Supplementary Course (EVA) in the MSE programme

Title: Introductory optics for photonics

Short Code: rEVA_IntroOpt

Credits	3
Profile	Photonics and Laser Engineering (Pho)
Responsible Institute /Centre	Institute of Computational Physics (ICP)
Responsible lecturer and contact informtion	**Beat Ruhstaller (beat.ruhstaller@zhaw.ch)**
Type and duration of examinations	Written test (70%) and report (30%)
Start date and duration	Semester: Autumn Detail: The exact dates for the five-day teaching block before the start of the semester (in September) will be determined together with the students.
Location	ZHAW, Lagerstrasse (ZL), Zürich
Course type	Block seminar: • 5 teaching days (~35%) • Short report on a mini-project (~30%) Written test (~35%)
Language of instruction	English
Short description (max. 300 characters)	This EVA is an intensive 5-day introduction into the fundamentals of optics as they are required in photonics. It will level out the different levels of competence in optics brought by the students from their respective BSc engineering courses of studies. The course addresses primarily the students beginning their studies in the Photonics profile.
Contents and Learning Objectives	At the end of this intensive course the students will know the conceptual differences between the three different ways of seeing light: as a ray, as a wave or as quanta (photons). The students will be able to decide which model is best suited for the applications of optics in photonics. In particular, they will be introduced into the following sub-fields of optics: **Part 1 - Geometrical optics** • Basics of geometrical optics • Optical imaging with lenses • Thin lenses / Thick lenses • Apertures • Mirrors • Aberrations • The human eye, magnifying lenses

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	• Basics of cameras • Microscope, telescope, teleobjective, zoom-camera -> as exercises **Part 2 – Wave optics** • Concept EM-wave • Maxwell equations and wave equation (incl. rot, div, grad) • Intensity & Poynting vector • Polarization concept (TE, TM, …) • Reflection and refraction at an interface – Fresnel equations • Interference and Fabry Perot interferometer • Diffraction: Frauenhofer diffraction slit/circular aperture Gratings (ref/transmission) Fresnel lens **Part 3 – Light-matter interactions: Photons, atoms and short introduction to materials science** • Photons and atoms • Interaction of light with bound electrons: mechanisms at the atomic level • Interaction of photons with systems of atoms (dielectric materials) • Interaction of light with free electrons • Interaction of light with metals, the Drude model			
Prerequisites	None.			
Literature	Course material will be provided digitally.			
Special requirements	None.			
Offer for profiles	Aviation (Avi)	☐	Business Engineering (BE)	☐
	Computer Science (CS)	☐	Data Science (DS)	☐
	Electrical Engineering (EIE)	☒	Energy & Environment (EnEn)	☒
	Mechanical Engineering (ME)	☒	Mechatronics & Automation (MA	☐
	Medical Engineering (Med)	☒	Photonics and Laser Engineering (Pho)	☒
	Information and Cyber Security (ICS)	☐	Civil Engineering (CE)	☐