Competence coverage matrix

GHENT UNIVERSITY

Master of Science in Electrical Engineering

Electronic Circuits and Systems

Academic year 2021-2022

Legend:
T=teaching methods
E=evaluation methods

			General Courses							Courses Related to the Main Subject				Master's Dissertation
			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
Competences in one/more scientific discipline(s)	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
	Apply Computer Aided Engineering (CAE) tools and advanced communication instruments in a creative and purposeful way.	T 8 E 7	T E	T E	T E	T E	T E	T	T E			T E	
	Analyse, specify, design (based on general needs) and realise complex (opto-)electronic systems.	T 8 E 8	T E	T E	T E	T E	T E		T E		T E		T E
	Take into account electromagnetic phenomena during the specification, design and realisation of complex (opto-)electronic systems.	T 5 E 5	T E		T E	T E	T E						T 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					T E		T E	T E	T E		T 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	T E				T E	T E			T E		T E
	Specifically for main subject 'Electronic Circuits and Systems': Specify and carry out measurements on complex systems that incorporate an important hardware component, and draw conclusions about the next steps in the design flow given the measurement outcomes.	T 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	T	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 E 3	T E				T E					T E	
	Interpret research findings in an objective and critical manner.	T 6 E 6				T E	T E	T E			T E	T E	T E
Intellectual competences	Independently form an opinion on complex situations and problems, and defend this point of view.	T 7 E 7	T E	T E			T E	T E			T E	T E	T 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 understand the limits of one's competences.	T 6 E 6	T E			T E	T E	T E				T E	T E
	Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.	T 4 E 3		T		T E	T E						T E
	Readily adapt to changing professional circumstances.	T 4 E 4					T E				T E	T E	T E
	Be receptive for and analyse critically the fast developments in electrical engineering.	T 6 E 6				T E	T E		T E		T E	T E	T E
Competences in cooperation and communication	Have the ability to communicate in English about the own field of specialisation.	T 9 E 9	T E		T E	T E	T E	T E		T E	T E	T E	T E
	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			T E	T E		
	Report on technical or scientific subjects verbally, in writing and using graphics.	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
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			T E		T 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	T E	T E	T	T E	T E	T E	T E		T E	T E	T E
	Reconcile conflicting specifications and prior conditions in a high quality and innovative concept or process.	T 11 E 10	T E	T E	T E	T E	T E	T	T E	T E	T E	T E	T E

Competence coverage matrix

GHENT UNIVERSITY

Master of Science in Electrical Engineering

Electronic Circuits and Systems

Academic year 2021-2022

Legend:
T=teaching methods
E=evaluation methods

			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.	T 6 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			T					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 21 E 21	W 13 E 12	W 17 E 15	W 23 E 23	W 35 E 35	W 18 E 13	W 12 E 12	W 11 E 11	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 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	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 Aided Engineering (CAE) tools and advanced communication 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 teruggevonden 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
E031420 Technology of Integrated Circuits and Microsystems	seminar: coached exercises	report	critical evaluation of experimentally obtained data, correct interpretation of results

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

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

<< **EMingwELEC1.3 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.** *Competences in one/more scientific discipline(s)*

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

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden 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	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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.

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 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.

<< **EMingwELEC1.7 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.** *Competences in one/more scientific discipline(s)*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden 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.
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.

<< **EMingwELEC1.8 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.** *Competences in one/more scientific discipline(s)*

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet 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 exercises online lecture online group work seminar: coached exercises lecture 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	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 electronics. 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.

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E003600	Information Theory	project	report	Analyse hard and soft decoding. Apply error detection and error correction for soft and hard decoding.
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.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden 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	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

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 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.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan 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 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	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	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 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 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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises project lecture	open book examination report oral examination	Have insight into intelligent antenna systems, multiple input multiple output systems and 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
E033640 High-speed Electronics	lecture	participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden 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 open book examination	Analyse hard and soft decoding. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E033702 Hardware-design Project	project	report	To transform theoretical knowledge from other courses into practical applications.
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.

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.
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	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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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 supervisory responsibilities.** *Competences in cooperation and communication*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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 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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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.

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 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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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.

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 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.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet 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 project	open book examination skills test oral examination	Being able to design a complex digital system in a hierarchical way
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion		Analyse microwave circuits based on impedance, admittance and scattering matrices. Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Synthesize filters and matching networks.
E033640 High-speed Electronics	lecture practicum	oral examination report assignment participation	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	guided self-study online seminar: coached exercises online lecture online group work seminar: coached exercises lecture group work	written examination assignment open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
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 and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E022230 Antennas and Propagation	project	report	Computer-aided design antennas based on the Friis formula
E031251 Design Methodology for FPGAs	lecture	open book examination oral examination	Knowing how to systematically explore the design space Being able to recognise the impact of performance measures on the implementation
E033021 Electromagnetic-aware High Frequency 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	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 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	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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
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/immunity. 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 of data 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 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.

<< **EMingwALG6.4 Possess sufficient ready knowledge and understanding to evaluate the results of complex calculations, or make approximate estimates.** *Profession-specific competence*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E022230 Antennas and Propagation	guided self-study seminar: coached exercises lecture: plenary exercises practicum lecture	open book examination skills test oral examination	Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering Mitigate fading by means of diversity, including polarisation diversity Analyse full-wave problems based on the integral equation solved by the method of moments Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector 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	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	lecture practicum	oral examination report	Understand and apply high-frequency models, transmission lines, S-parameters, noise parameters and impedance matching. Analyze and design of active and passive high-speed circuits
E003600 Information Theory	lecture seminar: coached exercises project	written examination report open book examination	Compute theoretical bounds for source and channel coding. Compute performance. Apply error detection and error correction for soft and hard decoding. Apply Viterbi decoding. Recognize the graphical representation of codes. Analyse hard and soft decoding. Compute the optimal quantizer. Use lossless and lossy source coding.
E012130 Modulation and Detection	lecture online seminar: coached exercises online lecture seminar: coached exercises	written examination open book examination	To have insight in the operation of algorithms for detection, equalization and channel estimation. To apply modulation techniques for transmission over dispersive channels and to determine their performance. To estimate the effect of channel properties (fading, dispersion) on the reliability of the communication link. To apply techniques for multiuser communication.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E033021	Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion		Have insight in the role of electromagnetic phenomena on EM aware design, including radiated/conducted emission/immunity. Be familiar with EMC norms.
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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden 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.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E033021 Electromagnetic-aware High Frequency Design	guided self-study online seminar: coached exercises online lecture: response lecture online lecture: plenary exercises online lecture lecture: plenary exercises self-reliant study activities practicum lecture excursion	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 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	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	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.

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