6.2 Modul Microwaves

Modulbezeichnung	**Microwaves**
Kürzel für Stundenplan	MIC
Semester	6
Modulverantwortliche(r)	Prof. Dr.-Ing. Stefan Bartels
Dozent(in)	Prof. Dr.-Ing. Stefan Bartels
Sprache	Englisch
Zuordnung zum Curriculum	Internationales Studium Elektrotechnik
Lehrform	3 V, Gruppengröße ca. 30, mit integrierten Übungen, 1 Pr, Gruppengröße max. 12
Arbeitsaufwand	64 h Präsenz Vorlesung incl. Übung + Praktikum 66 h Vor- und Nachbereitung Vorlesung und Übung 20 h Vor- und Nachbereitung Praktikum
Kreditpunkte (gem. ECTS)	5
Voraussetzungen	Knowledge in Radio Frequencies
Lernziele / Kompetenzen	The students will be able to design and analyze systems and subsystems for use in microwave communication. They can apply RF design techniques in the microwave frequency range using various specific microwave technologies such as microstrip, wavequide or wave in dielectric. They can design linear antennas as well as reflector- or horn-antennas for various purposes. They are familiar with matching network design using lumped or distributed elements of various technologies. In the laboratory they gain the ability to handle microwave-measurement-equipment such as spectrum-analyzers and scalar and vector network-analyzers. Two experiments are intended to be performed as a complete little project for the students A microvave filter`s specification is given and the students elaborate all steps that are needed to realize a 1st prototype such as CAD-based filter-design, optimization, manufacturing of the filter and finally evaluate the S-parameters by vector network-analysis.
Inhalt	**Introduction (Workload 2h)** **Antennas (Workload 30h)** • Radiation / Plane Wave • Polarization • Antenna Parameters (Radiation Pattern, Directivity and Gain, Effective Aperture, Input Impedance) • Power Transmission between Antennas • Hertzian Dipole • Radiation from Currents / Linear Antennas (General, Dipole Antennas)

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	• Radiation from Apertures (The Principle of Equivalence, Aperture Radiator Design, Horn Antenna, Parabolic Reflector Antenna **Wave Propagation in Different Media (Workload 25h)** • Free Space / Dielectric • Waveguide, Rectangular and Circular • Microstrip • Transmission Line Representation in Smith Chart **Components based on Transmission Lines (Workload 35h)** • Free Space / Dielectric (Quarterwave Transformer, Polarization Switches, Absorber) • Waveguide (Quarterwave Transformer, Taper, Inductor/Capacitor, Resonators, Directional Couplers) • Microstrip (Quarterwave Transformers, Resonators, Inductor/Capacitor, Planar Antenna (Patch), Quasi-Concentrated Elements, Directional Couplers) **Ferrite Components (Workload 10h)** • Fundamentals • Faraday Isolator • Circulator **Active Microwave Components (Workload 15h)** • Tubes (Travelling Wave Tube, Magnetron) • Semiconductors (Gunn Element, Impatt Diode, Transistors) **Experiments in the Lab:** • Experiment: Basic Microwave Components: (10h) • Experiment: Microstrip Filter Design (15h) (includes Introduction into CAD- Software) • Experiment: Network Analysis (8h) **Electives**: • Exp.: Antenna Design and Measurement, • Exp.: Microwave Amplifier Design and Measurement)
Literatur	• Voges, E., Hochfrequenztechnik Bd. 2, Hüthig 2002 • Roddy, D., SatelliteCommunication, MCGraw-Hill 2006 • Pehl, E., Mikrowellentechnik, VDE-Verlag 2012 • Meinke, Gundlach, Taschenbuch der Hochfrequenztechnik, Springer 1992 • Young, Electronic Communication Techniques, Prentice Hall 2003
Studien- / Prüfungsleistungen	Pr (Studienleistung), V (Prüfungsleistung): Klausur (120 Minuten)