

Name of programme: International Semester Information Technology / System Engineering

Title of Module	Specialty fibers, fiber-optic and sensor applications
Responsible person	Prof. Dr. Karl-Friedrich Klein
Teacher	Prof. Dr. Karl-Friedrich Klein
Module Code	E2F268
Type of Module	<input type="radio"/> obligatory module (Pflichtmodul), <input checked="" type="radio"/> elective module (Wahlpflichtmodul)
Level (BA / MA)	Bachelor
Language	English (German on demand)
Related Degree Programme/s	General Electrical Engineering, Communications Engineering and Computer Networks
Department	IEM
Location	<input type="radio"/> Gießen, <input checked="" type="radio"/> Friedberg
Availability/frequency of module	<input type="radio"/> every semester, <input type="radio"/> annually in the Winter Semester, <input checked="" type="radio"/> annually in the Summer Semester,
Hours per Week / Workload	4 HpW, contact hours per week 150 H in total
Number of CrP/ECTS	5 ECTS/CrP
Forms of instruction	<input checked="" type="radio"/> lecture <input type="radio"/> seminar <input checked="" type="radio"/> supervised training <input type="radio"/> Laboratory Practical Course
Qualifications and Goals	Learning outcomes: Knowledge: complementary knowledge of specialty fibers for use outside of the telecom / data transmission, for example in industrial, medical and measurement applications; complementary information of optical and fiber optic systems in modern sensors and related principles (intrinsic and extrinsic fiber optic sensors); knowledge of light sources (e.g. as LED and laser), detection systems and other components for fiber optic special applications Skills: qualification for implementation of optical and fiber optic systems with special fibers and their adaptations to the demands in e.g. industrial applications knowing their limits Competences: Design and evaluation of simple optical and fiber optic systems for special applications and sensor systems including the needed components, especially light sources.
Short Description of Contents	Fiber optic systems. Basics of Ray and Wave Optics. Light Sources: Laser, LED, etc. Detector systems: internal and external photoelectric effect, Spectrometers with PDA/CCD. Specialty fibers, properties of multimode and singlemode fibers: refraction and total reflection of light, attenuation, dispersion, bending, cut-off wavelength, damage, connectors, cables. Fiber optic applications. Optical systems. Extrinsic optical sensors (examples). Intrinsic sensors (microbending, evanescent field sensors, fiber Bragg sensors, OTDR and Raman effect, polarimeter). interferometric sensors without and with optical fibers.
Description of Contents (Umfang, unbeschränkt)	Content: Introduction to fiber optic systems. Basics of Ray and Wave Optics. Light Sources: Laser, LED, and other sources. Detector systems: internal and external photoelectric effect, Spectrometers with PDA/CCD. Overview of fiber optic: specialty fibers and properties of multimode and singlemode fibers: refraction and total reflection of light, attenuation, dispersion, bending, cut-off wavelength, damage, connectors/plugs and cables. Fiber optic applications in industry, medicine, analytics including data acquisition. Optical systems with components for sensors and modulation of optical parameters. Extrinsic optical sensors (examples). Intrinsic sensors (microbending, evanescent field sensors, fiber Bragg grating sensors distributed based on OTDR and Raman effect, polarimeter). interferometric sensors without and with optical fibers. Future applications.
Prerequisites	English level B2, basics of digital communication.
Assessment	<input type="radio"/> oral (<input type="radio"/> examination of xx minutes, <input type="radio"/> presentation), <input checked="" type="radio"/> written (x examination of xx minutes, <input type="radio"/> term paper), other:

Literature/Textbooks	<p>F.Mitschke: "Glasfasern: Physik und Technologie", VDE-Verlag</p> <p>W.Bludau: "Lichtwellenleiter in Sensorik und optischer Nachrichtentechnik", Springer (1998)</p> <p>M.Löffler-Mang: "Optische Sensorik", Vieweg (2008)</p> <p>E.Udd, B.Spillman: "Fiber-optic sensors: an introduction for engineers and scientists", John Wiley & Sons; 2. Auflage (2011), ISBN-10: 0470126841</p> <p>W. Glaser: "Photonik für Ingenieure", Verlag Technik GmbH (1997)</p> <p>W.Bludau: "Lichtwellenleiter in Sensorik und optischer Nachrichtentechnik", Springer (1998)</p> <p>D. Derickson (ed.): "Fiber Optic Test und Measurements ", Prentice Hall (1998)</p> <p>Wrobel, C.P.: Optische Übertragungstechnik in der Praxis , VDE-Verlag, 2004</p>
Other	