Competence coverage	matrix			G	ieneral	Cours	es			ses Re Main S			Maste r's Disser tation
GHENT UNIVERSITY Master of Science in Ele	ectrical Engineering		ation	Design Methodology for FPGAs	E033021 Electromagnetic-aware High Frequency Design	Š		tion	Design	Ø	ect	E031420 Technology of Integrated Circuits and Microsystems	
Electronic Circuits and	Systems		E022230 Antennas and Propagation	hodology f	netic-awar	E033640 High-speed Electronics	Theory	E012130 Modulation and Detection	E031440 VLSI Technology and Design	E008445 Sensors and Actuators	E033702 Hardware-design Project	of Integra	ssertation
Academic year 2021-20	22		ntennas aı	esign Metl	ectromagi	igh-speed	E003600 Information Theory	odulation	LSI Techn	ensors an	ardware-d	achnology ns	E091103 Master's Dissertation
Legend:			2230 Aı	E031251 D	3021 EI	3640 H	3600 In	2130 M	1440 VI	8445 S	3702 H	E031420 Tech Microsystems	1103 M
T=teaching methods E=evaluation methods			E02;	E03.	E03;	E03;	E00;	E013	E03.	E008	E03	E03	E09.
Competences in one/more scientific	Master and apply advanced knowledge in the own engineering discipline in solving complex problems.	T 10 E 10	T E	T E	T E	T E	T E	T E	T E		T E	T E	T E
discipline(s)	Apply Computer Aided Engineering (CAE) tools and advanced	T 8	Т	Т	Т	Т	Т	Т	Т			Т	
	communication instruments in a creative and purposeful way. Analyse, specify, design (based on general needs) and realise	E 7	E	E	E	E	E		E		Т	Е	Т
	complex (opto-)electronic systems.	E 8	E	E	E	E	Е		E		E		E
	Take into account electromagnetic phenomena during the specification, design and realisation of complex (opto-)electronic systems.	T 5 E 5	E		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 5 E 5					E		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 5 E 5	E				T E	T E			T E		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 8 E 8	T E	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 3 E 3				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 5 E 5	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 5 E 5	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 E				T E	T E	T E
	Select and apply the appropriate models, methods and techniques.	T 10 E 10	T E	T E		T E	T E	T E	T E	T E	T E	T E	T E
	Develop and validate mathematical models and methods.	T 3	T	-			T		_	-	-	T	
	Interpret research findings in an objective and critical manner.	E 3 T 6	Е			Т	E	Т			Т	E	Т
La de Discontinuidad de la contraction de la con		E 6				Ė	E	Е			Е	E	E
Intellectual competences	Independently form an opinion on complex situations and problems, and defend this point of view.	T 7 E 7	E	E			E	E			E	E	E
	Apply knowledge in a creative, purposeful and innovative way to research, conceptual design and production.	T 6 E 6				T E	T E	T E	T E			T E	T E
	Critically reflect on one's own way of thinking and acting, and	T 6	Т			T	T	T				T	T
	understand the limits of one's competences.	E 6	E			Е	E	Ē				E	E
	Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.	T 4 E 3		Т		E	E						E
	Readily adapt to changing professional circumstances.	T 4					T				T	T	T
	Be receptive for and analyse critically the fast developments in	E 4 T 6				Т	E T		Т		E T	T	T
Competences in	electrical engineering. Have the ability to communicate in English about the own field of	E 6 T 9	Т		Т	E	E	Т	Е	Т	E	E	E
Competences in cooperation and	specialisation.	E 9	Ė		Ē	Ė	Ė	Ė		Ė	Ė	Ė	Ė
communication	Project management: have the ability to formulate objectives, report efficiently, keep track of targets, follow the progress of the project,	T 11 E 11	T E	T E	T E	T E	T E	T E	T E	T E	T E	T E	T E
	Have the ability to work as a member of a team in a multi disciplinary workingenvironment, as well as being capable of taking on supervisory responsibilities.	T 4 E 4			T E		T E			E	E		
	Report on technical or scientific subjects verbally, in writing and using graphics.	T 11 E 11	E	E	T E	E	E	E	E	E	E	E	T E
Societal competences	Act in an ethical, professional and social way.	T 4 E 4			_	T E	T E					T E	T E
	Recognize the most important business and legal aspects of the own engineering discipline.	T 2 E 2			E		E						
	Understand the historical evolution of the own engineering discipline and its social relevance.	T 5 E 4				T E	T E	T				T E	T E
Profession-specific competence	Master the complexity of technical systems by using system and process models.	T 10 E 9	E	E	Т	E	E	E	E		E	E	E
	Reconcile conflicting specifications and prior conditions in a high quality and innovative concept or process.	T 11	T	T	T	T	T	Т	T	T	T	T	T
	quality and innovative concept of process.	E 10	E	E	E	Е	Е		Е	Е	Е	E	Е

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GHENT UNIVERSITY Master of Science in El Electronic Circuits and Academic year 2021-20 Legend: T=teaching methods E=evaluation methods	Systems		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	E031440 VLSI Technology and Design	E008445 Sensors and Actuators	E033702 Hardware-design Project	E031420 Technology of Integrated Circuits and Microsystems	E091103 Master's Dissertation
Profession-specific competence	Synthesize incomplete, contradictory or redundant data into useful information.	T 7 E 7	T E		T E	T E	T E			T E		T E	T E
	Possess sufficient ready knowledge and understanding to evaluate the results of complex calculations, or make approximate estimates.	E 6	T E		T E	T E	T E	T E					T E
	Pay attention to entire life cycles of systems, machines, and processes.	T 4 E 3			Т					T E	T E	T E	
	Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.	T 5 E 4		T E		T E	T E	T				T E	
	Pay attention to all aspects of reliability, safety, and ergonomics.	T 5 E 5			T E		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 E
							W 35 E 35	W 18 E 13			W 23 E 23	W 24 E 24	W 29 E 29

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

Competences in one/more scientific discipline(s)

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	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	guided self-study seminar: practical PC room classes project lecture	written examination 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 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 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.
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.
E031440 VLSI Technology and Design	guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies

E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	excursion seminar: coached exercises self-reliant study activities project lecture	open book examination report participation oral examination	detailed knowledge on microsystems process steps awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics. critical evaluation of experimentally obtained data, correct interpretation of results analysis and synthesis of a scientific article practical experience in cleanroom laboratories. The cleanroom visit will be replaced by a series of dedicated educational movies showing cleanroom activities. insight in the physics of microfabrication basic knowledge on different types of microsystems
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.

EMingwALG1.2 Apply Computer A	ided Engineering (CAE) tools	and advanced commun	ication instruments in a creative and purposeful way. Competences in one/more scientific discipline(s
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.
E031440 VLSI Technology and Design	project	report	Simulate and layout electronic circuits in modern IC technologies

critical evaluation of experimentally obtained data, correct interpretation of results

E031420 Technology of Integrated Circuits and Microsystems

seminar: coached exercises

report

<<	EMingwELEC1.1 Analyse, specify,	design (based on general nee	ds) and realise complex	(opto-)electronic systems.	Competences in one/more scientific discipline(s)
Course		Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- er	n evaluatievormen voorafgegaan door ** werden niet terugge	vonden 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 Mitigate fading by means of diversity, including polarisation diversity Have insight into the radiation mechanisms of wire antennas, horn at Have insight into radiowave propagation in mobile communications of fading, including frequency-selective fading Computer-aided design antennas based on the Friis formula	ntennas, planar antennas and reflector antennas
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 i Knowing the different sorts of interfaces and how they can be design Being able to analyse and use control and timing concepts in digital s Being able to recognise the impact of performance measures on the Being able to design a complex digital system in a hierarchical way Understanding how the design of a memory hierarchy can influence Being able to design and simulate test benches Being able to perform a hardware design from specification to final re-	ed systems implementation the performance of a system
E033021 I	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 so Have insight in the role of electromagnetic phenomena on EM aware Synthesize filters and matching networks.	attering matrices.
E033640 I	High-speed Electronics	guided self-study practicum lecture	oral examination report assignment	Understand and apply high-frequency models, transmission lines, S-Analyze and design of active and passive high-speed circuits	parameters, noise parameters and impedance matching.
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.	
E031440 \	VLSI Technology and Design	guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies	
E033702 I	Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical	applications.
E091103 I	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 Self-assessment with adequate and critical self-correction and object Communicate adequately on the research, the results and problems, laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different topical study, research and the reflection on the research, experiments, experimentations, designs, so Find an appropriate methodology, in accordance with the applicable	on and creativity, initiative and perseverance. tivity. present and found them, both to colleagues as to aspects in the execution of research (literature search, simulations, results, conclusions,).

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EMingwELEC1.2 Take into account electromagnetic phenomena during the specification, design and realisation of complex (opto-)electronic systems.

Competences in one/more scientific discipline(s)

systems.			
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	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
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. 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	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. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. 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.

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EMingwELEC1.3 Specifically for main subject 'Electronic Circuits and Systems': Know and creatively apply technology of integrated circuits for Competences in one/more scientific discipline(s) << the specification, design and realisation of micro systems which integrate mechanical elements, sensors and actuators. **Evaluation methods** Course learning outcome Course Teaching methods Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche E003600 Information Theory written examination Compute the optimal quantizer. seminar: coached exercises Apply error detection and error correction for soft and hard decoding. report open book examination Analyse hard and soft decoding. project E031440 VLSI Technology and Design guided self-study oral examination Understand the process flow of modern IC technologies project Simulate and layout electronic circuits in modern IC technologies report lecture E008445 Sensors and Actuators guided self-study Thoroughly understand and discuss the operation of electromotive, resistive, capacitive, inductive and primary sensors and oral examination online lecture report Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of practicum instrumentation software, the lecture implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way. E033702 Hardware-design Project To transform theoretical knowledge from other courses into practical applications. project report E091103 Master's Dissertation oral examination Define, study and analyse the research problem in a specific domain. master's dissertation 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.

laypeople.

Render and synthesise the results concisely.

topical study, research and the

Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to

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.

Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search,

•	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)
•	The state of the s	Compotenede in enermere colonime alcolpinio(e)

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Course	Teaching methods	Evaluation methods	Course learning outcome
oot: leer- en evaluatievormen voorafgegaan door ** werde	<u> </u>		3
022230 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
003600 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.
012130 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.
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 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.	-		
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	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.
E008445 Sensors and Actuators	guided self-study online lecture practicum lecture	oral examination report skills test	Thoroughly understand and discuss the operation of electromotive, resistive, capacitive, inductive and primary sensors and actuators. Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way. Explain linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Explain and/or derive linearization, bridge circuits, differential operation, transimpedance amplifiers.
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

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** w	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.
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
loot: leer- en evaluatievormen voorafgegaan door ** werden r	niet 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	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.
033702 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.

EMingwELEC1.8 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 terugg			
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.
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.

	olex problems and translate then		•
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden nie	t teruggevonden 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	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 exercise online lecture online group work seminar: coached exercises lecture group work	es	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.
E031440 VLSI Technology and Design	guided self-study project lecture	oral examination report	Simulate and layout electronic circuits in modern IC technologies
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture seminar: coached exercises self-reliant study activities	open book examination report participation oral examination	insight in the physics of microfabrication awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electron critical evaluation of experimentally obtained data, correct interpretation of results analysis and synthesis of a scientific article
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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EMingwALG2.2 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 ** werden niet t	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.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	self-reliant study activities	open book examination oral examination	analysis and synthesis of a scientific article
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 appropriate models, methods and techniques.

Scientific	competences

Course	ly the appropriate models, metho	Evaluation methods	Course learning outcome
Course Noot: leer- en evaluatievormen voorafgegaan door ** werden niet t	Teaching methods	Evaluation methods	Course learning outcome
Noot. leer- en evaluatievormen vooralgegaan door - werden niet t	eruggevonden in de studienche		
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
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.
E031440 VLSI Technology and Design	guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies
E008445 Sensors and Actuators	practicum	skills test report	Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture seminar: coached exercises	open book examination report oral examination	insight in the physics of microfabrication awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronic critical evaluation of experimentally obtained data, correct interpretation of 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.

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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 niet t	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.
E031420 Technology of Integrated Circuits and Microsystems	seminar: coached exercises	report	insight in the physics of microfabrication critical evaluation of experimentally obtained data, correct interpretation of results

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

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Scientific	com	petence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet t	eruggevonden 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.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	seminar: coached exercises	report	critical evaluation of experimentally obtained data, correct interpretation of 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.

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

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Intellectual competences

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet t	teruggevonden 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.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture seminar: coached exercises self-reliant study activities project	open book examination report participation oral examination	analysis and synthesis of a scientific article awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics critical evaluation of experimentally obtained data, correct interpretation of 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.

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

<< EMingwALG3.2	Apply knowledge in a creative, purpo	oseful and innovative way to resea	rch, conceptual design and production.	Intellectual competences
Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgeg	aan door ** werden niet teruggevonden in de studiefiche			
E033640 High-speed Electronics	practicum	assignment report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance manalyze and design of active and passive high-speed circuits	
E003600 Information Theory	lecture seminar: coached ex project	written examination rercises 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 Detecti	on group work online group work	assignment	To have insight in the operation of algorithms for detection, equalization and character To apply modulation techniques for transmission over dispersive channels and to To estimate the effect of channel properties (fading, dispersion) on the reliability To apply techniques for multiuser communication.	o determine their performance.
E031440 VLSI Technology and I	Design guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies	
E031420 Technology of Integrate Microsystems	ed Circuits and lecture seminar: coached ex self-reliant study active project	•	analysis and synthesis of a scientific article critical evaluation of experimentally obtained data, correct interpretation of result	ts
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 crea Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present an laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in t topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, Find an appropriate methodology, in accordance with the applicable scientific no	the execution of research (literature search, results, 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 ** werden niet t	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 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, ar fading, including frequency- selective fading Computer-aided design antennas based on the Friis formula
E033640 High-speed Electronics	lecture	participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matchir 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	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.
E031420 Technology of Integrated Circuits and Microsystems	seminar: coached exercises	report	critical evaluation of experimentally obtained data, correct interpretation of 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.

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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 i	niet teruggevonden in de studiefiche		
E031251 Design Methodology for FPGAs	lecture		Knowing how to systematically explore the design space
			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.
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 co	ımpetence
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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet te	eruggevonden in de studiefiche		
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.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.
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.

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 t	teruggevonden 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.
E031440 VLSI Technology and Design	guided self-study	oral examination	Understand the process flow of modern IC technologies
	project	report	Simulate and layout electronic circuits in modern IC technologies
	lecture	•	
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.
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.

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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
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. 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 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	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.
E008445 Sensors and Actuators	guided self-study online lecture practicum lecture	oral examination report	Thoroughly understand and discuss the operation of electromotive, resistive, capacitive, inductive and primary sensors and actuators. Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way. Explain linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Explain and/or derive linearization, bridge circuits, differential operation, transimpedance amplifiers.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture seminar: coached exercises self-reliant study activities project	open book examination report participation oral examination	analysis and synthesis of a scientific article writing of a scientific report
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.
E031440 VLSI Technology and Design	project	report	Simulate and layout electronic circuits in modern IC technologies
E008445 Sensors and Actuators	practicum	skills test report	Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	project seminar: coached exercises self-reliant study activities	participation report	practical experience in cleanroom laboratories. The cleanroom visit will be replaced by a series of dedicated educational movies showing cleanroom activities. critical evaluation of experimentally obtained data, correct interpretation of results writing of a scientific report
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

supervisory responsibilities.			• • • •
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	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.
E008445 Sensors and Actuators	practicum	skills test	Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of
		report	instrumentation software, the
		•	implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data
			transmission in a mature
			way.
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.
E031440 VLSI Technology and Design	project	report	Simulate and layout electronic circuits in modern IC technologies
E008445 Sensors and Actuators	practicum	report	Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations of data transmission in a mature way.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	project seminar: coached exercises self-reliant study activities	open book examination report oral examination	analysis and synthesis of a scientific article critical evaluation of experimentally obtained data, correct interpretation of results writing of a scientific report
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 ** werden niet t	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.
E031420 Technology of Integrated Circuits and Microsystems	lecture seminar: coached exercises	open book examination oral examination	critical evaluation of experimentally obtained data, correct interpretation of results awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.
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.

EMingwALG5.3 Understand the historical evolution of the own engineering discipline and its social relevance.				Societal 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	
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 estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performation of the effect of channel properties (fading, dispersion) on the reliability of the communication links. To apply techniques for multiuser communication.	
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and re	ecycling of electronics.
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 persev 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 coll laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research 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	leagues as to

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

Profession-s	pecific com	petence
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EMingwALG6.1 Master the comple	xity of technical systems by u	sing system and proce	ss models. Pro	fession-specific competence
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 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 Synthesize filters and matching networks.	/conducted emission/immunity.
E033640 High-speed Electronics	lecture practicum	oral examination report assignment participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parame Analyze and design of active and passive high-speed circuits	ters 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	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 the To estimate the effect of channel properties (fading, dispersion) on the reliability of the commun To apply techniques for multiuser communication.	eir performance.
E031440 VLSI Technology and Design	guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies	
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.	
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	detailed knowledge on microsystems process steps insight in the physics of microfabrication basic knowledge on different types of microsystems	
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 a Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, I laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclu Find an appropriate methodology, in accordance with the applicable scientific norms of the specific control of the specific	both to colleagues as to f research (literature search,

Profession-s	pecific	competence
1 1010001011 0		COMPONION

EMingwALG6.2 Reconcile conflictions.	ng specifications and prior co	onditions in a highquali	ty and innovative concept or process.	Profession-specific competence
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	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	n
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 matrice. Have insight in the role of electromagnetic phenomena on EM aware design, includ 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 do To estimate the effect of channel properties (fading, dispersion) on the reliability of To apply techniques for multiuser communication.	etermine their performance.
E031440 VLSI Technology and Design	guided self-study project lecture	oral examination report	Understand the process flow of modern IC technologies Simulate and layout electronic circuits in modern IC technologies	
E008445 Sensors and Actuators	practicum	skills test report	Using sensors and actuators efficiently in practical applications, including the consumption instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagneti transmission in a mature way.	•
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.	
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fab	orication, usage and recycling of electronics.
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 creativit Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and for 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, reserving an appropriate methodology, in accordance with the applicable scientific norms.	execution of research (literature search, sults, conclusions,).

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

Course EMingwALG6.3 Synthesize incomp	Teaching methods	Evaluation methods	Course learning outcome Profession-specific com
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg		Lvaluation methods	Course learning outcome
	evenuen in de cidalenene		
E022230 Antennas and Propagation	project	report	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 emission/imr Synthesize filters and matching networks.
E033640 High-speed Electronics	lecture practicum	oral examination report 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.
E008445 Sensors and Actuators	practicum	skills test report	Using sensors and actuators efficiently in practical applications, including the consulting of datasheets, the use of instrumentation software, the implementation of hardware (computer) interfacing and dealing with electromagnetic interferences and other limitations transmission in a mature way.
E031420 Technology of Integrated Circuits and Microsystems	seminar: coached exercises	report	critical evaluation of experimentally obtained data, correct interpretation of 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 sea 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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	estimates.			
Course		Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en e	evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche		
E022230 A	ntennas 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 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 E	lectromagnetic-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 emission/immunity. Synthesize filters and matching networks.
E033640 H	igh-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 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.
E012130 M	lodulation 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.
E091103 M	laster'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.

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

Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	evonden 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.
E008445 Sensors and Actuators	lecture online lecture	oral examination	Explain linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Explain and/or derive linearization, bridge circuits, differential operation, transimpedance amplifiers.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics

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

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Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet te	eruggevonden 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 implementation
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 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.
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.

EMingwALG6.7 Pay attention to all aspects of reliability, safety, and ergonomics.			and ergonomics.	Profession-specific competence	
Course		Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en	evaluatievormen voorafgegaan door ** werden niet terugge	evonden in de studiefiche			
E033021 E	lectromagnetic-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 Ir	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.	
E008445 S	ensors and Actuators	lecture online lecture	oral examination	Explain linearity, calibration, noise, precision, sensitivity and other sensor characteristics; Explain and/or derive linearization, bridge circuits, differential operation, transimpedance amplifiers.	
E033702 H	lardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.	
	echnology of Integrated Circuits and licrosystems	project seminar: coached exercises	participation report	practical experience in cleanroom laboratories. The cleanroom visit will be replaced by a series of dedicated educational movies showing cleanroom activities. critical evaluation of experimentally obtained data, correct interpretation of results	

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 ** werden niet t	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.
E031420 Technology of Integrated Circuits and Microsystems	lecture	open book examination oral examination	awareness of possibilities and limitations regarding sustainability aspects during fabrication, usage and recycling of electronics.
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.