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| **Department** | SciTec |
| **Degree programme** | SI |
| **Module name** | **Optical Instruments** |
| **Module number** | **SciTec.2.200** |
| **Study and Examination Regulations** | ER-version 38 (of 21.03.2018),<br>ER-version 39 (of 23.07.2019),<br>ER-version 41 (of 16.07.2021) |
| **Compulsory/ compulsory optional/ optional module** | compulsory optional module |
| **Module coordinator** | Prof. Dr. Robert Brunner |
| **Module content** | Fundamentals in ray-optics as a basis for the understanding of the working principle of optical instruments:<br>▪ Fresnel-Principle (principle of least time)<br>▪ imaging-equation, optical properties of a lens-makers formula<br>▪ aperture and field stop, pupils and windows<br>▪ aberrations (chromatic, spherical, coma, astigmatism, distortion, field curvature)  correction of aberrations<br>Wave optics:<br>▪ Huygens-Principle, grating equation, Abbe-theory<br>▪ Maxwell-Equations, Fourier-Optics, Fraunhofer-Diffraction, Rayleigh-Criterion, DOF<br>Introduction into the structure and working principles of optical instruments:<br>▪ Eye and visual perception, microscopy (bright-field – dark-field, phase-contrast, Fluorescence-Microscope)<br>▪ optical Lithography (deep-UV – EUV, illumination systems phase masks)<br>▪ spectral sensors (Czerny-Turner, imaging spectrometer)<br>special modern optical elements:<br>▪ diffractive optical elements<br>▪ switchable elements |
| **Learning objectives** | After completing the module, the students are able to:<br>▪ explain the basic principle of ray optics and apply the competency to simple optical systems.<br>▪ transfer basic optical concepts to application-oriented problems.<br>▪ to describe the basic wave optical aspects, in particular to explain the wave-optical influence on optical resolution.<br>▪ to compare different optical instruments such as microscopes, projection units, telescopes and spectroscopic systems. |
| **Course type (lecture, seminar, exercises, practical course)** | 3 L – 0 S – 0 E – 1 P |
| **Recommended literature** | ▪ Pedrotti: Introduction to Optics. Addison-Wesley; 3rd edition, 2006<br>▪ Hecht: Optics. Addison-Wesley; 4th edition, 2001<br>▪ Born, Wolf: Principles of Optics; Cambridge University Press; 7th edition, 1999<br>▪ Goodman: Introduction to Fourier Optics; McGraw-Hill, 1996 |
| **Learning materials** | self-provided manuscript/ CD with lecture transparencies |
| **Method(s) of instruction/ media being used** | lecture and practical course |
| **Level/ category** | Master (category: 2) |
| **Which semester (winter/ summer term)** | summer term |
| **Which semester during the programme** | 2 |
| **Requirements for attendance, necessary knowledge** | Basic courses in Physics and Mathematics |
| **Assessment (written/ oral test, paper, etc.)** | Written examination (90 minutes),<br>course achievement: practical course |
| **ECTS credits** | 6 |
| **Work load in:** | 180 h of total work load, therefrom<br>▪ 60 h of presence at university<br>▪ 120 h of self-study |
| **Usability of this module** | Micro- and Nanostructures, Precision Instrumentation, Research Internship, |

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| | Master Thesis |
| **Frequency of offer** | Every study year |
| **Duration of module** | 1 semester |
| **Place/ room** | Ernst-Abbe-Hochschule Jena - University of Applied Sciences Jena |
| **Time** | According to schedule |
| **Language(s)** | English |