TECHNISCHE HOCHSCHULE LÜBECK

Module: Wireless Localization

Level	Master	**Short Name**	WiLoc
Responsible Lecturers	Bartels – v. Mensenkampff, Stefan, Prof. Dr.; Hellbrück, Horst, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	1	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	SuSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Oral Exam	**Exam Language**	German/English
Exam Length (minutes)	30	**Exam Grading System**	One-third Grades
Learning Outcomes	After successful completion of this course, the students will be able to: • design antennas for radar applications. They are familiar with various radar techniques and the design of related RF-components and -systems. • apply, evaluate and benchmark localization methods, algorithms and related realizations		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Radar

(of Module: Wireless Localization)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2,5
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	75
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	1. Introduction
	
	2. Basics
	• Radar Equation
	• Coherent and Non-Coherent Pulse Radar
	• Distance to Target
	• Angular Position of Target
	• Wave Propagation
	• Reflection and Transmission at Interfaces
	
	3. Radar Antennas
	• Radiators
	  • Offset Reflector Antennas
	  • Cassegrain Reflector Antennas
	  • Multibeam Antennas
	  • Lens Antennas
	  • Dielectric Antennas
	• Antenna Arrays
	• Radomes
	
	4. Radar Cross Section
	
	5. Radar Techniques
	• CW Radar

	• Doppler Radar
	• FMCW Radar
	• MTI Radar
	• Pulse Doppler Radar
	• Tracking Radar
	    • Sequential Lobing
	    • Conical Scan
	    • Monopulse
	        • Amplitude Monopulse
	        • Phase Monopulse
	    • SAR (Synthetic Aperture Radar)

Literature	Skolnik, M. I. Introduction to Radar Systems, McGraw-Hill, 2003
Remarks	

Module Course: Localization

(of Module: Wireless Localization)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2,5
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	75
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Basics Wireless Communication
	  • Frequency ranges
	  • Modulation types, waveforms, cells
	• Algorithms
	  • Synchronization
	  • Time-Of-Flight (Measurements)
	  • Distance measurements
	  • Angle measurements
	  • Trilateration
	  • Triangulation
	• Positioning systems
	  • Cellular systems (telecommunication)
	  • Satellites (GPS)
	  • Indoor positioning
	• Applications
	• Performance evaluation
	• Summary and outlook

Literature	• Ground-Based Wireless Positioning by Kegen Yu • Beiträge zur Ultra-Wideband Ortung (Hannoversche Beiträge zur Nachrichtentechnik) Taschenbuch von Stefan Galler • Wireless Positioning: Principles and Practice, Ian Sharp, Kegen Yu, Springer • Bensky, Alan. Wireless Positioning Technologies and Applications

Remarks	