Modules MSc Communications Engineering (MSCE) PO20181 (start WS18/19)

Module ID	Module	Lecturer	Semester	ECTS	Focus on

Core Modules Communications Systems (CS): at least 10 Credits

EI7433	Adaptive and Array Signal Processing	Ivrlac	WS	5	
EI70330	Data Networks	Kellerer	WS	5	
EI70320	Channel Coding	Wachter-Zeh	WS/SS	5	
EI70350	Information Theory	Kramer	WS	5	
EI7432	System Aspects in Communications	Viering	WS	5	

Core Modules Communication Electronics (CE): at least 10 Credits

EI70510	Analog and Mixed-Signal Electronics	Brederlow	WS	5	
EI70610	Electronic Design Automation	Gräb / Li	WS	5	
EI70530	Embedded Systems and Security	Sigl	WS/SS	5	
EI7355	Nanosystems	Becherer	WS/SS	5	
EI7384	System-on-Chip Technologies	Herkersdorf	WS	5	

Elective Modules Advanced Topics: at least 5 Credits

EI79001	Advanced Topics in Communications Systems	Guest Professor	SS	5	CS
EI79002	Advanced Topics in Communications Electronics	Guest Professor	SS	5	CE

Electives: 28 Credits

Fewer electives, if you have passed more core modules or elective modules advanced topics, in total 53 credits:

EI71070	Advanced Cryptographic Implementations	De Santis	SS	5	
EI71077	Algorithms in Quantum Theory	Kramer	WS	6	CS
EI7450	Analysis, Modelling and Simulation of Communication Networks	Kellerer	SS	6	CS
EI73081	Antennas and Wave Propagation	Eibert	SS	5	CS
EI71086	Applied Machine Intelligence	Diepold	SS	9	CS
EI7411	Channel Codes for Iterative Decoding	Liva	SS	5	CS
EI7271	Chip Multicore Processors	Herkersdorf	SS	6	CS/CE
EI7440	Circuit Theory and Communications	Ivrlac	WS	5	CS/CE
EI71079	CMOS Analog-to-Digital Converters	Brederlow	SS	5	CE
EI74121	Coded Modulation	Bartz/Matuz	SS	5	CS
EI71087	Coding Theory for Storage and Networks	Wachter-Zeh	SS	5	CS
EI71004	Communication Acoustics	Seeber	WS	6	CS
EI7644	Communication Network Reliability	Mas Machuca	SS	5	CS

Module ID	Module	Lecturer	Semester	ECTS	Focus on
EI73181	Computational and Analytical Methods in Electromagnetics	Eibert	WS	6	CS/CE
EI74351	Convex Optimization	Utschick	WS	6	CS
EI71067	Digital Signal Processing for Optical Communication Systems	Fehenberger	SS	5	
EI70410	High-Frequency Amplifiers and Oscillators	Eibert	SS	5	CE
EI70630	HW/SW Codesign	Herkersdorf	WS/SS	5	CE
EI7341	Image and Video Compression	Steinbach	SS	5	CS
EI71083	Intelligent Machine Design - Mechatronics Fundamentals	Haddadin	SS	6	CE/CS
EI71064	Introduction to Quantum Networks	Nötzel	WS/SS	5	
EI71084	IoT Security	Steinhorst	WS/SS	5	CE
EI70360	Machine Learning and Optimization	Heckel	WS	5	CS
EI71018	Machine Learning for Communications	Kramer	WS	5	CS
EI71040	Machine Learning: Methods and Tools	Ecker	WS	5	CE
EI71059	Mixed Integer Programming and Graph Algorithms for Engineering Problems	Schlichtmann	WS	5	CE
EI7436	MIMO Systems	Joham	WS	6	CS
EI71095	Multi-Criteria Optimization and Decision Analysis for Embedded Systems Design	Herkersdorf	WS	5	CE
EI70220	Digital Signal Processing	Steinbach	WS/SS	5	CS
EI7352	Multimedia Communications	Steinbach	SS	5	CS
EI7353	Multi-User Information Theory	Kramer	SS	5	CS
EI7356	Network Planning	Schupke	WS	5	CS
EI5075	Optical Communication Systems	Hanik	WS	6	CS
EI7633	Optical Networks	Mas Machuca	SS	5	CS
EI74042	Mathematical Methods of Circuit Design	Gräb	WS/SS	5	CE
EI70730	Memory Technology for Data Storage	Kreupl	WS/SS	5	CE
EI7485	Physical Principles of Electromagnetic Fields and Antenna Systems	Ivrlac	SS	6	CS
EI71029	Physical Unclonable Functions	Sigl	WS	5	CE
EI71073	Quantum Computers and Quantum Secure Communications	Sepulveda	SS	5	CE
EI76471	Quantum Information Theory	Boche	WS/SS	5	CS
EI71093	Quantum Optomechanics	Weig	SS	5	CE
EI73761	Radar Signals and Systems	Siart	WS	5	CS
EI0432	Satellite Navigation	Günther	WS	6	CS
EI71060	Security in Communications and Storage	Wachter-Zeh	WS	5	CS
EI70380	Signal Processing and Machine Learning	Utschick	SS	5	CS
EI71068	Solving Inverse Problems with Deep Learning	Heckel	SS	6	
EI70240	Statistical Signal Processing	Utschick	SS	5	CS
EI70640	Synthesis of Digital Systems	Müller-Gritschneder	WS/SS	5	CE
EI71013	System Design for the Internet of Things	Steinhorst	SS	5	CE

Module ID	Module	Lecturer	Semester	ECTS	Focus on
EI5077	System-on-Chip Platforms	Herkersdorf	SS	6	CE
EI7624	Techno-Economic Analysis of Telecommunication Networks	Mas Machuca	WS	5	CS
EI50141	Testing Digital Circuits	Otterstedt	WS	5	CE
EI70550	Timing of Digital Circuits	Li	WS	5	CE
EI71053	Topics in Optimization for Data-Driven Applications	Boche	WS	5	CS
EI71075	Wireless Communications	Kramer	WS	5	CS

Laboratories: 12 Credits

EI5032	Communications Lab	Kramer	WS	6	CS
EI72071	Computational Haptics Laboratory	Steinbach	SS	6	CS
EI72561	Convex Optimization Laboratory	Utschick	SS	6	CS
EI7420	Digital Signal Processing Lab	Utschick	WS/SS	9	CS
EI50881	High-Frequency Circuit Laboratory	Eibert	WS/SS	6	CE
EI50291	Image and Video Compression Lab	Steinbach	WS/SS	6	CS
EI78049	IoT Remote Lab	Steinhorst	WS/SS	6	
EI78060	Lab CMOS A/D Converter Design	Brederlow	WS	6	CE
EI78064	Lab CMOS Voltage Regulation Circuit Design	Brederlow	SS	6	CE
EI78031	Practical Training Project Integrated Systems	Plattner	SS	6	CE
EI5042	Project Lab IC Design	Herkersdorf	WS/SS	6	CE
EI78033	Projektpraktikum Audio-Signalverarbeitung	Seeber	WS/SS	6	CE
EI78014	Projektpraktikum Sicheres SoC für das Internet der Dinge	Sigl	WS/SS	6	CE
EI7493	Signal Processing for Audio Technology	Seeber	SS	8	CS
EI5030	Simulation of Optical Communication Systems Lab	Hanik	WS/SS	6	CS
EI5069	Smart Card Lab	Sigl	WS/SS	6	CS/CE
EI78017	Software Defined Networking Lab	Kellerer	WS/SS	6	CS
EI78045	Software Defined Radio Laboratory	Boche	WS/SS	6	
EI7402	SystemC Lab	Herkersdorf	WS/SS	6	CE
EI7403	VHDL System Design Lab	Schlichtmann	WS/SS	6	CE
EI7426	Wireless Communications Laboratory	Kramer	SS	5	CS
EI50471	Wireless Sensor Networks Laboratory	Kellerer	WS/SS	6	CS

The labs count towards the final grade point average with their corresponding credit weight. For all labs at the department, there is always a special registration deadline.

Registration information for labs and details about introductory meetings are made available on the websites of the various chairs shortly before the beginning of each semester. So please check these websites.

Module ID	Module	Lecturer	Semester	ECTS	Focus on

Seminars: 5 Credits

EI73141	Brain, Mind and Cognition (Seminar)	Diepold	WS	5	CS
EI77001	Seminar Embedded Systems and Internet of Things	Steinhorst	WS/SS	5	CS
EI77009	Seminar Machine Learning	Heckel	WS/SS	5	CS
EI77011	Seminar Nano- & Optomechanical Quantum Technologies	Weig	WS/SS	5	CE
EI77015	Seminar on Coding and Cryptography	Wachter-Zeh	WS/SS	5	CS
EI77013	Seminar on Digital Communications	Kramer	WS/SS	5	CS
EI77014	Seminar on Optical Communications	Hanik	WS/SS	5	CS
EI5092	Seminar on Security in Information Technology	Sigl	WS	5	CS/CE
EI5090	Seminar on Signal Processing in Communications	Utschick	WS	5	CS
EI5091	Seminar on Topics in Antennas and Propagation	Eibert	WS	5	CS/CE
EI5087	Seminar on Topics in Communications Networking	Kellerer	WS	5	CS
EI77502	Seminar on Topics in Electronic Design Automation	Schlichtmann	WS	5	CE
EI77501	Seminar on Topics in Integrated Systems	Herkersdorf	WS	5	CE
EI77503	Scientific seminar on structure, architecture and application of sensor circuits	Brederlow	WS/SS	5	CE
EI5084	Seminar on Topics in Signal Processing	Steinbach	WS	5	CS

Interdisciplinary Courses: 8 Credits

Recommended:

	German Language Course	TUM Language Center	WS/SS	6	
EI04004	Strategic Management for Engineers	Sauerbrey	WS/SS	3	

As interdisciplinary course, any TUM course on a topic different from electrical and computer engineering (no EIxx module number) and other universities can be taken. The courses can only be counted, if there is a confirmation of the course including the number of credits. Any language course (excepting English), offered by e.g. the TUM language center, can be counted as an interdisciplinary course. If you want to be sure, if your course will be counted, please contact the program manager. The grades of the interdisciplinary modules will not count toward your final grade.

Research Internship: 12 Credits

Duration and Timing

The research internship (in German so called Forschungspraxis) is a career-related, full-time (approx. 35-40 hours per week, depending on the company) professional experience at the university or in industry with a minimum length of 9 weeks. If required by industry, we can certify that 9

weeks are required as a mandatory research internship for your studies. Usually it is scheduled immediately after the second semester until the beginning of the third semester. Please consider the following suggested timeline:

March	Start looking for research internship placement
End of July	Final Exams for semester 2
August through mid-October	Research Internship
Mid-October	Semester 3 begins
End of October	Hand in the required paperwork

Research Internship Arrangement & Registration

How to get an internship

Students must arrange for an internship themselves. The following guidelines have to be followed: In case you need a confirmation that a research internship is required by your curriculum, please contact us: msce@ei.tum.de

To find a research internship project, please contact the chairs directly. Some chairs list available projects on their website. If you want to do the research internship in industry, you have to find a professor at TUM who will supervise it. Please find a professor before signing any industry contract to avoid any inconvenience. Once you have found a research internship position, please report it to the program manager. You must write a technical report about your internship (approx. 1-2 pages per week). At the end of the research internship, you will present your results to the professor, followed by a short discussion.

Technical Report

At the end of your research internship, you must write a technical report that documents the work and presents the results. A good structure for an internship report is: cover and title page; abstracts; table of contents; introduction; problem definition; theory; implementation; testing for correctness of results, performance, usability, assessment; conclusions and ideas for future work; and references.
The total length of the report should be at least 1-2 pages per week.
You should also include one page of critical analysis (not simply a description) of the experience in terms of learning objectives and overall experience at the time of completion of the internship.