

Faculty of Engineering and Health – English and English-friendly course offer during winter semester 2023 / 2024

Courses taught in English:

- **Business Planning (3 ECTS) (Achim Ibenthal)**

Students will acquire an entrepreneurial viewpoint in relation to the preparation and implementation of projects.

This includes the acquisition of projects, knowledge of the basic elements of business plans and their preparation, mastery of elementary techniques for the preparation of projects, business plans and their preparation, mastery of elementary techniques of project planning and preparation, and knowledge of important aspects of project management, such as planning control, budget, resource and risk management.

The knowledge is demonstrated by means of a team-oriented example project for the preparation of a business plan.

- **Multimedia Communications Technology (3 ECTS) (Achim Ibenthal)**

Students will learn the theoretical basics of representation, coding and transmission of multimedia data. In particular, they will be able to adapt the representation of data to different media, such as mobile or home devices, depending on their source model.

Another aspect is the transmission of audiovisual data via channels with different requirements on bandwidth and real-time behaviour. The students will be able to combine knowledge from different areas of communication technology and apply it in a problem-oriented manner.

- **Tolerancing of Opto-Mechanical Systems (3 ECTS) (Christoph Gerhard/Kai Bröking)**

Students will learn to:

- fundamentally understand relevant manufacturing tolerances, reproduce and explain them
- independently apply acquired knowledge to the analysis and evaluation of opto-mechanical systems and independently calculate solutions
- confidently classify the influences of production technology on the imaging quality of opto-mechanical systems

Courses in which course materials and exams will be available in English:

- Basics and Applications of Plasmas (5 ECTS) (Christoph Gerhard)

The goals of this course are to learn and understand the principles and basics of plasma physics and gas discharges as well as to comprehend the mechanisms and interactions within plasmas on the one hand and the relevant plasma-surface interactions and related effects on the other hand. Based on this knowledge, applications of technical plasmas in materials science and photonics are understood and can be described. At the end of the course, the attendees will thus have learnt the necessary theory and developed skills in basic and applied plasma physics and technology. Thanks to a number of exercises, case studies and worked examples that are worked out in the course of the lecture, the participants will be able to describe plasmas and to identify and configure relevant plasma parameters for technical applications.

- Computer-Assisted Optical System Design (5 ECTS) (Christoph Gerhard)

In the frame of this course, the essential and relevant basics for computer-assisted optical system design are treated. The lessons include the following theory:

1. Introduction to imaging models

(basic considerations, basic lens parameters, paraxial imaging, geometric-optical imaging, wave optics)

2. Calculation of optical systems

(lensmaker's equation, imaging equation, magnification, compound lenses, condition for achromatism, Gaussian beam propagation)

3. Basic considerations for lens design

(analysis of imaging tasks, finding appropriate start systems, considering general conditions)

4. Aberrations/defects in optical systems

(Seidel sums, spherical aberration, chromatic aberration, coma, astigmatism, Petzval field curvature, distortion, ghost images, wave aberrations, contrast)

5. Evaluation of imaging performance using graphs and tables

(transverse ray aberration (TRA) diagram, wave front plots, spot diagrams, field diagrams, modular transfer function (MTF) diagrams, Seidel bars)

6. From task to solution

(definition and choice of start systems, optimization, evaluation, documentation)

7. Impact of manufacturing tolerances

(glass bulk defects, surface defects, form deviations, position tolerances)

In addition to theory, this course includes notable practical training (20 hrs.) using the free software PreDesigner and Winlens 3DBasic. Both programs are introduced and the use of this software is practiced and exercised on the basis of selected use-oriented examples. Such practical training is performed accompanying to theory and includes the choice of appropriate optical systems for a given task, the modification/optimization of such systems, and the evaluation of its imaging performance.

The learning outcomes of this course are:

- Learning and understanding the basic considerations of optical system design
- Analysing imaging tasks and finding appropriate solutions
- Evaluating optical systems using software tools
- Using optical design software, setting up simple optical systems

- **Optics Manufacturing** (1 ECTS) (Christoph Gerhard)

This course covers particularly used and applied machines, working materials, testing procedures, and machining steps for classical optics manufacturing. Moreover, it addresses the production and specification of optical glasses as well as unconventional production techniques and novel approaches. It also provides an overview on optical materials and components; presents an introduction and explanation of the necessary considerations and procedures for the initial definition of manufacturing tolerances and the relevant industrial standards for optics manufacturing; and addresses the assembly of opto-mechanical setups and possible manufacturing errors, and the impact of the resulting inaccuracies.