Other Study Programs	▪ EPR in Bachelor Elektrotechnik 2020 ▪ EPR in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.7 KL - CAD-Konstruktion für die Optometrie

Module ID	KL_BaOPT2021
Module Name	CAD-Konstruktion für die Optometrie
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Michael Gartz/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Michael Gartz/Professor Fakultät IME

Learning Outcome(s)

> Was: Die Studierenden können mechanische Bauteile und Systeme, z.B. zur Brillen-Fassungen oder Justage-Fassungen von optische Bauteilen, selbst konstruieren, analysieren, vergleichen und beurteilen,
> Womit: indem sie sich in ein 3D-Konstruktionsprogramm einarbeiten mit Hilfe der Übungen und dabei das Fachwissen über technische Zeichnungen aus der Vorlesung verwenden. Indem Sie das Fachwissen über Projektplanung aus der Vorlesung in ihrem eigenen Projekt verwenden und in eigenen Vorträgen, die in der Projektarbeit erarbeiteten mechanischen Konstruktionslösungen und ihre Projektplanung präsentieren. Indem sie die Inhalt der Vorlesung, eigene Recherchen und Ergebnisse der Projektbesprechungen zur Realisierung eines Projektes verwenden,
> Wozu: um später in Entwicklungsabteilungen, z.B. der Optischen Industrie oder anderer Industrien, eigene 3D Konstruktionen erstellen zu können für die Herstellung von Sehhilfen oder für die Vermessung von Sehhilfen und vor allem, um mechanische Konstruktionen von Maschinenbau Ingenieuren zu verstehen und deren technische Zeichnungen korrekt lesen zu können, da interdisziplinäre Zusammenarbeit nur möglich ist, wenn man die spezifischen Vokabeln der anderen Disziplinen kennt. Um später 3D-Konstruktionen für verschiedenste Systeme hinsichtlich der mechanischen Eigenschaften beurteilen zu können. Um erarbeitete oder bewertete Konstruktions- Lösungen fachlich korrekt zu präsentieren.

Module Contents

Lecture / Exercises

basic skills of technical drawing
composition of the engineering detail drawing
drawing formats
labelling field and list of parts
arrangement of the views
line types and line strength
technical views
engineering standards
dimensioning
normal dimensioning
coordinate dimensioning
sectional view
representation of a thread
surface specifications
tolerances
fitting
position tolerances and form tolerances
suitable for production constructiong and dimensioning

Three-dimensional construction
Introduction to a 3D CAD program
sketching
basics
sketching tools
Project geometries
work elements
work points
working axes
work levels
3D elements
extrusion
rotation
bores
thread
roundings
subassemblies
place components
create components in assemblies
replace components in assemblies
create dependencies
editing components in assemblies
detailed drawings
derive detail drawing from 3D component
create Views
dimension

construction elements in particular precision mechanics
free from distortion lens holder
scatter-resistant components
beam drops

Materials and material science
ferrous alloy
non-ferrous metals
synthetic materials
special materials
glassware
ceramics

surface refinement
varnishing
anodizing
coating
burnishing

manufacturing method
turning
milling
drilling
grinding

analysis of strain and mechanical strength
fundamentals
applications

to assess
surface quality
dimensional accuracy
feasibility of the construction

Project

technical drawing

Create a 3D geometric model using a CAD program

Checking and evaluating the design in production-orientated manner

Check and evaluate strength simulation for plausibility

Recognizing and understanding interrelationships

analyse a constructive task
analyze Independently recognized constructive tasks
Analyze the given constructive tasks

design a solution approach for the constructive task
Consideration of construction possibilities / resources
Consideration of the available time quota

Presentation of a project outline
Describe the task
outline the approach

Final presentation with presentation of the realized solution approach
Describe the task
outline the approach
Present results in a clearly structured way
Discuss technical and scientific results

apply scientific / technical laws
Calculating and drawing beam paths
Estimate error influences
Check the suitability of the construction, check the composition

Work on complex technical tasks in a team
Organize into subtasks
Discuss measurement results
complement each other meaningfully

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Project
Examination Types with Weights	▪ accompanying: project work [ungraded] and ▪ final: oral examination [100%]
Workload	150 Hours

Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours
Recommended Prerequisites	mathematics elementary geometry three-dimensional spatial sense
Mandatory Prerequisites	▪ Project requires attendance in the amount of: 2 Präsentationstermine ▪ Participation in final examination only after successful participation in Project
Recommended Literature	▪ Hoischen, Technisches Zeichnen, Cornelsen ▪ Krause Werner, Grundlagen der Konstruktion, Hanser ▪ Decker Karl Heinz, Maschinenelemente, Funktion, Gestaltung und Berechnung, Hanser ▪ Steinhilper, Röper, Maschinen- und Konstruktionselemente 1 und 2, Springer ▪ Naumann, Schröder, Bauelemente der Optik, Hanser Verlag
Use of the Module in Other Study Programs	▪ KL in Bachelor Elektrotechnik 2020 ▪ KL in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.8 KOLL - Kolloquium zur Bachelorarbeit

Module ID	KOLL_BaOPT2021
Module Name	Kolloquium zur Bachelorarbeit
Type of Module	Mandatory Module
ECTS credits	3
Language	deutsch, englisch bei Bedarf
Duration of Module	1 Semester
Recommended Semester	7
Frequency of Offering	every term
Module Coordinator	Studiengangsleiter(in) Bachelor Optometrie
Lecturer(s)	verschiedene Dozenten*innen / diverse lecturers

Learning Outcome(s)

> Studierende sind in der Lage, über die im Rahmen ihrer Bachelorarbeit bearbeitete wissenschaftliche Problemstellung dem Auftraggeber und einem Fachauditorium angemessen mündlich zu berichten und das wissenschaftliche Vorgehen sowie die erzielten Ergebnisse und gewonnenen Erkenntnisse und deren Beurteilung zu diskutieren und zu verteidigen.

Module Contents

Colloquium

> The colloquium serves to determine whether the student is able to present the results of the Bachelor's thesis, its technical and methodological foundations, interdisciplinary contexts and extracurricular references orally, to justify them independently and to assess their significance for practice

Teaching and Learning Methods	Colloquium
Examination Types with Weights	▪ final: Colloquium [100%]
Workload	90 Hours
Contact Hours	0 Hours ≙ 0 SWS
Self-Study	90 Hours
Recommended Prerequisites	
Mandatory Prerequisites	See exam regulations §29, paragraph 2
Recommended Literature	
Use of the Module in Other Study Programs	▪ KOLL in Bachelor Elektrotechnik 2020 ▪ KOLL in Bachelor Elektrotechnik und Informationstechnik 2024 ▪ KOLL in Bachelor Medientechnologie 2020 ▪ KOLL in Bachelor Medientechnologie 2024 ▪ KOLL in Bachelor Technische Informatik 2020 ▪ KOLL in Bachelor Informatik und Systems-Engineering 2024
Specifics and Notes	See also examination regulations §29.
Last Update	25.8.2025, 12:39:14

6.9 KOP - Kinderoptometrie

6.10 LB - Licht- und Beleuchtungstechnik ergonomischer Arbeitsplätze

Module ID	LB_BaOPT2021
Module Name	Licht- und Beleuchtungstechnik ergonomischer Arbeitsplätze
Type of Module	Mandatory Module
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	5
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Holger Weigand/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Holger Weigand/Professor Fakultät IME

Learning Outcome(s)

> Kompetenz zum Aufbau, zur Analyse und zur Optimierung einer Lichtplanung im Bereich der Arbeitsplatzbeleuchtung unter Zuhilfenahme von Simulationssoftware.
>
> Kompetenz zur Vermessung und Qualifizierung von Lichtquellen in arbeitsteiliger Teamarbeit.
>
> Kompetenz zum Erwerb vertiefter Fertigkeiten in der Lichtmesstechnik durch eigenständiges Aufarbeiten des theoretischen Hintergrunds von Messanordnungen.

Module Contents

Lecture / Exercises

> Radiometric and geometric basics
> Photometric, colorimetric and physiological basics
> Basic concepts of light generation and light measurement
> Basics of lighting design
> Importance of simulation software in the context of lighting technology
>
> Use of lighting design software for:
> Calculation of photometric quantities from selected sources and receivers
> Construction of lighting configurations
> Analysis of lighting configurations
> Optimization of lighting configurations
> Implementation of a lighting design in the field of general lighting

Lab

> Development of an understanding of different photometric quantities and their significance for general lighting based on experiments. Whereby, real light sources are measured in team work.
>
> Preparation of data sheets for lamps and / or luminaries on the basis of previously performed measurements of the corresponding photometric properties.

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Lab
Examination Types with Weights	▪ accompanying: term paper [40%] and ▪ final: (digital) written exam [60%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours

Recommended Prerequisites	Geometric Optics Foundations in Mathematics and Physics
Mandatory Prerequisites	Lab requires attendance in the amount of: 2 Termine
Recommended Literature	▪ R. Baer, M. Barfuss, D. Seifert: Beleuchtungstechnik: Grundlagen, 4. Auflage, Huss-Medien, 2016 ▪ H.-J. Hentschel: Licht und Beleuchtung, 5. Auflage, Hüthig Jehle Rehm, 2001 ▪ H. R. Ris: Beleuchtungstechnik für Praktiker, 6. Auflage, VDE Verlag, 2019 ▪ B. Schröder, H. Treiber: Technische Optik, 11. Auflage, Vogel Communications Group, 2014
Use of the Module in Other Study Programs	▪ LB in Bachelor Elektrotechnik 2020 ▪ LB in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.11 LMK - Mikroskopieverfahren

Module ID	LMK_BaOPT2021
Module Name	Mikroskopieverfahren
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME

Learning Outcome(s)

Was:
Das Modul vermittelt Kompetenzen zur Konzepzionierung (K.5, K.11), Auslegung (K.5, K.11), Analyse (K.2, K.3, K.4, K.11) und Überprüfung (K.11) von Mikroskopen, insbesondere Lichtmikroskopen, sowie interferometrischen Mess-Systemen (auch OCT) unter besonderer Berücksichtigung der zugrunde liegenden physikalischen Wirkprinzipien. Diese Wirkprinzipien werden letztlich nur exemplarisch an Mikroskopen diskutiert und sind in viele Bereiche der technischen Optik und Augenoptik übertragbar.

Vorlesungsbegleitend findet ein projektnahes (K.18) Praktikum statt. Sprachliche Kompetenzen (K.20) zur präzisen Darstellung technisch komplexer Zusammenhänge werden durch verpflichtende schriftliche Vorbereitung und Ausarbeitung geschult. Die durchzuführende Fehleranalyse und -diskussion sowie Spiegelung an erwartbaren Ergebnissen, vermittelt Bewertungskompetenzen (K.13).

Feste Zeitvorgaben und Termine für Vorbereitung (K.18), Ausarbeitung, Protokoll-Abgabe und ggf. Überarbeitung befördern die Entscheidungsfähigkeit (K.16) und vor allem dieSelbstorganisation (K.19).

Womit:
Der Dozent vermittelt neben Wissen und Fertigkeiten in einer Vorlesung mit integrierten kurzen Übungsteilen die Kompetenz, verschiedene Eigenschaften von Licht (Aplitude, Phase, Polarisation, Wellenlänge, Kohärenz) so zu nutzen, dass verschiedene Kontrastierungsverfahren in bildgebenden Systemen unter Ausnutzung eben dieser Eigenschaften ermöglicht werden. Durch die Diskussion der zu Grunde liegenden pysikalischen Wirkprinzipien wird die Transferleistung von der Mikroskopie in andere Bereich der technischen Optik sowie der Augenoptik ermöglicht. Weiterhin wird ein Praktikum durchgeführt, welches projektartigen Charakter hat: Neben einer schriftlichen Vorbereitung sind Mikroskope selber aus Komponenten aufzubauen, zu justieren und mit diesen bildgebende und auch messtechnische Aufgaben durchzuführen. Zu jedem Versuch ist eine schriftiche Ausarbeitung erforderlich.

Wozu:
Kompetenzen im Verständnis, des Entwurfes, der Entwicklung, der Analyse und der Überprüfung von optisch bildgebenden und messtechnischen Systemen sind essentiell für viele Personen, die im Bereich der Photonik tätig sein wollen. Im Bereich der Augenoptik ist die vergrößernde Bildgebung am Auge von besonderer Bedeutung. Hier ist insbesondere die Optische Kohärenz Tomographie zu nennen. Die veranstaltung ist aufgrund Ihres MINT Ansatzes dem Handlungsfeld HF.1 zuzuordnen. Durch die Anwendung der Prinzipien und Verfahren im Bereich der Augenoptik wird aber das HF.3 berührt.

Module Contents

Lecture

depth of field
paraxial, on the object side
near and far point
hyperfocal distance
wace optical, on the image side

amplitude- and phase objects
law of Lamberr-Beer
optical density
phase, refraction index and optical distance
Abbe's theory of image formation
relative phase of diffraction orders
of amplitude objects
of phase objects

phase microscope
with phase disc
location and size of zero'th diffraction order
spatial coherence
diffraction artefacts
Zernike
location and size of zero'th diffraction order
spatial coherence
the priniciple of Babinet
diffraction artefacts
visibility and contrast
attenuation in the phase ring

coherence
visibility of interference
temporal coherence
lenght of wavetrains
spectral composition of wavetrains
time shifted arrival of amplitude split wavetrains
fast change of interference patterns
coherence time
spatial coherence
spatially split wavetrains
phase shift in spatially split wavetrains in dependence of the location of the origin
spatial overlay of interference patterns
spatial coherence length

interferometer
Michelson
compensation plate
second interference pattern
Mach-Zehnder
phase shifts on reflexions
complementary interference patterns
contrast of unequal splitted wavefronts
ambiguity of intereference patterns
white light interferometer
interference colors and contrast function

interference microscope
Linnik

sorted pairs of objectives
Michelson
long work distance objectives
Mirau
Schwarzschild objectives
differential interference contrast
birefringence
modification of Huygens' principle
indicatrix
Wollaston-, Nomarski- and Smith prisms
splitting below resolution
interference colors
base optical path difference and lambda plate
coherence requirements in the DIC
temporal
spatial
transmission-interference microscopes
Leitz' Mach-Zehnder interference microscope
interphaco microscope

calculate depth of field

convert optical density, dynamic in images and absorption coefficients into on another

determine phase discontinuities at interfaces quatitatively

calaculate sizes of phase rings and angular apertures of Zernike phase microscopes

calculate the strength of diffraction orders and derive image contrast from them

estimate temporal coherence from bandwith of frequencies and wavelengths and vice versa

estimate spatial coeherence from lightsource size and distance and vice versa

draw ray paths of the different interference micorscopes and explain them

calculate the requirements regarding coherence in the different interference microscopes

calculate geometries from ackquired interferograms

predict colors in white light interferometry

explain and compare physically and technically the underliying principles of different microscopes

Lab

set up Köhler illumination

balancing lengths and angles in interferometers

prepare objects for microscopy

set up, adjust and use microscopes, especially
bright field
dark field
reflexion
transmission
Zernike phase contrast
Linnik interference contrast
differential interference contrast

> choose a suitable microscopy principle for a given object and task
>
> tell artefacts from object details
>
> judge image quality
>
> write scientific report
> describe the task
> descirbe the idea of the solution
> explain the experimental setup
> explain the data processing
> make error analysis
> present the results and make a critical discussion

Teaching and Learning Methods	▪ Lecture ▪ Lab
Examination Types with Weights	▪ accompanying: project work and ▪ final: oral examination
Workload	150 Hours
Contact Hours	34 Hours ≙ 3 SWS
Self-Study	116 Hours
Recommended Prerequisites	mathematics; vector calculus complex numbers physics / optics: geometrical optics wave optics
Mandatory Prerequisites	▪ Lab requires attendance in the amount of: 5 Labortermine ▪ Participation in final examination only after successful participation in Lab
Recommended Literature	▪ Bayer, Riesemberg, Handbuch der Mikroskopie, VEB Verlag
Use of the Module in Other Study Programs	▪ LMK in Bachelor Elektrotechnik 2020 ▪ LMK in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.12 LMW - Licht-Materie-Wechselwirkung

Module ID	LMW_BaOPT2021
Module Name	Licht-Materie-Wechselwirkung
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Uwe Oberheide/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Uwe Oberheide/Professor Fakultät IME

Learning Outcome(s)

> Die Studierenden können den wechselseitigen Einfluss von Licht und Materialeigenschaften analysieren und die Auswirkungen auf die Lichtausbreitung bei niedrigen Intensitäten beschreiben,
> indem sie die Zusammenhänge mathematisch und physikalisch analysieren und in einfachen technischen Anwendungen theoretisch darstellen,
> damit sie in Folgelehrveranstaltungen und dem Berufsalltag anwendungsspezische Komponenten und Verfahren der optischen Technologien für messtechnische und materialbearbeitende Systeme auswählen können.

Module Contents

Lecture / Exercises

Propagation of electromagnetic waves:
- Lorentz oscillator
- permeability

Interaction processes of light and matter:
- (complex) refractive index
- absorption
- scattering
- luminescence

Generation of polarized light

Birefringence
- polarization
- phase plates

Energy levels:
- atomic spectra
- fluorescence / phosphorescence
- band structure

Detection of electromagnetic radiation:
- semiconductor detectors
- measuring systems for spatial distributions

Light-induced material processing:
- lithography
- ablation

Photonic crystals

Recognizing and transfer of analogies of known physical processes (excited, damped oscillator -> Lorentz oscillator)
Transfer of idealized systems to real systems and derivation of the qualitative behavior of the system
Describing and explaining relationships between quantities (absorption / refractive index) and transferring them to real materials
Analyze technical applications and questions, break them down into individual processes and solve them via known light-matter-interaction processes.

Exercises / Lab

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Exercises / Lab
Examination Types with Weights	▪ accompanying: term paper [ungraded] and ▪ final: oral examination [100%]
Workload	150 Hours
Contact Hours	57 Hours ≙ 5 SWS
Self-Study	93 Hours

Recommended Prerequisites	Physics: oscillator, wave propagation, index of refraction Material science: electrical material properties (permeability, band gap) electrical dipole Mathematics: linear algebra (vector / matrix calculations) Optics: radiometric and photometric properties, geometrical optics, wave optics
Mandatory Prerequisites	
Recommended Literature	▪ Pedrotti - Optik für Ingenieure, Springer ▪ Saleh, Teich - Grundlagen der Photonik, Wiley-VCH
Use of the Module in Other Study Programs	▪ LMW in Bachelor Elektrotechnik 2020 ▪ LMW in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.13 LT - Lasertechnik

Module ID	LT_BaOPT2021
Module Name	Lasertechnik
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME

Learning Outcome(s)

Was:
Das Modul vermittelt Kompetenzen zur Konzepzionierung (K.5, K.11), Auslegung (K.5, K.11), Analyse (K.2, K.3, K.4, K.11) und Überprüfung (K.11) von Lasern und Lasersystemen für die Lasermaterialbearbeitung unter besonderer Berücksichtigung der zugrunde liegenden physikalischen Wirkprinzipien und betriebswirtschaftlicher Aspekte (K. 14).

Vorlesungsbegleitend findet ein projektnahes (K.18) Praktikum statt, wobei die Aufgaben in Zweier-Teams zu bearbeiten sind (K.15). Sprachliche Kompetenzen (K.20) zur präzisen Darstellung technisch komplexer Zusammenhänge werden durch verpflichtende schriftliche Vorbereitung und Ausarbeitung geschult. Die durchzuführende Fehleranalyse und -diskussion sowie Spiegelung an erwartbaren Ergebnissen, vermittelt Bewertungskompetenzen (K.13).

Feste Zeitvorgaben und Termine für Vorbereitung, Ausarbeitung, Protokoll-Abgabe und ggf. Überarbeitung befördern die Entscheidungsfähigkeit (K.16) und vor allem die Selbstorganisation (K.19).

Womit:
Der Dozent vermittelt neben Wissen und Fertigkeiten in einer Vorlesung mit integrierten kurzen Übungsteilen die Kompetenz, verschiedene Eigenschaften von Lasern, Laserlicht und der Laserlicht-Materiewechselwirkung auf physikalischen Zusammenhänge zurückführen zu können und deren wirtschaftliche Konsequenzen zu beurteilen. Weiterhin wird ein Praktikum durchgeführt, welches projektartigen Charakter hat: Neben einer schriftlichen Vorbereitung sind Laser selber aufzubauen und mit eigenen optischen Aufbauten zu charakterisieren. Zu jedem Versuch ist eine schriftiche Ausarbeitung erforderlich.

Wozu:
Kompetenzen im Verständnis, des Entwurfes, der Entwicklung, der Analyse, der Überprüfungund des Einsatzes von Lasersystemen sind essentiell für Personen, die im Bereich der Photonik tätig sein wollen. Für Optometristen betrifft dies das HF 1: Laser und Lasersystem sind in der Augenheilkunde weit verbreitet. Im Bereich der Netzhaut Operationen, der refraktiven Hornhaut Chirurgie, der Behandlung des grünen Stars, der Behandlung des grauen Stars und auch der Nach-Star Behandlung werden oft Laser eingesetzt. Laseranlagen sind wissenschaftlich, technisch komplexe und teure Investitionsgüter, deren Projektierung, Anschaffung und Betreuung typischerweise in qualifiziert zusammengesetzten Gruppen stattfindet.

Module Contents

Lecture

Types of lasers and their fileds of application
gas lasers
CO2 laser
excimer laser
argon ion laser
dye laser
solid state laser
diode laser
optical pump
telecommunication
laser material processing

laser principle
absorption, spontaneous emission, stimulated emission
Maxwell-Boltzmann distribution
inversion
3- and 4 level systems
rate equations

transversal modes
Frensel number
optical regimes: geometrical optics, Fresnel diffraction and Fraunhofer diffraction
diffraction operator, Eigenvalues and Eigenfunctions
Lagueree-Gauss modes and Hermite-Gauss modes
mathematics of Laguerre-Gauss modes
transversal monomode lasers

axial modes
resonator and standing waves
comb of modes and amplification bandwith
Fabry-Perot interferometer, Etalon
frequency bandwidth of an axial mode
quality factor and finesse
axially monomode laser
temporal coherence, coherence length

properties of the gaussian beam
complete definiton with one single parameter: beam radius or Rayleigh length
Beam quality and beam quality factor
diffraction limited beam as consequence of Heisenberg's uncertainty relation

propagation of gaussian beams
beam transfer matrices
ABCD law of beam propagation
Rayleigh length as location of strongest wavefront bending
types of - and reasons for - deviations of Gaussian beam propagation from geometrical optics

resonator design
g parameter
stability of resonators as a eigenvalue problem
stability diagram
stability and mode volume

If sufficient time in the semster left:

Ultra short pulse lasers
laser materials with high amplificationbandwidth
dispersion compensation
mode coupling and Kerr effect
hard and soft aperture mode coupling
starting mechanisms for mode coupling
orders of magnitude of physical properties of ultra short pulse lasers
average power
pulse peak power
intensity
light pressure
strength of the electrical field
energy transferred to electrons
light-matter interaction
warming an melting
vaporizing and subliming
photo disruption
electron-phonon coupling time
Coulomb explosion
generation of hard x-rays
cold material processing and its applications

classify laser materials
differentiate and classify transverse modes
calculate quality factor and finess of a Fabry-Perot interferometer
calculates the propagation of Gaussian beams
calculate the stability of a resonator
calculate the most important optical parameters of a laser
choose a suitable laser and optical system for a given application

All aquired knowledge is not ment to be fact based knowledge but should be inerconnected within by a deeper understanding of the underlying physical principles and intellectual transfer should be possible:

- physics of laser light generation and physical properties of laser light
- physics of light-matter interaction
- diffraction theory

Lab

- build a laser, align and start it

- build a setup of measuring tranverse modes, measure traverse modes and calculate beam quality

- measure axial modes, find out the free spectral range, the spectral bandwith of a single mode, the amplification bandwidth of a laser, the coherence length of a laser

- build a diode pumped solid state laser

- build a unit for frequency doubling and use it in combination with a diode pumped solid state laser.

- write scientific report
describe the task
descirbe the idea of the solution
explain the experimental setup
explain the data processing
make error analysis
present the results and make a critical discussion

Teaching and Learning Methods
- Lecture
- Lab

Examination Types with Weights	▪ accompanying: exercise lab [ungraded] and ▪ final: oral examination [100%]
Workload	150 Hours
Contact Hours	34 Hours ≙ 3 SWS
Self-Study	116 Hours
Recommended Prerequisites	mathemtics: matrices differential calculus integral calculus physics / optics: basics of geometrical optics basics of wave optics
Mandatory Prerequisites	▪ Lab requires attendance in the amount of: 4 Versuchstermine ▪ Participation in final examination only after successful participation in Lab
Recommended Literature	▪ Eichler, Eichler: Laser - Bauformen, Strahlführung, Anwendungen (Springer) ▪ Poprawe: Lasertechnik (Copy-Shop AC-UNI-COPY) ▪ Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer)
Use of the Module in Other Study Programs	▪ LT in Bachelor Elektrotechnik 2020 ▪ LT in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.14 MA1 - Mathematik

Module ID	MA1_BaOPT2021
Module Name	Mathematik
Type of Module	Mandatory Module
ECTS credits	10
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Heiko Knospe/Professor Fakultät IME
Lecturer(s)	▪ Prof. Dr. Heiko Knospe/Professor Fakultät IME ▪ Prof. Dr. Hubert Randerath/Professor Fakultät IME ▪ Prof. Dr. Beate Rhein/Professor Fakultät IME

Learning Outcome(s)

> Was: Das Modul vermittelt die grundlegenden Konzepte und Methoden der Mathematik, die in der Technik benötigt werden (K. 3). Die Abstraktion und mathematischen Formalisierung von Problemen soll erlernt und angewendet werden (K. 2). Die Studierenden lernen in der Mathematik die Grundzüge wissenschaftlichen Arbeitens kennen (K. 12).
> Womit: Der Dozent/die Dozentin vermittelt Wissen und Basisfertigkeiten in der Vorlesung. In der Übung bearbeiten die Studierenden unter Anleitung Aufgaben. Die Übung wird durch Hausaufaben und Online-Aufgaben (E-Learning) ergänzt. Zusätzlich findet ein Tutorium statt.
> Wozu: Grundlegende Mathematik-Kenntnisse werden in mehreren Modulen des Studiengangs benötigt und sind anerkannter Teil der Basisausbildung. Mathematische Methoden sind essentiell zur Planung, Realisierung und Integration technischer Anwendungen (HF 1). Die Analyse und Bewertung von Anforderungen, Konzepten und Systemen erfordert häufig mathematische Methoden (HF 2).

Module Contents

Lecture / Exercises

Fundamentals
- Sets, numbers, sums, products, factorial, binomial coefficients
- Real numbers, order, intervals, completeness
- Propositional logic
- Induction
- Maps and their properties
- Real functions, boundedness, monotonicity, inverse function

Elementary functions
- Polynomials and rational functions
- Power function, root function, exponential and logarithmic functions
- Trigonometric functions

Sequences, series and continuity
- Real sequences and limits
- Series and (optional) convergence criteria
- Power series and (optional) radius of convergence
- Limits of function values
- Continuity and properties of continuous functions
- Asymptote

Differential calculus
- Differentiability and derivation
- Derivation rules
- Higher derivatives
- Extreme points and curve discussion
- Taylor polynomial, Taylor series
- Newton method
- Rule of de l`Hospital

Vectors, matrices and linear systems of equations
- Vector calculus in R^n
- Scalar product
- Vector product
- Lines
- Planes
- Matrices and computations
- Linear systems of equations and Gaussian algorithm
- Linear independence, generating set and basis
- Rank of a matrix
- Quadratic matrices and invertible matrices
- Determinant
- Cramer's rule (optional)

Complex numbers
- Normal form and calculation rules
- Polar and exponential form
- Complex sequences, series, functions, power series, Euler's formula
- Powers and roots of complex numbers

Exercises / Lab

Online maths course OMB+ with the contents:
- Numbers, fractions
- Roots, powers, proportionality
- Equations in one unknown variable

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Exercises / Lab

Examination Types with Weights	▪ accompanying: exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
Workload	300 Hours
Contact Hours	57 Hours ≙ 5 SWS
Self-Study	243 Hours
Recommended Prerequisites	-
Mandatory Prerequisites	Participation in final examination only after successful participation in Exercises / Lab
Recommended Literature	▪ P. Hartmann, Mathematik für Informatiker, vieweg Verlag ▪ T. Westermann, Mathematik für Ingenieure, Springer Verlag ▪ T. Rießinger, Mathematik für Ingenieure, Springer Verlag ▪ M. Knorrenschild, Mathematik für Ingenieure 1, Hanser Verlag ▪ W. Schäfer, G. Trippler, G. Engeln-Müllges (Hrg.), Kompaktkurs Ingenieurmathematik, Fachbuchverlag Leipzig ▪ L. Papula, Mathematik für Ingenieure und Naturwissenschaftler, Band 1 und 2, Vieweg+Teubner Verlag ▪ G. Hoever, Höhere Mathematik kompakt, Springer Verlag ▪ O. Forster, Analysis 1, Vieweg Verlag ▪ C. Blatter, Analysis 1, Springer Verlag ▪ hm4mint.nrw, Online-Kurs Höhere Mathematik 1 ▪ M. Spivak, Calculus, Cambridge University Press ▪ G. Strang, Lineare Algebra, Springer Verlag ▪ H. Grauert, I. Lieb, Differential- und Integralrechnung I, Springer Verlag ▪ W. Walter, Analysis 1, Springer Verlag
Use of the Module in Other Study Programs	▪ MA1 in Bachelor Elektrotechnik und Informationstechnik 2024 ▪ MA1 in Bachelor Technische Informatik 2020 ▪ MA1 in Bachelor Informatik und Systems-Engineering 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.15 MSS - Medizinische Statistik und Studienplanung

6.16 NDQ - Nachhaltigkeit durch Qualität

Module ID	NDQ_BaOPT2021
Module Name	Nachhaltigkeit durch Qualität
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every winter term
Module Coordinator	Ansgar Beuten/Lehrbeauftragter
Lecturer(s)	Ansgar Beuten/Lehrbeauftragter

Learning Outcome(s)

Die Studierenden kennen die verschiedenen Formen von Nachhaltigkeit (ökologisch, ökonomisch, sozial), können diese voneinander abgrenzen und im Kontext erläutern.

Die Studierenden können für die verschiedenen Formen von Nachhaltigkeit Ziele definieren, Kennzahlen ableiten und Ansätze im Hinblick auf Nachhaltigkeit bewerten.

Die Studierenden können Nachhaltigkeit zielgruppenspezifisch argumentieren und fachlich vertreten.

Die Studierenden sind in der Lage das Mindset eines Gegenübers in Themen der Nachhaltigkeit positiv zu verändern.

Die Studierenden können verschiedene Arten von Qualität benennen, erkennen, erklären und differenzieren.

Die Studierenden können verschiedene Methoden des Qualitätsmanagements erkennen, erklären, differenzieren und anwenden.

Die Studierenden kennen verschiedene Werkzeuge des Qualitätsmanagements und können diese erklären und anwenden.

Die Studierenden sind in der Lage, Verbindung zwischen Nachhaltigkeit und Qualität herzustellen, Abhängigkeiten zu erkennen und zu analysieren. Die Studierenden können durch Anwenden der erlerneten Methoden und Werkzeuge Nachhaltigkeit erzeugen und optimieren.

Module Contents

Lecture

Seminar-style Teaching

Teaching and Learning Methods	▪ Lecture ▪ Seminar-style Teaching
Examination Types with Weights	▪ accompanying: oral contribution [100%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours
Recommended Prerequisites	▪ Modul MA1: erforderlich für das Verständnis statistischer Methoden ▪ Modul MA2: erforderlich für das Verständnis statistischer Methoden
Mandatory Prerequisites	▪ Seminar-style Teaching requires attendance in the amount of: An mindesten acht Terminen des Seminars müssen sich die Studierenden anwesend sein und sich beteiligen. ▪ Participation in final examination only after successful participation in Seminar-style Teaching
Recommended Literature	

Use of the Module in Other Study Programs	▪ NDQ in Bachelor Elektrotechnik 2020 ▪ NDQ in Bachelor Elektrotechnik und Informationstechnik 2024 ▪ NDQ in Bachelor Medientechnologie 2020 ▪ NDQ in Bachelor Medientechnologie 2024 ▪ NDQ in Bachelor Technische Informatik 2020 ▪ NDQ in Bachelor Informatik und Systems-Engineering 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.17 NO - Neuroophthalmologie

6.18 OD - Raytracing optischer Instrumente

Module ID	OD_BaOPT2021
Module Name	Raytracing optischer Instrumente
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch und englisch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every summer term
Module Coordinator	Prof. Dr. Holger Weigand/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Holger Weigand/Professor Fakultät IME

Learning Outcome(s)

> Kompetenz zum Aufbau, zur Analyse, zur Optimierung und Auslegung abbildender optischer Systeme unter Zuhilfenahme von Simulationssoftware.
>
> Kompetenz zum Erwerb vertiefter Fertigkeiten im Optik-Design durch eigenständiges Durcharbeiten von Literatur und Software-Dokumentation zu einer speziellen Thematik.

Module Contents

Lecture / Exercises

> Connection of Gaussian optics, geometric optics and wave optics
> Basic concepts of aberration theory
> Modelling an imaging system in optical design
> Modelling of image errors in terms of ray and wave aberrations
> Importance of simulation software in the context of optical design

> Use of optical design software for:
> Structure of imaging optical systems
> Analysis of imaging optical systems
> Optimization of imaging optical systems
> Tolerancing of imaging optical systems

Lab

> Independent development / programming of simulation scripts with the help of English-language software documentation

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Lab
Examination Types with Weights	▪ accompanying: term paper [40%] and ▪ final: (digital) written exam [60%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours
Recommended Prerequisites	Geometric optics and wave optics Foundations in Mathematics and Physics Basic knowledge of technical English
Mandatory Prerequisites	

Recommended Literature	▪ R. Kingslake, R. B. Johnson: Lens Design Fundamentals, 2nd Edition, Academic Press, 2009 ▪ R. Kingslake: Optical System Design, Academic Press, 1983 ▪ H. Gross (Ed.): Handbook of Optical Systems, Volume 3: Aberration Theory and Correction of Optical Systems, Wiley, 2007 ▪ W. J. Smith: Modern Optical Engineering: The Design of Optical Systems, 4th Edition, McGraw-Hill, 2007
Use of the Module in Other Study Programs	▪ OD in Bachelor Elektrotechnik 2020 ▪ OD in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.19 OMT - Anwendungen optischer Messtechniken

Module ID	OMT_BaOPT2021
Module Name	Anwendungen optischer Messtechniken
Type of Module	Mandatory Module
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	6
Frequency of Offering	every winter term
Module Coordinator	Prof. Dr. Michael Gartz/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Michael Gartz/Professor Fakultät IME

Learning Outcome(s)

> Was: Die Studierenden können optische Detektoren, Spektroskopieverfahren und Reflektometriesysteme vergleichen, analysieren, beurteilen und bewerten und diese in der Optometrie anwenden,
> Womit: indem sie in Vorträgen die verschiedenen physikalischen Strahlungsdetektions- Verfahren, konkrete Vertreter und den physikalischen Aufbau von Detektoren und Grundlegendes zur optischen Spektroskopie und u.v.m. kennen lernen, sowie in Übungen selbstständig vertiefen.
> Indem sie in Praktikumsversuchen die Theorien, eigenen Berechnungen und selbst erstellten Programme durch Experimente verifizieren,
> Wozu: um später in Entwicklungsabteilungen von optischen Messtechnikunternehmen Messprobleme zu verstehen, zu analysieren, konstruktive Lösungen zu erarbeiten und zu realisieren. Um als beratende Ingenieure Kundenprobleme zu analysieren und mit am Markt befindlichen Systemen Applikationen zu erstellen, die die optometrieschen, optischen Messprobleme lösen oder am Markt befindliche Messsysteme auswählen, beurteilen und bewerten, ob sie zur Lösung in der Augenheilkunde geeignet sind."

Module Contents

Lecture / Exercises

Optical detectors:
photodiode
optical properties
spectral sensitivity
detectivity
random noise
temporal response
electrical parameters
photocurrent
capacity
saturation voltage
sensitivity / efficiency
wiring
element mode of operation
biased mode of operation
avalanchediode
optical properties
spectral sensitivity
detectivity
random noise
temporal response
electrical parameters
photocurrent
capacity
saturation voltage
sensitivity / efficiency
wiring
element mode of operation
biased mode of operation
photomultiplier
optical properties
spectral sensitivity
detectivity
random noise
temporal response
electrical parameters
photocurrent
capacity
sensitivity / efficiency
wiring
mode of operation

reflectometry
antireflection coatings
dielectric mirrors

spectroscopy
types of spectrometer
prism spectrometer
grating spectrometer
angle- and linear dispersion
spectral resolution
calibration and scaling
emission spectroscopy
absorption spectroscopy
application of spectroscopy
spectral measurement / colour measurement
non-contact layer thickness measurement

multi beam interference
Fabry-Perot interferometer
laser mode / laser resonator
free spectral range
interference filter

optical wave guide
principle of the light guiding
total reflection
composition of the light wave guide
monomode fiber
multimode fibre
step index fibre
graded index fiber
aperture
materials of the light fibre
attenuation
band width
gradient optics

optical measurement systems
light barrier
set-up
transmission ligt barrier
reflection light barrier
laser light barrier
operating factors
applications
safety engineering
velocimetry
automating

calculation
of the reflectivity
of the layer thickness based of spectral measurements

to characterise
the spectral rsponse function of optical receiver
the time response of optical detectors

selection of
photodiodes for special applications
light fibre types for claimed applications

to evaluate and to assess
the precision of optical measurements
the usabilityof different detectors for optical measurement tasks

to recognize measurement requirements

to denominate
methods for resolution of a recognized optical measurement
requirement

Lab

align of optical settings

make record series of measurements and document them

generate diagrams

checking results for plausibility

recognize and understand correlations

measurement by oscilloscope

make mathematical error analysis

realize basical optical set-ups, assemble, align, make a functional check

investigate natural scientific and technical principles by optical set-ups
project record series of measurements,
estimate error effects,
check the suitability of the set-up

make the evaluation of self generated record series of measurements
present measurement values graphically
calculate implicit values in correct mathematical manner from
measurement values
recognize logical errors and name them
simulate measurement values with given formulas

compose a traceable report
describe the conceptual formulation
state the method of resolution
represent the results in a clear manner
discuss the results in a technical, academic manner

work on complex technical tasks by teamwork
organize in subtasks
present the results and
make a critical discussion

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Lab
Examination Types with Weights	▪ accompanying: lab report [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours
Recommended Prerequisites	geometrical optics radiometry Mathematics 1 and 2 Physics wave optics
Mandatory Prerequisites	▪ Lab requires attendance in the amount of: 5 Praktikumstermine ▪ Participation in final examination only after successful participation in Lab
Recommended Literature	▪ Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer) ▪ Hecht: Optik (Oldenbourg) ▪ Bergmann, Schaefer, Bd.3, Optik, de Gruyter ▪ Schröder, Technische Optik, Vogel Verlag ▪ Naumann, Schröder, Bauelemente der Optik, Hanser Verlag ▪ Mark Johnson, Photodetection and Measurement, Mc Graw Hill
Use of the Module in Other Study Programs	▪ OMT in Bachelor Elektrotechnik 2020 ▪ OMT in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.20 PAT - Pathologie

6.21 PHA - Pharmakologie

6.22 PX1 - Praxisphase 1

6.23 PX2 - Praxisphase 2

6.24 PXP - Praxisprojekt

6.25 SGA - Anerkennung "Staatlich geprüfter Augenoptiker"

Module ID	SGA_BaOPT2021
Module Name	Anerkennung "Staatlich geprüfter Augenoptiker"
Type of Module	Mandatory Module
ECTS credits	90
Language	
Duration of Module	1 Semester
Recommended Semester	3
Frequency of Offering	every term
Module Coordinator	Studiengangsleiter(in) Bachelor Optometrie
Lecturer(s)	
Learning Outcome(s)	
Module Contents	
Teaching and Learning Methods	
Examination Types with Weights	
Workload	2700 Hours
Contact Hours	0 Hours ≙ 0 SWS
Self-Study	2700 Hours
Recommended Prerequisites	
Mandatory Prerequisites	
Recommended Literature	
Use of the Module in Other Study Programs	
Specifics and Notes	
Last Update	25.8.2025, 12:34:03

6.26 SKL - Spezielle Kontaktlinsen

6.27 SRF - Strahlung, Radiometrie, Fotometrie

Module ID	SRF_BaOPT2021
Module Name	Strahlung, Radiometrie, Fotometrie
Type of Module	Elective Modules
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every summer term
Module Coordinator	Prof. Dr. Michael Gartz/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Michael Gartz/Professor Fakultät IME

Learning Outcome(s)

> Was: Die Studierenden können Licht- und Strahlungsquellen ausmessen, charakterisieren, analysieren, vergleichen und bewerten. Sie können die Spektren von Strahlungsquellen berechnen und beurteilen und Licht und optische Strahlung differenzieren. Sie können Radiometrische Größen in Fotometrische Größen, also vom Auge wahrgenommene Größen, umrechnen.
> Womit: indem sie in Vorträgen die Radiometrischen- und Fotometrischen Grundgrößen sowie die Strahlungsübertragungsgesetze kennen gelernt haben, sowie die physikalischen Grundprinzipien zur Strahlungserzeugung und die Theorie zur Berechnung der Spektren von Hohlraumstrahlern. \nIndem sie in Übungen die Theorie und Berechnungen selbstständig vertiefen und in Praktikumsversuchen die Theorien und eigenen Berechnungen durch Experimente verifizieren,
> Wozu: um später eigene Strahlungs- oder Lichtquellen und Messsystem zur Beurteilung von Strahlungsquellen zu entwerfen und mittels mathematischer Formeln relevante optische charakterisierende Größen der Quellen zu berechnen. Um später bestehende Licht- und Strahlungsquellen für verschiedenste Beleuchtungs-Applikation auszuwählen und zu bewerten.Um die Unterschiede zwischen radiometrischen Größen und denen vom Auge wahrgenommen Größen bewerten und berücksichtigen zu können.

Module Contents

Lecture / Exercises

basic optical principles of radiometry and photometry
spectrum of electromagnetic radiation
colour
colour temperature
radiometric basic optical principles:
differential solid angle
radiant energy, power, output power per unit solid angle
power output per unit area, power output per unit solid angle
and unit emitting area, power input per unit area,
energy per unit area
photometric basic optical principles:
luminance, luminous flux, luminosity,
photometric brightness, illuminance, illumination
Lambertian radiator
radiation transfer law
material classification figures to describe the interaction
radiation with material
spectral reflectance
spectral transmittance
spectral absorptance
spectral emissivity
thermal equilibrium
stationariness

radiation laws of the Black-body radiation:
Planck's law
Rayleigh-Jeans law
ultraviolet catastrophe
Wien's law of radiation
Wien's displacement law
Stefan-Boltzmann law
Kirschhoffsche laws

Scattering
Raylegh scattering
Mie scattering

radiation detector:
photodiode
spectrometer
bolometer
spezial detectors

properties of specialized elements and optical systems:
radiationen sources
black-body radiator
grey radiator
luminescence radiator
specialized radiation sources: synchrotron, plasma source
etc.
selective radiators
pyrometric
optical set-up,
functionality
correction of environmental temperature
light sources:
halogen lamp
electric discharge lamp
LED

calculation of
conversion of the spectral energy density to spectral radiance
conversion of the frequency specific spectral radiance to
wave length specific spectral radiance
spectral radiant exitance from spectral radiance
conversion between radiometric quantity
and photometricquantity
radiant efficiency
wave length from band gap in case of led's

to distinguish
specified time of thermal radiators
specified time of luminescence radiators

to evaluate and to assess
thermal radiators
luminescence radiators
discharge radiation sources

Lab

align of optical settings

make record series of measurements and document them

generate diagrams

checking results for plausibility

recognize and understand correlations

make mathematical error analysis

realize basical optical set-ups, assemble, align, make a functional check

investigate natural scientific and technical principles by optical set-ups
project record series of measurements,
estimate error effects,
check the suitability of the set-up

make the evaluation of self generated record series of measurements
present measurement values graphically
calculate implicit values in correct mathematical manner from
measurement values
recognize logical errors and name them
simulate measurement values with given formulas

compose a traceable report
describe the conceptual formulation
state the method of resolution
represent the results in a clear manner
discuss the results in a technical, academic manner

work on complex technical tasks by teamwork
organize in subtasks
present the results and make a critical discussion

Teaching and Learning Methods	▪ Lecture / Exercises ▪ Lab
Examination Types with Weights	▪ accompanying: exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
Workload	150 Hours
Contact Hours	45 Hours ≙ 4 SWS
Self-Study	105 Hours

Recommended Prerequisites	differential calculus, integral calculus, trigonometry, elementary geometry
Mandatory Prerequisites	▪ Lab requires attendance in the amount of: 3 Praktikumstermine ▪ Participation in final examination only after successful participation in Lab
Recommended Literature	▪ Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer) ▪ Hecht: Optik (Oldenbourg) ▪ Bergmann, Schaefer, Bd.3, Optik, de Gruyter ▪ Schröder, Technische Optik, Vogel Verlag ▪ Naumann, Schröder, Bauelemente der Optik, Hanser Verlag
Use of the Module in Other Study Programs	▪ SRF in Bachelor Elektrotechnik 2020 ▪ SRF in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.28 TAI - Technologien der augenoptischen Industrie

Module ID	TAI_BaOPT2021
Module Name	Technologien der augenoptischen Industrie
Type of Module	Elective Modules
ECTS credits	5
Language	
Duration of Module	1 Semester
Recommended Semester	4-6
Frequency of Offering	every term
Module Coordinator	Studiengangsleiter(in) Bachelor Optometrie
Lecturer(s)	
Learning Outcome(s)	
Module Contents	
Teaching and Learning Methods	
Examination Types with Weights	
Workload	150 Hours
Contact Hours	0 Hours ≙ 0 SWS
Self-Study	150 Hours
Recommended Prerequisites	
Mandatory Prerequisites	
Recommended Literature	
Use of the Module in Other Study Programs	
Specifics and Notes	
Last Update	25.8.2025, 12:34:03

6.29 TO - Technische Optik

Module ID	TO_BaOPT2021
Module Name	Technische Optik
Type of Module	Mandatory Module
ECTS credits	5
Language	deutsch
Duration of Module	1 Semester
Recommended Semester	5
Frequency of Offering	every summer term
Module Coordinator	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME
Lecturer(s)	Prof. Dr. Stefan Altmeyer/Professor Fakultät IME

Learning Outcome(s)

Was:
Das Modul vermittelt Kompetenzen zur Konzepzionierung (K.5, K.11), Auslegung (K.5, K.11), Analyse (K.2, K.3, K.4, K.11) und Überprüfung (K.11) technischer optischer Systeme, insbesondere mit eigenen Lichtquellen und der daraus resultierenden verflochtenen Strahlengänge.
Vorlesungsbegleitend findet ein projektnahes (K.18) Praktikum statt. Sprachliche Kompetenzen (K.20) zur präzisen Darstellung technisch komplexer Zusammenhänge (K.12), werden durch verpflichtende schriftliche Vorbereitung und Ausarbeitung geschult. Die durchzuführende Fehleranalyse und -diskussion sowie Spiegelung an erwartbaren Ergebnissen, vermittelt Bewertungskompetenzen (K.13).

Feste Zeitvorgaben und Termine für Vorbereitung, Ausarbeitung, Protokoll-Abgabe und ggf. Überarbeitung befördern die Entscheidungsfähigkeit (K.16) und vor allem die Selbstorganisation (K.19).

Womit:
Der Dozent vermittelt neben Wissen und Basisfertigkeiten in einer Vorlesung mit integrierten kurzen Übungsteilen verschiedene Fertigkeiten bezüglich technischer, optischer Syteme, die auf die Augenoptik übertragbar sind. So sind Konzepte für die Berechnung von Hauptebenen übertragbar auf die Augenmodelle oder die Auslegungsprinzipien für optische Systeme mit eigener Lichtquelle sind übertragbar auf Spaltlampen oder OCT Systeme. Weiterhin wird ein Praktikum durchgeführt, welches projektartigen Charakter hat: Neben einer schriftlichen Vorbereitung ist der optische Aufbau aus Einzelteilen selber zu gestalten, zu justieren und zu optimieren, bevor die eigentliche Messaufgabe erfolgen kann. Zu jedem Versuch ist eine schriftiche Ausarbeitung erforderlich.

Wozu:
Kompetenzen im Verständnis, des Entwurfes, der Entwicklung, der Analyse und der Überprüfung technischen, optischen Systeme sind essentiell für Personen die im Bereich der Photonik tätig sein wollen. Für Optometristen bedeutet das ein tieferes Verständnis für den Aufbau, die Funktionsweise und die Verlässlichkeit der Messergebnisse von Optometrischen Geräten. Damit ist vornehmlich das Handlungsfeld HF.1 berührt. Einige der Konzepte lassen sich jedoch auch auf das Auge selbst übertragen und berühren damit HF.3

Module Contents

Lecture

maginification
reproduction scale
angular magnification
magnifier magnification
axial magnification

cardinal planes and points
node points and focal points in optical systems with asymmetric refrective indices
intendes shift of principal planes
telephoto lens
reverse telephot lens, laser material processing

multi lens systems
analytical calculation of a doublet
focal group of a camera
acessory lenses for macro photos
calculation of multi lens systems by repeated doublet calculation
approach of lens grouping in objectives

image shift
under water photography
special microscopy objectives foruse with cover glass
optical aberrations of plane-parallel glass sheets

Principle of Fermat
derivation of the law of refraction
wave-optical explaination of the properties of a lens
derivation of the sine condition

Aperture and F# number
aperture
of a glass fiber
of an optical imaging system
F# number
written F# number
effective F# number
relation of aperture and (effective) F# number
object- and image-related apertures and F# numbers
image brightness and exposure time

diffraction at a circular apertur
mathematical description
criteria for resolution
Rayleigh criterium
Sparrow criteriium
size of the Airy disc
smallest resolvable distance
in the object and in the image
in terms of the apertures and F# numbers
beneficial and empty magnification
technical examples: optical lithography, microscope, optical pickup for CD/DVD/blu-ray

lenses
imaging lens: glass and plastics
field lens: suitability of Fresnel lenses, requirements regarding dust

hard apertures and images of them
aperture stop and field stop
pupils and portholes
principal rays
complementary roles of aperture- and field-stops in imaging- and lighting-raypaths
principles of construction for optical devices with own light sources. Examples: overheadprojector, beamer, microscope

Microscopes
simple and joint
with and without field lens
reflection and transmission
Köhler illumination
interwoven light ptahs of imaging and illumination path

If there is enough time in the semester:

Abbe's theory of imaging
Decomposition of any object into gratings, Fourier decomposition
Diffraction orders: number of and phas-relationship
limiting resolution
contrast
off-axis illumination
how to build
resolution enhancement
decrease of contrast
principles of construction of a lithography machine

Analyse, calculate and design multi lens optical systems paraxially

Shift the principal planes to intended locations in optical systems.

Convert Apertured and F# numbers on the object- and image side.

Calculate imaging resolution of optical systems on the object- and image side.

Calculate the image shift.

Calculate the resolution loss due to angular dependent image shift of high aperture systems.

Design raypaths of optical systems with integrated illumination

Transfer the principles of construction of different microscope types to other optical devices.

Calculate the contrast of optical on- and off-axis systems

Lab

- Build and align a Gallilei and a Kepler telescope

- Determine the focal lenght of an objective with the method of Abbe, Bessel or different

- Determine the principal planes with the method of Abbe of by extrapolation of the reproduction scale

- Determine the resolution of a microscope with Köhler illumination

- Determine image brightness in a microscope in dependence of reproduction scale and aperture.

- Watch and compare the object and the diffraction image in the Fourier plane in a diffraction apparatus. Perform intended image manipulations by modifications in the Fourier plane. Achieve e.g. a spatial frequency doubling.

> - write scientific report
> describe the task
> descirbe the idea of the solution
> explain the experimental setup
> explain the data processing
> make error analysis
> present the results and make a critical discussion

Teaching and Learning Methods	▪ Lecture ▪ Lab
Examination Types with Weights	▪ accompanying: project work or exercise lab [ungraded] and ▪ final: (digital) written exam or oral examination [100%]
Workload	150 Hours
Contact Hours	34 Hours ≙ 3 SWS
Self-Study	116 Hours
Recommended Prerequisites	mathematics: differntial calculus integral calculus physics / optics: basics of geometrical optics basics of wave optics
Mandatory Prerequisites	▪ Lab requires attendance in the amount of: 5 Termine ▪ Participation in final examination only after successful participation in Lab
Recommended Literature	▪ Pedrotti, Pedrotti, Bausch, Schmidt: Optik für Ingenieure. Grundlagen (Springer) ▪ Hecht: Optik (Oldenbourg)
Use of the Module in Other Study Programs	▪ TO in Bachelor Elektrotechnik 2020 ▪ TO in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

6.30 VWA - Verfassen wissenschaftlicher Arbeiten

Module ID	VWA_BaOPT2021
Module Name	Verfassen wissenschaftlicher Arbeiten
Type of Module	Mandatory Module
ECTS credits	3
Language	deutsch und englisch
Duration of Module	1 Semester
Recommended Semester	7
Frequency of Offering	every term
Module Coordinator	Prof. Dr. Holger Weigand/Professor Fakultät IME
Lecturer(s)	verschiedene Dozenten

Learning Outcome(s)

> Kompetenz zum Recherchieren von Fachliteratur
> Kompetenz zum Verfassen wissenschaftlicher Aufsätze
> Kompetenz zum Ausarbeiten wissenschaftlicher Vorträge

Module Contents

Seminar

> Know different approaches to research
> Navigating libraries, catalogs and databases
> Know and use search strategies and search tools
> Generate search terms
>
> Independent literature research on a selected topic

Project

> Know the structure of a scientific paper
> Reflect on the basics of academic writing
> Know and apply the rules of scientific citation and reference
> Know and practise the structure of a scientific presentation
>
> Be able to write scientific essays
> Being able to prepare and present scientific papers

Teaching and Learning Methods	▪ Seminar ▪ Project
Examination Types with Weights	▪ accompanying: term paper [ungraded] and ▪ accompanying: project work [ungraded]
Workload	90 Hours
Contact Hours	23 Hours ≙ 2 SWS
Self-Study	67 Hours
Recommended Prerequisites	Englische Sprachkenntnisse auf dem Niveau der Sekundarstufe 2
Mandatory Prerequisites	
Recommended Literature	▪ Nach Vorgabe des / der Dozenten der Kompetenzwerkstatt

Use of the Module in Other Study Programs	▪ VWA in Bachelor Elektrotechnik 2020 ▪ VWA in Bachelor Elektrotechnik und Informationstechnik 2024
Specifics and Notes	
Last Update	25.8.2025, 12:39:14

7. Electives Catalogs

The following shows which modules can be selected in a particular elective area. The following notes and regulations apply to all elective areas:

- **When choosing modules from elective catalogs, the conditions formulated in Profiles also apply.**
- The semester in which elective modules of an elective catalog can typically be taken can be found in the study plans.
- As a rule, modules are only offered in either the summer or winter semester. This means that any required accompanying examination can only be taken in this semester. The summative examinations for modules in Faculty 07 are usually offered in the examination period after each semester.
- A completed module is recognized for a maximum of one elective area, even if it is listed in several elective areas.
- There is an admission restriction for some modules. More information on this can be found in the announcements on admission restrictions.
- Registration and admission to non-faculty modules are subject to deadlines and other conditions set by the faculty or university offering the module. Their admission cannot be guaranteed. Students must contact the relevant external lecturer in good time to find out whether they are allowed to take part in an external module and what they need to do to register and participate.
- Upon application, a suitable modules can be added to the elective area. Such an application must be submitted informally to the head of degree program at least four months before the planned participation in that module. The examination board decides on the acceptance of the application in consultation with the head of degree program and suitable teaching staff. A study achievement to be recognized
  - must fit in with the intended graduate profile of the degree program and contribute to its achievement,
  - must be oriented towards learning outcomes and must not serve solely to impart knowledge,
  - must at least correspond to the qualification level of a Bachelor's degree program,
  - must represent a meaningful increase in competence against the background of the intended course of study,
  - must have been completed by an examination and
  - must not be identical in terms of content and learning outcomes to coursework that has already been completed.
- Modules are not listed below,
  - which in the past were only recognized for an elective catalog as part of individual recognition procedures or
  - which in the past were only recognized for an elective catalog as part of a stay abroad and the associated individual learning agreement.

Stays abroad

- Students who have integrated a stay abroad into their studies and have completed coursework at a foreign university can have this recognized upon application and with the approval of the examination board.
- A Learning Agreement must be concluded with the Faculty's Recognition Officer before the start of the stay abroad. In particular, it is agreed for which mandatory modules or elective catalogs the coursework completed abroad will be recognized.

7.1 WM1 - Wahlmodul 1

Im Rahmen der Wahlmodule können Fächer aus dem Wahlmodulverzeichnis gewählt werden. Für das Wintersemester stehen folgende Fächer zur Auswahl:
You must select modules of 5 ECTS credit points in total out of this catalog.

Modules of the faculty:

Module ID	Module Name	ECTS
ABT	Abbildungstheorie	5
KL	CAD-Konstruktion für individuelle optische Sehhilfen	5
LMK	Mikroskopieverfahren	5
LMW	Licht-Materie-Wechselwirkung	5
LT	Lasertechnik	5
NDQ	Nachhaltigkeit durch Qualität	5
VIS	undefined	undefined

7.2 WM2 - Wahlmodul 2

Im Rahmen der Wahlmodule können Fächer aus dem Wahlmodulverzeichnis gewählt werden. Für das Sommersemester stehen folgende Fächer zur Auswahl:
You must select modules of 5 ECTS credit points in total out of this catalog.

Modules of the faculty:

Module ID	Module Name	ECTS
NDQ	Nachhaltigkeit durch Qualität	5
OD	Raytracing optischer Instrumente	5
SRF	Strahlung, Radiometrie, Fotometrie	5
TAI	Technologien der augenoptischen Industrie	5

7.3 WM3 - Wahlmodul 3

Im Rahmen der Wahlmodule können Fächer aus dem Wahlmodulverzeichnis gewählt werden. Für das Wintersemester stehen folgende Fächer zur Auswahl:
You must select modules of 5 ECTS credit points in total out of this catalog.

Modules of the faculty:

Module ID	Module Name	ECTS
ABT	Abbildungstheorie	5
KL	CAD-Konstruktion für individuelle optische Sehhilfen	5
LMK	Mikroskopieverfahren	5
LMW	Licht-Materie-Wechselwirkung	5
LT	Lasertechnik	5
NDQ	Nachhaltigkeit durch Qualität	5
VIS	undefined	undefined

8. Profiles

In diesem Studiengang sind keine Studienschwerpunkte vorgesehen

9. Examination Types

The forms of examination referenced in the module descriptions are explained in more detail below. The explanations are taken from the examination regulations, §19ff. In case of deviations, the text of the examination regulations applies.

(Digital) Written exam

Written, paper-based or digitally supported examination. Details are regulated in §19 of the examination regulations.

Oral examination

Examination to be taken orally. Details are regulated in §21 of the examination regulations.

Oral contribution

See §22, para. 5 of the examination regulations: An oral contribution (e.g. paper, presentation, negotiation, moderation) serves to determine whether students are capable of independently working on a practice-oriented task within a specified period of time using scientific and practical methods and presenting it in a technically appropriate manner by means of verbal communication. This also includes answering questions from the auditorium regarding the oral presentation. The duration of the oral presentation is determined by the examiner at the beginning of the semester. The facts relevant to the grading of the oral presentation are to be recorded in a protocol; students should also submit the written documents relating to the oral presentation for documentation purposes. Students must be notified of the grade no later than one week after the oral presentation.

Technical discussion

See §22, Para. 8 of the examination regulations: A technical discussion serves to determine professional competence, understanding of complex technical contexts and the ability to solve problems analytically. Students and examiners have roughly equal speaking time in the technical discussion in order to enable a discursive technical exchange. One or more discussions are held with an examiner during the semester or in summary form. Students should present and explain practice-related technical tasks, problems or project plans from the degree program and explain the relevant technical background, theoretical concepts and methodological approaches for processing the tasks. Possible solutions, procedures and considerations for solving the problem must be discussed and justified. The facts relevant to the grading of the technical discussion must be recorded in a protocol.

Project work

See §22, Para. 6 of the examination regulations: The project work is an examination that consists of independently working on a specific problem under supervision using scientific methodology and documenting the results. In addition to the quality of the answer to the question, the organizational and communicative quality of the implementation, such as slides, presentations, milestones, project plans, meeting minutes, etc., are also relevant for assessment.

Lab report

See §22, para. 10 of the examination regulations: An internship report (e.g. experimental protocol) serves to determine whether students are capable of independently carrying out a practical laboratory task within a specified period of time, as well as documenting, evaluating and reflecting on the process and results in writing. Preparatory homework may be required before the actual experiment is carried out. Technical discussions may take place during or after the experiment. Internship reports can also be admitted to the examination in the form of group work. Students must be notified of the assessment of the practical placement report no later than six weeks after submission of the report.

Exercise lab

See §22, para. 11 of the examination regulations: The examination form “practical training” tests the technical skills in the application of the theories and concepts learned in the lecture as well as practical skills, for example the use of development tools and technologies. For this purpose, several tasks are set during the semester, which are to be solved either alone or in group work, on site or as homework by a given deadline. The solutions to the tasks must be submitted by the students in (digital) written form. The exact criteria for passing the examination will be announced at the beginning of the corresponding course.

Exercise lab under examination conditions

See §22, para. 11, sentence 5 of the examination regulations: A “practical training course under examination conditions” is a practical training course in which the tasks are to be completed within the time frame and under the independent conditions of an examination.

Term paper

See §22, para. 3 of the examination regulations: A term paper (e.g. case study, research) serves to determine whether students are capable of independently completing a specialist task in written or electronic form using scientific and practical methods within a specified period of time. The topic and scope (e.g. number of pages of the text section) of the term paper are determined by the examiner at the beginning of the semester. A declaration of independence must be signed and submitted by the candidate. In addition, technical discussions may be held.

Learning portfolio

A learning portfolio documents the student competence development process by means of presentations, essays, excerpts from internship reports, tables of contents of term papers, notes, to-do lists, research reports and other performance presentations and learning productions, summarized as so-called “artefacts”. The learning portfolio only becomes an examination item in conjunction with the student's reflection (in writing, orally or in a video) on the use of these artifacts to achieve the learning objective previously made transparent by the examiner. During the creation of the learning portfolio, feedback on development steps and/or artifacts is given over the course of the semester. A revised form of the learning portfolio - in handwritten or electronic form - is submitted as the examination result following the feedback.

Single / Multiple choice

See §20 of the examination regulations.

Access colloquium

See §22, para. 12 of the examination regulations: An entrance colloquium serves to determine whether the students fulfill the specific requirements to be able to work independently and safely on a defined practical laboratory task using scientific and practical methods.

(Intermediate) Certificate

See §22, para. 7 of the examination regulations: A test/intermediate test certifies that the student has completed a piece of coursework (e.g. draft) to the required standard. The scope of work to be completed and the required content and requirements can be found in the respective module description in the module handbook and in the assignment.

Open book preparation

The open book assignment (OBA) is a short term paper and therefore an unsupervised written or electronic examination. It is characterized by the fact that, according to the examiner's declaration of aids, all aids are generally permitted. Special attention is drawn to the safeguarding of good scientific practice through proper citation etc. and the requirement of independence in the performance of each examination.

Thesis

Bachelor's or Master's thesis as defined in the examination regulations §25ff: The Master's thesis is a written assignment. It should show that the student is capable of independently working on a topic from their subject area within a specified period of time, both in its technical details and in its interdisciplinary contexts, using scientific and practical methods. Interdisciplinary cooperation can also be taken into account in the final thesis.

Colloquium

Colloquium for the Bachelor's or Master's thesis as defined in the examination regulations §29: The colloquium serves to determine whether the student is able to present the results of the Master's thesis, its technical and methodological foundations, interdisciplinary contexts and extracurricular references orally, to justify them independently and to assess their significance for practice.

10. Profile Module Matrix

The following section describes the extent to which the modules of the degree program support and develop the competencies and fields of action of the study program as well as certain study program criteria as defined by the University of Applied Science TH Köln.

Abbr.	Module Name	HF1 - Auslegung, Entwicklung un...	HF2 - Verständnis der physiolog...	HF3 - Untersuchung optischer Wa...	K.1 - Finden sinnvoller Grenzen...	K.2 - Abstrahieren	K.3 - Optische Vorgänge in Real...	K.4 - Erkennen, Verstehen und a...	K.5 - MINT Modelle nutzen	K.6 - Augenoptische Systeme sim...	K.7 - Augenoptische Systeme ana...	K.8 - Augenoptische Systeme ent...	K.9 - Augenoptische Systeme rea...	K.10 - Augenoptische Systeme prü...	K.11 - Informationen beschaffen ...	K.12 - Optometrische Zusammenhän...	K.13 - Arbeitsergebnisse bewerte...	K.14 - Betriebswirtschaftliches ...	K.15 - Komplexe Aufgaben im Team...	K.16 - In unsicheren Situationen...	K.17 - Gesellschaftliche und eth...	K.18 - Lernkompetenz demonstrier...	K.19 - Sich selbst organisieren ...	K.20 - Sprachliche und interkult...	SK.1 - Global Citizenship	SK.2 - Internationalisierung	SK.3 - Interdisziplinarität	SK.4 - Transfer
ABT	Abbildungstheorie	●				●	●	●	●	●			●	●	●	●	●		●	●		●	●	●				
AVW	Visuelle und auditive Wahrnehmung	●	●	●			●	●																			●	
BAA	Bachelorarbeit	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●				
BMO	Bildgebende Verfahren der Optometrie	●	●	●	●	●	●	●	●	●	●	●		●	●	●					●			●				
BWR	Betriebswirtschaft und Recht	●				●									●		●	●			●	●		●	●		●	
EPR	Erstsemesterprojekt	●					●	●			●	●	●	●	●	●	●			●	●	●	●	●	●				
KL	CAD-Konstruktion für die Optometrie	●	●	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●				
KOLL	Kolloquium zur Bachelorarbeit	●	●	●	●	●										●	●			●	●			●	●			
KOP	Kinderoptometrie		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●			
LB	Licht- und Beleuchtungstechnik ergonomischer Arbeitsplätze	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●						●	●			
LMK	Mikroskopieverfahren	●				●	●	●	●						●		●			●		●	●	●	●			
LMW	Licht-Materie-Wechselwirkung	●	●		●	●	●		●		●				●		●											
LT	Lasertechnik	●				●	●	●	●						●		●	●	●	●		●	●	●	●			
MA1	Mathematik	●	●			●			●	●	●	●	●		●		●		●					●				
MSS	Medizinische Statistik und Studienplanung		●		●	●		●	●		●				●	●	●	●	●	●	●	●	●	●	●			

Abbr.	Module Name	HF1 - Auslegung, Entwicklung un...	HF2 - Verständnis der physiolog...	HF3 - Untersuchung optischer Wa...	K.1 - Finden sinnvoller Grenzen...	K.2 - Abstrahieren	K.3 - Optische Vorgänge in Real...	K.4 - Erkennen, Verstehen und a...	K.5 - MINT Modelle nutzen	K.6 - Augenoptische Systeme sim...	K.7 - Augenoptische Systeme ana...	K.8 - Augenoptische Systeme ent...	K.9 - Augenoptische Systeme rea...	K.10 - Augenoptische Systeme prü...	K.11 - Informationen beschaffen ...	K.12 - Optometrische Zusammenhän...	K.13 - Arbeitsergebnisse bewerte...	K.14 - Betriebswirtschaftliches ...	K.15 - Komplexe Aufgaben im Team...	K.16 - In unsicheren Situationen...	K.17 - Gesellschaftliche und eth...	K.18 - Lernkompetenz demonstrier...	K.19 - Sich selbst organisieren ...	K.20 - Sprachliche und interkult...	SK.1 - Global Citizenship	SK.2 - Internationalisierung	SK.3 - Interdisziplinarität	SK.4 - Transfer
NDQ	Nachhaltigkeit durch Qualität		●			●	●				●		●		●	●	●			●							●	●
NO	Neuroophthalmologie		●	●	●	●	●	●	●		●			●	●	●	●		●	●	●	●	●	●				
OD	Raytracing optischer Instrumente	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●						●	●			
OMT	Anwendungen optischer Messtechniken	●	●	●	●	●	●	●	●	●	●			●	●	●	●		●	●				●	●			
PAT	Pathologie		●		●	●	●	●	●						●	●	●				●	●	●					
PHA	Pharmakologie		●	●	●	●	●	●	●						●	●	●			●	●	●	●	●	●			
PX1	Praxisphase 1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
PX2	Praxisphase 2	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
PXP	Praxisprojekt	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●			
SGA	Anerkennung "Staatlich geprüfter Augenoptiker"																											
SKL	Spezielle Kontaktlinsen	●	●	●	●	●	●	●	●		●	●	●	●	●	●	●		●	●	●	●	●	●	●			
SRF	Strahlung, Radiometrie, Fotometrie	●	●	●	●	●	●	●	●	●	●			●	●	●	●							●	●			
TAI	Technologien der augenoptischen Industrie																											
TO	Technische Optik	●				●	●	●	●						●	●	●			●		●	●	●	●			
VWA	Verfassen wissenschaftlicher Arbeiten	●	●	●											●	●	●			●	●	●	●	●	●			

11. Version History

The table below lists the different versions of the course offer. The versions are sorted in reverse chronological order with the currently valid version in the first row. The individual versions can be accessed via the link in the right-hand column on the right.

Version	Date	Changes	Link
1.4	2024-11-29-12-00-00	1. Version zur Abstimmung im Fakultätsrat	Link
1.3	2024-11-29-12-00-00	1. Begutachtete Version für Reakkreditierung 2024 2. Neues Layout für sämtliche Modulhandbücher	Link
1.2	2024-02-23-15-00-00	1. Generelle Überarbeitung des Layouts 2. Eingangstexte bei Wahlmodulkatalogen und Schwerpunkten überarbeitet und POs angeglichen 3. Lehrveranstaltung BWR (Kim) sowohl im Sommer- als auch Wintersemester. 4. Modellierung von Energiesystemen der Fakultät 09 als wählbares Modul im allgemeinen Wahlkatalog im Master Technische Informatik	Link
1.1	2023-03-08-16-00-00	1. Licht- und Beleuchtungstechnik (LB) Wintersemester-Wahlmodulen zugeordnet; BaTIN-Modul "Web-Architekturen" SGL zugeordnet und vakante Lehrveranstaltung vorerst entfernt.	Link
1.0	2023-02-24-20-00-00	1. Allgemeine Bereinigung von kaputten Links (http 404)	Link