Competence coverage		G	eneral	Course	es		Cour		elated t Subject		r's Disser		
					sign								tation
GHENT					incy De					vorks			
UNIVERSITY		FPGAs	Electromagnetic-aware High Frequency Design					E012320 Mobile and Broadband Access Networks		ulation			
Master of Science in Ele	ectrical Engineering		agation	/ for FP	are High	ics		ection		nd Acce	oject	and Sim	c
Communication and Inf	formation Technology		d Propa	odology	etic-awa	Electron	Theory	ind Dete		3roadba	sign Pr	alysis a	sertatior
Academic year 2021-20	22		E022230 Antennas and Propagation	E031251 Design Methodology for	romagn	E033640 High-speed Electronics	E003600 Information Theory	E012130 Modulation and Detection	otics	le and E	E033702 Hardware-design Project	E011322 Queueing Analysis and Simulation	E091103 Master's Dissertation
Logonde			30 Anter	31 Desig		10 High-	00 Inforr	30 Modu	E019370 Robotics	20 Mobil)2 Hard	22 Queu	3 Mast
Legend: T=teaching methods E=evaluation methods			E02223	E03125	E033021	E03364	E00360	E01213	E01937	E01232	E03370	E01132	E09110
Competences in one/more scientific	Master and apply advanced knowledge in the own engineering discipline in solving complex problems.	T 11 E 11	T	T E	T	T E	T E	T E	T	T E	T	T	T
discipline(s)	Apply Computer Aided Engineering (CAE) tools and advanced communication instruments in a creative and purposeful way.	T 8	Т	Т	Т	Т	Т	T	Т	Т			
	Analyse, specify, design (based on general needs) and realise	E 7	T	T	E T	E T	E T		Е	T	T		T
	complex (opto-)electronic systems. Take into account electromagnetic phenomena during the	E 8	E T	Е	E T	E T	E T			E T	E		E T
	specification, design and realisation of complex (opto-)electronic systems.	E 6	E		Е	E	E			E			E
	Specifically for main subject 'Electronic Circuits and Systems': Know and creatively apply technology of integrated circuits for the specification, design and realisation of micro systems which integrate mechanical elements, sensors and actuators.	T 4 E 4					E		E		E		E
	Specifically for main subject 'Electronic Circuits and Systems': Analyse, specify, design (based on fairly generally formulated needs) and implement advanced algorithms for signal and data processing in information and communication systems.	T 7 E 7	T E				T E	T E	T E	T E	T E		T E
	Specifically for main subject 'Electronic Circuits and Systems': Specify and carry out measurements on complex systems that incorporate an important hardware component, and draw conclusions about the next steps in the design flow given the measurement outcomes.	T 7 E 7	T E	T E	T E	T E	T E				T E		T E
	Specifically for main subject 'Communication and Information Technology': Account for technological process limitations during the specification, design and realisation of (opto-) electronic systems.	T 4 E 4				T E	T E		T E				T E
	Specifically for main subject 'Communication and Information Technology': Analyse, specify, design (based on fairly generally formulated needs) and implement advanced algorithms and protocols for data processing and data exchange in telecommunication systems and multimedia systems.	T 7 E 7	T E				T E	T E		T E	T E	T E	T E
	Specifically for main subject 'Communication and Information Technology': Specify and carry out measurements on complex systems that incorporate an important software component, and draw conclusions about the further development path given the measurement outcomes.	T 6 E 6	E		T E		T E			T E	T E		T E
Scientific competences	Analyse complex problems and translate them into concrete research questions.	T 8 E 7	T E	T E			T E	Т	T E	T E	T E		T E
	Consult the scientific literature as part of the own research.	T 4 E 4		_			T		T		T		T
	Select and apply the appropriate models, methods and techniques.	T 10 E 10	T E	T E		T E	T	T E	T	T E	T	T E	T
	Develop and validate mathematical models and methods.	T 3 E 3	T E				T E					T E	
	Interpret research findings in an objective and critical manner.	T 6 E 6	_			T E	T	T E	T E		T E	_	T E
Intellectual competences	Independently form an opinion on complex situations and problems, and defend this point of view.	T 8 E 8	T E	T E		_	T E	T E	T	T E	T		T E
Competences	Apply knowledge in a creative, purposeful and innovative way to research, conceptual design and production.	T 7 E 6				T E	T E	T E	T E	T E		Т	T E
	Critically reflect on one's own way of thinking and acting, and understand the limits of one's competences.	T 6 E 6	T E			Т	Т	Т	Т	_			Т
	Stay uptodate with the evolutions in the discipline to elevate the	T 6		Т		E T	T	Е	E T	Т			T
	own competences to expert level. Readily adapt to changing professional circumstances.	E 5				Е	E T		E	Е	Т		E T
	Be receptive for and analyse critically the fast developments in	E 3 T 6				Т	E T		Т	Т	E		E T
Competences in	electrical engineering. Have the ability to communicate in English about the own field of	E 6 T 10	т		Т	E	E	Т	E	E	E	Т	E
cooperation and communication	specialisation. Project management: have the ability to formulate objectives,	E 10	E T	Т	E	E T	E	E T	E	Ē	E	E	E
30mmumoation	report efficiently, keep track of targets, follow the progress of the project, Have the ability to work as a member of a team in a multi	T 4	E	E	E	E	E	E	E		E		Ė
	disciplinary workingenvironment, as well as being capable of taking on supervisory responsibilities.	E 4			Е		Е		E		E		
	Report on technical or scientific subjects verbally, in writing and using graphics.	T 10 E 10	T E	T E	T E	T E	T E	T E	T E	T E	T E		T E
Societal competences	Act in an ethical, professional and social way.	T 3 E 3				T E	T E						T E
	Recognize the most important business and legal aspects of the own engineering discipline.	T 2 E 2			T E		T E						
	Understand the historical evolution of the own engineering discipline and its social relevance.	T 7 E 4				T E	T E	Т	Т	T E		Т	T E
Profession-specific	Master the complexity of technical systems by using system and process models.	T 10	Ţ	T	Т	Т	Т	T	T		T	Т	Т
competence	Reconcile conflicting specifications and prior conditions in a high	E 8	E T	E T	Т	E T	E T	E T	E T	Т	E T		T
	quality and innovative concept or process.	E 9	Е	Е	Е	Е	Е		Е	Е	Е		E

GHENT UNIVERSITY Master of Science in E Communication and In Academic year 2021-20	formation Technology		E022230 Antennas and Propagation	E031251 Design Methodology for FPGAs	E033021 Electromagnetic-aware High Frequency Design	E033640 High-speed Electronics	E003600 Information Theory	E012130 Modulation and Detection	E019370 Robotics	E012320 Mobile and Broadband Access Networks	E033702 Hardware-design Project	E011322 Queueing Analysis and Simulation	E091103 Master's Dissertation
T=teaching methods E=evaluation methods			=0222	=0312	=0330	=0336	=003€	=0121	=0193	=0123	=0337	<u>=</u> 0113	=0911
Profession-specific	Synthesize incomplete, contradictory or redundant data into usefu	I T 7	T		T	T	Т		Т			Т	Т
competence	information.	E 7	E		E	E	E		E			E	E
	Possess sufficient ready knowledge and understanding to evaluat the results of complex calculations, or make approximate estimates.	E 7	T E		T E	T E	E	E		E			T E
	Pay attention to entire life cycles of systems, machines, and processes.	T 3 E 2			Т					T E	T E		
	Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.	T 6 E 5		T E		T E	T E	Т	T E	T E			
	Pay attention to all aspects of reliability, safety, and ergonomics.	T 4 E 4			T E		T E			T E	T E		
	Have insight into and understanding of the importance of entrepreneurship.	T 2 E 2				T E					T E		
	Show perseverance, innovativeness, and an aptitude for creating added value.	T 4 E 4	T E				T E		T E				T
			W 21 E 21					W 18 E 13				W 9 E 6	W 29

EMingwALG1.1 Master and apply advanced knowledge in the own engineering discipline in solving complex problems. <<

Competences in one/more scientific discipline(s)

seminar: coached exercises ecture: plenary exercises project ecture	written examination report oral examination open book examination written examination oral examination open book examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula Knowing how to systematically explore the design space Knowing how to use programmable components such as FPGAs to implement a digital system Knowing what an RTOS is and how it differs from another OS Being able to draw Pareto curves Knowing the different sorts of interfaces and how they can be designed
seminar: coached exercises ecture: plenary exercises project ecture guided self-study seminar: practical PC room classes project	report oral examination open book examination written examination oral examination	Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula Knowing how to systematically explore the design space Knowing how to use programmable components such as FPGAs to implement a digital system Knowing what an RTOS is and how it differs from another OS Being able to draw Pareto curves
seminar: practical PC room classes project	oral examination	Knowing how to use programmable components such as FPGAs to implement a digital system Knowing what an RTOS is and how it differs from another OS Being able to draw Pareto curves
		Being able to analyse and use control and timing concepts in digital systems Being able to recognise the impact of performance measures on the implementation Being able to design a complex digital system in a hierarchical way Understanding how the design of a memory hierarchy can influence the performance of a system Being able to design and simulate test benches Being able to perform a hardware design from specification to final realisation in reconfigurable hardware
online seminar: coached exercises online lecture: response lecture	report skills test	Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity Synthesize filters and matching networks.
guided self-study oracticum ecture	oral examination report assignment	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
ecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
guided self-study conline seminar: coached exercises conline lecture conline group work seminar: coached exercises ecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
guided self-study oracticum ecture group work	written examination report assignment	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.
John John John John John John John John	nline seminar: coached exercises nline lecture: response lecture nline lecture: plenary exercises nline lecture cture: plenary exercises elf-reliant study activities acticum cture cture cture cture cture cture cture cture chinar: coached exercises nline lecture nline group work eminar: coached exercises cture oup work uided self-study acticum cture cture nline group work eminar: coached exercises cture oup work uided self-study acticum cture	nline seminar: coached exercises nline lecture: response lecture skills test oral examination open book examination report assignment open book examination report open book examination open book exa

E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E011322 Queueing Analysis and Simulation	lecture seminar: coached exercises	written examination with open questions	To assess the performance of queueing systems quantitatively and qualitatively To select the most suitable models, methods and techniques for specific queueing problems To master mathematical solution techniques for queueing problems To construct a simulation program and to process simulation results
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	evonden in de studiefiche		
E022230 Antennas and Propagation	project	oral examination report	Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	seminar: practical PC room classes	skills test	Being able to design and simulate test benches Knowing how to use programmable components such as FPGAs to implement a digital system
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	written examination report skills test oral examination open book examination	Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Synthesize filters and matching networks.
E033640 High-speed Electronics	guided self-study practicum lecture	assignment report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	project	report	Apply error detection and error correction for soft and hard decoding. Compute performance.
E012130 Modulation and Detection	group work online group work		To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	written examination report assignment	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Have entry-points to the literature and current work about robotics, sensor processing and robot control applied to a variety of autonomous robotic tasks. Understand the assumptions and rationale behind data interpretation, information extraction and artificial intelligence/machine learning applied to mobile robotics.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	lecture seminar: practical PC room classes project	written examination skills test oral examination open book examination	Knowing how to systematically explore the design space Knowing how to use programmable components such as FPGAs to implement a digital system Knowing the different sorts of interfaces and how they can be designed Being able to analyse and use control and timing concepts in digital systems Being able to recognise the impact of performance measures on the implementation Being able to design a complex digital system in a hierarchical way Understanding how the design of a memory hierarchy can influence the performance of a system Being able to design and simulate test benches Being able to perform a hardware design from specification to final realisation in reconfigurable hardware
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	written examination report skills test oral examination open book examination	Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity Synthesize filters and matching networks.
E033640 High-speed Electronics	guided self-study practicum lecture	oral examination report assignment	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,...).

Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwELEC1.2 Take into account electromagnetic phenomena during the specification, design and realisation of complex (opto-)electronic Competences in one/more scientific discipline(s) << **Teaching methods Evaluation methods** Course learning outcome Course Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche guided self-study Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering E022230 Antennas and Propagation written examination seminar: coached exercises Mitigate fading by means of diversity, including polarisation diversity report Analyse full-wave problems based on the integral equation solved by the method of moments lecture: plenary exercises oral examination open book examination Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas project lecture Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequencyselective fading Computer-aided design antennas based on the Friis formula quided self-study E033021 Electromagnetic-aware High Frequency Design Analyse microwave circuits based on impedance, admittance and scattering matrices. written examination online seminar: coached exercises report Be familiar with EMC norms. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. online lecture: response lecture skills test Synthesize filters and matching networks. online lecture: plenary exercises oral examination online lecture open book examination lecture: plenary exercises self-reliant study activities practicum lecture excursion E033640 High-speed Electronics guided self-study oral examination Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. practicum Analyze and design of active and passive high-speed circuits assignment lecture E003600 Information Theory lecture written examination Compute theoretical bounds for source and channel coding. Apply error detection and error correction for soft and hard decoding. seminar: coached exercises Apply Viterbi decoding. open book examination project Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding. E012320 Mobile and Broadband Access Networks to gain insight in network modeling algorithms and their applications/limitations guided self-study written examination to apply these techniques for routing and design problems in access networks seminar: coached exercises report to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks practicum skills test lecture participation to analyse the behavior of mobile and wireless networks through network simulations open book examination to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications E091103 Master's Dissertation Define, study and analyse the research problem in a specific domain. master's dissertation oral examination Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. assignment Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werd	len niet teruggevonden in de studiefiche		
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute the optimal quantizer. Apply error detection and error correction for soft and hard decoding. Analyse hard and soft decoding.
E019370 Robotics	guided self-study practicum lecture group work	written examination report assignment	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Represent simple motion systems with matrix groups, examine their possibilities and limitations, derive control laws for selected mobile robots.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search,

topical study, research and the

reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,...). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

<<	EMingwELEC1.4 Specifically for main subject 'Electronic Circuits and Systems': Analyse, specify, design (based on fairly generally formulated	Competences in one/more scientific discipline(s)
	needs) and implement advanced algorithms for signal and data processing in information and communication systems.	

Course	Teaching methods	Evaluation methods	on and communication systems. Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet te	ruggevonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	written examination report assignment	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Represent simple motion systems with matrix groups, examine their possibilities and limitations, derive control laws for selected mobile robots.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwELEC1.5 Specifically for main subject 'Electronic Circuits and Systems': Specify and carry out measurements on complex systems that Competences in one/more scientific discipline(s) incorporate an important hardware component, and draw conclusions about the next steps in the design flow given the measurement outcomes.

outcomes.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche		
E022230 Antennas and Propagation	practicum	skills test report	Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas
E031251 Design Methodology for FPGAs	lecture seminar: practical PC room classes	skills test	Knowing how to systematically explore the design space Being able to recognise the impact of performance measures on the implementation Being able to design and simulate test benches
E033021 Electromagnetic-aware High Frequency Design	practicum	report	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
E033640 High-speed Electronics	lecture practicum	report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute the optimal quantizer. Apply error detection and error correction for soft and hard decoding.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwELEC1.6 Specifically for main subject 'Communication and Information Technology': Account for technological process limitations Competences in one/more scientific discipline(s)

Course	Teaching methods	ctronic systems. Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** we	erden niet teruggevonden in de studiefiche		
E033640 High-speed Electronics	lecture practicum	oral examination report assignment	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E019370 Robotics	guided self-study practicum lecture group work	written examination report assignment	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Represent simple motion systems with matrix groups, examine their possibilities and limitations, derive control laws for selected mobile robots.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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EMingwELEC1.7 Specifically for main subject 'Communication and Information Technology': Analyse, specify, design (based on fairly generally Competences in one/more scientific discipline(s) formulated needs) and implement advanced algorithms and protocols for data processing and data exchange in telecommunication systems

and multimedia systems.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	ruggevonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination oral examination open book examination	Mitigate fading by means of diversity, including polarisation diversity
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E011322 Queueing Analysis and Simulation	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	To assess the performance of queueing systems quantitatively and qualitatively To select the most suitable models, methods and techniques for specific queueing problems To master mathematical solution techniques for queueing problems To construct a simulation program and to process simulation results
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwelect.8 Specifically for main subject 'Communication and Information Technology': Specify and carry out measurements on complex of competences in one/more scientific discipline(s) systems that incorporate an important software component, and draw conclusions about the further development path given the measurement

outcomes.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche		
E022230 Antennas and Propagation	practicum	skills test report	Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas
E033021 Electromagnetic-aware High Frequency Design	practicum	report	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet te	_	Evaluation methods	Course rearring cateonic	
worden met te	raggevenden in de diadienene			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report oral examination open book examination	Computer-aided design antennas based on the Friis formula Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments	
E031251 Design Methodology for FPGAs	lecture	open book examination oral examination	Knowing how to systematically explore the design space Being able to analyse and use control and timing concepts in digital systems	
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	S	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.	
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Understand the breadth and challenges faced in the field of mobile robotics. Have entry-points to the literature and current work about robotics, sensor processing and robot control applied autonomous robotic tasks.	d to a variety of
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access not to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diversi	
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.	
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverant Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagu laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literatopical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of students.	es as to

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EMingwALG2.2 Consult the scientific literature as part of the own research.

Scientific competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werd	en niet teruggevonden in de studiefiche		
E003600 Information Theory	project	report	Analyse hard and soft decoding. Apply error detection and error correction for soft and hard decoding.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Understand the breadth and challenges faced in the field of mobile robotics. Have entry-points to the literature and current work about robotics, sensor processing and robot control applied to a variety of autonomous robotic tasks.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG2.3 Select and	apply	the	e appropriate	models,	, methods	and ted	chniques.	
EMINGWALG2.3 Select and	appiy	tne	appropriate	e models,	, metnoas	and ted	enniques.	

<<	EMingwALG2.3 Select and apply	the appropriate models, metho	ds and techniques.	Scientific competence
Course		Teaching methods	Evaluation methods	Course learning outcome
Voot: leer- e	en evaluatievormen voorafgegaan door ** werden niet teru	uggevonden in de studiefiche		
E022230	Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula
E031251	Design Methodology for FPGAs	lecture	open book examination oral examination	Knowing how to systematically explore the design space
E033640	High-speed Electronics	lecture practicum	oral examination report assignment	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
	Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130	Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370	Robotics	guided self-study practicum lecture group work	assignment report	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics.
E012320	Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum	written examination report skills test participation open book examination	to design network protocols for mobile and wireless networks and to optimize protocol parameters to apply these techniques for routing and design problems in access networks to analyse the behavior of mobile and wireless networks through network simulations
E033702	Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E011322	Queueing Analysis and Simulation	seminar: coached exercises	written examination with open questions	To select the most suitable models, methods and techniques for specific queueing problems
E091103	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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EMingwALG2.4 Develop and validate mathematical models and methods.

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Scientific competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden nie	et teruggevonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E011322 Queueing Analysis and Simulation	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	To assess the performance of queueing systems quantitatively and qualitatively To construct a simulation program and to process simulation results

EMingwALG2.5 Interpret research findings in an objective and critical manner.

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Scientific competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werde	en niet teruggevonden in de studiefiche		
E033640 High-speed Electronics	lecture practicum	report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching Analyze and design of active and passive high-speed circuits
E003600 Information Theory	project	report	Analyse hard and soft decoding. Compute performance. Apply error detection and error correction for soft and hard decoding.
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG3.1 Independently form an opinion on complex situations and problems, and defend this point of view.

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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	uggevonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	project	skills test	Knowing how to systematically explore the design space Being able to design a complex digital system in a hierarchical way
E003600 Information Theory	project	report	Analyse hard and soft decoding. Compute performance. Apply error detection and error correction for soft and hard decoding.
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG3.2 Apply knowledge in a creative, purposeful and innovative way to research, conceptual design and production.

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Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet	_		•	
E033640 High-speed Electronics	practicum	assignment report	Understand and apply high-frequency models, transmission lines, S-parameters, n Analyze and design of active and passive high-speed circuits	oise parameters and impedance matching.
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and chann To apply modulation techniques for transmission over dispersive channels and to a To estimate the effect of channel properties (fading, dispersion) on the reliability of To apply techniques for multiuser communication.	letermine their performance.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including represer environment, for information interpretation by mobile robots. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology.	ntation of (expectations about) the
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of to analyse the behavior of mobile and wireless networks through network simulatio to design network protocols for mobile and wireless networks and to optimize protocol to analyse and evaluate access networks and mobile networks in terms of performance.	ns col parameters
E011322 Queueing Analysis and Simulation	lecture seminar: coached exercises		To assess the performance of queueing systems quantitatively and qualitatively To select the most suitable models, methods and techniques for specific queueing To master mathematical solution techniques for queueing problems To construct a simulation program and to process simulation results	
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativi Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and f laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, re Find an appropriate methodology, in accordance with the applicable scientific norm	ound them, both to colleagues as to execution of research (literature search, sults, conclusions,).

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EMingwALG3.3 Critically reflect on one's own way of thinking and acting, and understand the limits of one's competences.

Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** we	rden niet teruggevonden in de studiefiche			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	open book examination report oral examination	Have insight into intelligent antenna systems, multiple input multiple output systems and bea Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antenna Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and Have insight into radiowave propagation in mobile communications systems, distinguish between fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula	s s and reflector antennas phased arrays
E033640 High-speed Electronics	lecture	participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parar Analyze and design of active and passive high-speed circuits	neters and impedance matching.
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimat To apply modulation techniques for transmission over dispersive channels and to determine To estimate the effect of channel properties (fading, dispersion) on the reliability of the comm To apply techniques for multiuser communication.	their performance.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (environment, for information interpretation by mobile robots. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology.	expectations about) the
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found then laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, concision an appropriate methodology, in accordance with the applicable scientific norms of the specific control of the self-correction and objectivity.	n, both to colleagues as to of research (literature search, clusions,).

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EMingwALG3.4 Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.

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Intellectual competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	uggevonden in de studiefiche		
E031251 Design Methodology for FPGAs	lecture		Knowing how to systematically explore the design space
E000040 III I I I I I			Being able to perform a hardware design from specification to final realisation in reconfigurable hardware
E033640 High-speed Electronics	lecture	participation	Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture	written examination	Analyse hard and soft decoding.
·		open book examination	Apply error detection and error correction for soft and hard decoding.
			Apply Viterbi decoding.
E019370 Robotics	guided self-study	assignment	Understand the breadth and challenges faced in the field of mobile robotics.
	practicum	report	Have entry-points to the literature and current work about robotics, sensor processing and robot control applied to a variety of
	lecture		autonomous robotic tasks.
	group work		
E012320 Mobile and Broadband Access Networks	lecture	written examination	to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks
E091103 Master's Dissertation	master's dissertation	oral examination	Define, study and analyse the research problem in a specific domain.
		assignment	Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance.
			Self-assessment with adequate and critical self-correction and objectivity.
			Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to
			laypeople.
			Render and synthesise the results concisely.
			Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search,
			topical study, research and the
			reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,).
			Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG3.5 Readily adapt to changing professional circumstances.

Intellectual competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werd	len niet teruggevonden in de studiefiche		
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwELEC3.1 Be receptive for and analyse critically the fast developments in electrical engineering.

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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	uggevonden in de studiefiche		
E033640 High-speed Electronics	lecture	participation	Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture	written examination	Compute theoretical bounds for source and channel coding.
	seminar: coached exercises	report	Compute performance.
	project	open book examination	Apply error detection and error correction for soft and hard decoding.
			Apply Viterbi decoding.
			Recognize the graphical representation of codes.
			Analyse hard and soft decoding.
			Compute the optimal quantizer.
			Use lossless and lossy source coding.
E019370 Robotics	guided self-study	assignment	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the
	practicum	report	environment, for information
	lecture		interpretation by mobile robots.
	group work		Understand a selection of application domains for mobile robot technology.
E012320 Mobile and Broadband Access Networks	guided self-study	written examination	to gain insight in network modeling algorithms and their applications/limitations
	seminar: coached exercises	report	to apply these techniques for routing and design problems in access networks
	practicum	skills test	to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks
	lecture	participation	to analyse the behavior of mobile and wireless networks through network simulations
		open book examination	to design network protocols for mobile and wireless networks and to optimize protocol parameters
		·	to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
091103 Master's Dissertation	master's dissertation	oral examination	Define, study and analyse the research problem in a specific domain.
		assignment	Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance.
			Self-assessment with adequate and critical self-correction and objectivity.
			Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to
			laypeople.
			Render and synthesise the results concisely.
			Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search,
			topical study, research and the
			reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,).
			Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Topobing motheds	Evaluation matheds	Course learning outcome
Course Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	Teaching methods evonden in de studiefiche	Evaluation methods	Course learning outcome
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project practicum lecture	written examination report oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula
E033021 Electromagnetic-aware High Frequency Design		written examination	Analyse microwave circuits based on impedance, admittance and scattering matrices.
	online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	report skills test oral examination open book examination	Be familiar with EMC norms. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity Synthesize filters and matching networks.
E033640 High-speed Electronics	lecture practicum	oral examination report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	project	participation	Analyse hard and soft decoding.
E003000 Information Theory	project	report	Analyse hard and soft decoding. Apply error detection and error correction for soft and hard decoding.
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	written examination report assignment	Propose, analyse and compare different hard- and software options for sensing and actuation in mobile robotics. Understand simple planning strategies for mobile robots. Understand a selection of application domains for mobile robot technology. Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Have entry-points to the literature and current work about robotics, sensor processing and robot control applied to a variety of autonomous robotic tasks. Understand the assumptions and rationale behind data interpretation, information extraction and artificial intelligence/machine learning applied to mobile robotics. Understand the breadth and challenges faced in the field of mobile robotics. Represent simple motion systems with matrix groups, examine their possibilities and limitations, derive control laws for selected mobile robots.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E011322 Queueing Analysis and Simulation	self-reliant study activities	report	To construct a simulation program and to process simulation results
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG4.2 Project management: have the ability to formulate objectives, report efficiently, keep track of targets, follow the progress of the Competences in cooperation and communication project,...

project,			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	evonden in de studiefiche		
E022230 Antennas and Propagation	project	report	Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	project	skills test	Being able to design a complex digital system in a hierarchical way
E033021 Electromagnetic-aware High Frequency Design	practicum	report	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
E033640 High-speed Electronics	practicum	report	Analyze and design of active and passive high-speed circuits
E003600 Information Theory	project	report	Analyse hard and soft decoding. Compute performance. Apply error detection and error correction for soft and hard decoding.
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study group work	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG4.3 Have the ability to work as a member of a team in a multidisciplinary workingenvironment, as well as being capable of taking on Competences in cooperation and communication supervisory responsibilities.

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche		
E033021 Electromagnetic-aware High Frequency Design	practicum	report	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
E003600 Information Theory	project	report	Analyse hard and soft decoding. Compute performance. Apply error detection and error correction for soft and hard decoding.
E019370 Robotics	group work	assignment	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.

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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	evonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project practicum lecture	written examination report oral examination open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	project	skills test	Being able to design a complex digital system in a hierarchical way
E033021 Electromagnetic-aware High Frequency Design	practicum	report	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity.
E033640 High-speed Electronics	practicum	report	Analyze and design of active and passive high-speed circuits
E003600 Information Theory	project	report	Analyse hard and soft decoding. Compute performance. Apply error detection and error correction for soft and hard decoding.
E012130 Modulation and Detection	group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	guided self-study practicum lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG5.1 Act in an ethical, professional and social way.

Societal competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** were	den niet teruggevonden in de studiefiche		
E033640 High-speed Electronics	lecture practicum	participation report	Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

EMingwALG5.2 Recognize the most important business and legal aspects of the own engineering discipline.

Societal competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche		
E033021 Electromagnetic-aware High Frequency Design	excursion	written examination	Be familiar with EMC norms.
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.

EMingwALG5.3 Understand the historical evolution of the own engineering discipline and its social relevance.

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Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	•			
7000040 II'd accept Floring's	Level and	and describe	And an addition of our and an additional days to	
E033640 High-speed Electronics	lecture	participation	Analyze and design of active and passive high-speed circuits	
E003600 Information Theory	lecture	written examination	Compute theoretical bounds for source and channel coding.	
	seminar: coached exercises	report	Compute performance.	
	project	open book examination	Apply error detection and error correction for soft and hard decoding.	
			Apply Viterbi decoding.	
			Recognize the graphical representation of codes.	
			Analyse hard and soft decoding.	
			Compute the optimal quantizer.	
			Use lossless and lossy source coding.	
E012130 Modulation and Detection	lecture		To have insight in the operation of algorithms for detection, equalization and channel estimation.	
	online lecture		To apply modulation techniques for transmission over dispersive channels and to determine their p	performance.
			To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication	
			To apply techniques for multiuser communication.	
E019370 Robotics	lecture		Understand the breadth and challenges faced in the field of mobile robotics.	
			Realise and exploit the importance of a full problem formulation, including representation of (expedit	ctations about) the
			environment, for information	,
			interpretation by mobile robots.	
E012320 Mobile and Broadband Access Networks	lecture	written examination	to analyse and evaluate access networks and mobile networks in terms of performance and usabil	lity for diverse applications
E011322 Queueing Analysis and Simulation	lecture		To master mathematical solution techniques for queueing problems	
			To select the most suitable models, methods and techniques for specific queueing problems	
E091103 Master's Dissertation	master's dissertation	oral examination	Define, study and analyse the research problem in a specific domain.	
		assignment	Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and	d perseverance.
			Self-assessment with adequate and critical self-correction and objectivity.	
			Communicate adequately on the research, the results and problems, present and found them, both	h to colleagues as to
			laypeople.	
			Render and synthesise the results concisely.	
			Critically analyse, formulate, study, execute and/or process different aspects in the execution of re	esearch (literature search,
			topical study, research and the	•
			reflection on the research, experiments, experimentations, designs, simulations, results, conclusio	ns,).
			Find an appropriate methodology, in accordance with the applicable scientific norms of the specific	

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EMingwALG6.1 Master the complexity of technical systems by using system and process models.

Profession-spe	ecific competence
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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	¥		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report oral examination open book examination	Computer-aided design antennas based on the Friis formula Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments
E031251 Design Methodology for FPGAs	lecture project	open book examination skills test oral examination	Being able to design a complex digital system in a hierarchical way
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion		Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Synthesize filters and matching networks.
E033640 High-speed Electronics	lecture practicum	oral examination report assignment participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E019370 Robotics	group work practicum	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E011322 Queueing Analysis and Simulation	lecture seminar: coached exercises		To assess the performance of queueing systems quantitatively and qualitatively To select the most suitable models, methods and techniques for specific queueing problems To master mathematical solution techniques for queueing problems To construct a simulation program and to process simulation results
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

FMingwAl G6 2 Reconcile conflicting specifications and prior conditions in a highquality and innovative concept or process

Profession-	specific	competenc	e
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EMingwALG6.2 Reconcile conflicting specifications and prior conditions in a highquality and innovative concept or process. Profess				Profession-specific competence
Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teru	ggevonden in de studiefiche			
E022230 Antennas and Propagation	project	report	Computer-aided design antennas based on the Friis formula	
E031251 Design Methodology for FPGAs	lecture	open book examination oral examination	Knowing how to systematically explore the design space Being able to recognise the impact of performance measures on the implementation	
E033021 Electromagnetic-aware High Frequency Desig	n guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	written examination report skills test oral examination open book examination	Analyse microwave circuits based on impedance, admittance and scattering matrices Have insight in the role of electromagnetic phenomena on EM aware design, including Synthesize filters and matching networks.	
E033640 High-speed Electronics	lecture practicum	oral examination report assignment	Analyze and design of active and passive high-speed circuits	
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	lecture online lecture		To have insight in the operation of algorithms for detection, equalization and channel To apply modulation techniques for transmission over dispersive channels and to detect To estimate the effect of channel properties (fading, dispersion) on the reliability of the To apply techniques for multiuser communication.	ermine their performance.
E019370 Robotics	guided self-study lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including representate environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.	ion of (expectations about) the
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wire to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protoco to analyse and evaluate access networks and mobile networks in terms of performance.	parameters
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.	
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and fou laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the extopical study, research and the reflection on the research, experiments, experimentations, designs, simulations, resulfind an appropriate methodology, in accordance with the applicable scientific norms of	nd them, both to colleagues as to recution of research (literature search, ts, conclusions,).

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EMingwALG6.3 Synthesize incomplete, contradictory or redundant data into useful information.

Profession-s	

<<	EMingwALG6.3 Synthesize incomp	lete, contradictory or redunda	ant data into useful inform	nation.	Profession-specific competent
Course		Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en	n evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche			
E022230 A	Antennas and Propagation	project	report	Computer-aided design antennas based on the Friis formula	
E033021 E	Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture	written examination report skills test oral examination open book examination	Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including Synthesize filters and matching networks.	radiated/conducted emission/immunity.
E033640 H	High-speed Electronics	lecture practicum	oral examination report participation	Analyze and design of active and passive high-speed circuits	
E003600 I	nformation Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E019370 F	Robotics	guided self-study practicum lecture group work	written examination report assignment	Realise and exploit the importance of a full problem formulation, including representation environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.	on of (expectations about) the
E011322(Queueing Analysis and Simulation	lecture seminar: coached exercises	written examination with open questions	To assess the performance of queueing systems quantitatively and qualitatively To select the most suitable models, methods and techniques for specific queueing prob To master mathematical solution techniques for queueing problems To construct a simulation program and to process simulation results	plems
E091103 M	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, in Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the exe topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results Find an appropriate methodology, in accordance with the applicable scientific norms of	d them, both to colleagues as to cution of research (literature search, s, conclusions,).

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EMingwALG6.4 Possess sufficient estimates.	ready knowledge and unders	standing to evaluate the	e results of complex calculations, or make approximate Profession-specific of	competenc
Course	Teaching methods	Evaluation methods	Course learning outcome	
loot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	gevonden in de studiefiche			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises practicum lecture	open book examination skills test oral examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antenna Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schado fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula	
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture	written examination report skills test oral examination open book examination	Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emissior Synthesize filters and matching networks.	n/immunity.
E033640 High-speed Electronics	lecture practicum	oral examination report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance Analyze and design of active and passive high-speed circuits	matching.
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	lecture online seminar: coached exercises online lecture seminar: coached exercises	written examination open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.	
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networ to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse ap	
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues a laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.	

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EMingwALG6.5 Pay attention to entire life cycles of systems, machines, and processes.

Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome				
loot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche							
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion		Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Be familiar with EMC norms.				
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications				
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.				

EMingwALG6.6 Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.

EMingwALG6.6 Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs. Profession-specific competer				
Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet ter	ruggevonden in de studiefiche			
E031251 Design Methodology for FPGAs	lecture	open book examination oral examination	Knowing how to systematically explore the design space Being able to recognise the impact of performance measures on the implement	ation
E033640 High-speed Electronics	lecture practicum	participation	Analyze and design of active and passive high-speed circuits	
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012130 Modulation and Detection	lecture online lecture		To have insight in the operation of algorithms for detection, equalization and characters are apply modulation techniques for transmission over dispersive channels and To estimate the effect of channel properties (fading, dispersion) on the reliability To apply techniques for multiuser communication.	to determine their performance.
E019370 Robotics	guided self-study lecture group work	assignment report	Realise and exploit the importance of a full problem formulation, including repre environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.	sentation of (expectations about) the
E012320 Mobile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations to analyse the behavior of mobile and wireless networks through network simula to design network protocols for mobile and wireless networks and to optimize put to analyse and evaluate access networks and mobile networks in terms of performance.	of wireless and wired access networks ations rotocol parameters

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<<	EMingwALG6.7 Pay attention to all	aspects of reliability, safety,	and ergonomics.	Profession-specific competer	
Course		Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en e	evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche			
E033021 E	ectromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	written examination report skills test oral examination open book examination	Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Be familiar with EMC norms.	
E003600 In	formation Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.	
E012320 M	obile and Broadband Access Networks	guided self-study seminar: coached exercises practicum lecture	written examination report skills test participation open book examination	to gain insight in network modeling algorithms and their applications/limitations to apply these techniques for routing and design problems in access networks to analyse theoretical concepts in order to explain the operation and limitations of wireless and wired access networks to analyse the behavior of mobile and wireless networks through network simulations to design network protocols for mobile and wireless networks and to optimize protocol parameters to analyse and evaluate access networks and mobile networks in terms of performance and usability for diverse applications	

To transform theoretical knowledge from other courses into practical applications.

E033702 Hardware-design Project

project

report

EMingwALG6.8 Have insight into and understanding of the importance of entrepreneurship.

Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet	teruggevonden in de studiefiche		
E033640 High-speed Electronics	lecture	participation	Analyze and design of active and passive high-speed circuits
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.

EMingwALG6.9 Show perseverance, innovativeness, and an aptitude for creating added value.

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Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werde	n niet teruggevonden in de studiefiche		
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	written examination report open book examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, schadowing, and fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E019370 Robotics	guided self-study group work	assignment report	Realise and exploit the importance of a full problem formulation, including representation of (expectations about) the environment, for information interpretation by mobile robots. Understand a selection of application domains for mobile robot technology.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.