Competence coverage matrix

GHENT UNIVERSITY

Master of Science in Industrial Engineering and Operations Research

Academic year 2021-2022

Legend:
T=teaching methods
E=evaluation methods

			General Courses							Master's Dissertation
			E004255 Operations Research Models and Methods	E005741 Simulation of Stochastic Systems	E076950 Engineering Economy	E076340 Information Technology and Data Processing	E004241 Industrial Systems Modelling and Optimization	E004152 Heuristics and Search Methods	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 7 E 7	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 2 E 2		T E		T E			
	Have a thorough knowledge of fundamental fields of industrial systems engineering such as company- and production management, corporate finance, time study and methods engineering, operations research, quality measurement techniques and ICT.	T 6 E 6	T E	T E		T E	T E	T E	T E
	Have a thorough knowledge of supporting fields of industrial systems engineering such as cost price evaluation, investment analysis, project management and ergonomics.	T 3 E 3			T E	T E			T E
	Master and apply advanced industrial engineering techniques in industrial production, logistics, service sectors and administrative and management processes.	T 1 E 1							T E
	Have a thorough knowledge of the advanced mathematical and statistical foundations of production systems and business processes.	T 4 E 4	T E	T E			T E		T E
	Master and apply advanced operational research techniques to the field of production and logistic systems and in operational business processes.	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 5 E 5	T E	T E			T E	T E	T E
	Consult the scientific literature as part of the own research.	T 3 E 3				T E	T E		T E
	Select and apply the appropriate models, methods and techniques.	T 5 E 5	T E	T E	T E		T E		T E
	Develop and validate mathematical models and methods.	T 4 E 4	T E	T E			T E	T	
	Interpret research findings in an objective and critical manner.	T 4 E 3		T		T E		T E	T E
	Analyse business processes under the circumstances of variability and uncertainty through the use of mathematical optimisation, simulation and statistical techniques.	T 5 E 5	T E	T E	T E		T E		T E
	Calculate and follow up the costs and benefits of projects and project proposals, taking the uncertainty and impreciseness of data into account adequately.	T 4 E 4		T E	T E	T E			T E
	Autonomously develop optimisation and simulation models for complex industrial systems.	T 5 E 5	T E	T E			T E	T E	T E
	Creatively develop optimisation and simulation models for realistic industrial systems.	T 5 E 5	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 6 E 6		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 4 E 4		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 3 E 2		T				T E	T E
	Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.	T 2 E 1		T					T E
	Readily adapt to changing professional circumstances.	T 3 E 2		T	T E				T E
	Show a holistic conception about the role of the human factor in company processes in order to effectively put the planned process improvements into practice.	T 1 E 1							T E
	Show a holistic conception about the role of technology in business processes in order to effectively put the planned process improvements into practice.	T 2 E 2			T E				T E
Competences in cooperation and communication	Have the ability to communicate in English about the own field of specialisation.	T 4 E 5		T E	T E	T E		E	T E
	Project management: have the ability to formulate objectives, report efficiently, keep track of targets, follow the progress of the project,...	T 3 E 3		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 2 E 2		T E		T E			
	Report on technical or scientific subjects verbally, in writing and using graphics.	T 4 E 5		T E		T E	T E	E	T E
	Work together with colleagues from the own and other fields of expertise as well as with technical and assisting staff.	T 2 E 1		T		T E			
	Provide a training in the developed working methods to the involved assisting staff, bearing in mind multidisciplinary aspects.								
Societal competences	Act in an ethical, professional and social way.	T 2 E 2				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			

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			E004255 Operations Research Models and Methods	E005741 Simulation of Stochastic Systems	E076950 Engineering Economy	E076340 Information Technology and Data Processing	E004241 Industrial Systems Modelling and Optimization	E004152 Heuristics and Search Methods	E091103 Master's Dissertation
Societal competences	Understand the historical evolution of the own engineering discipline and its social relevance.	T 2 E 2				T E			T E
	Integrate social and societal impacts of new industrial and technological developments into business strategies, systems and processes.	T 3 E 3			T E	T E			T E
Profession-specific competence	Master the complexity of technical systems by using system and process models.	T 4 E 4	T E	T E			T E		T E
	Reconcile conflicting specifications and prior conditions in a high quality and innovative concept or process.	T 3 E 3		T E				T E	T E
	Synthesize incomplete, contradictory or redundant data into useful information.	T 3 E 3		T E				T E	T E
	Possess sufficient ready knowledge and understanding to evaluate the results of complex calculations, or make approximate estimates.	T 3 E 4		T E		T E		E	T E
	Pay attention to entire life cycles of systems, machines, and processes.								
	Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.	T 1 E 1			T E				
	Pay attention to all aspects of reliability, safety, and ergonomics.	T 3 E 2		T		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 2 E 2				T E			T E
	Continuously and critically analyse and optimise the stages a product completes in order to improve the efficiency of business processes.	T 4 E 4	T E	T			T E	E	T E
	Design and improve operational systems that generate products and services, based on scientific principles.	T 2 E 2		T E					T E
	Plan and clearly describe operational duties that employees have to perform, taking into consideration the necessary machinery and resources.	T 1 E 1		T E					
	Develop methods that allow to design new goods and services, avoiding any waste of resources.	T 1 E 1							T E
			W 12 E 12	W 31 E 24	W 13 E 13	W 22 E 22	W 15 E 15	W 14 E 18	W 35 E 35

<< **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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study self-reliant study activities seminar	written examination	Develop a spreadsheet model in order to compare different engineering alternatives from an economic perspective
E076340 Information Technology and Data Processing	lecture seminar: practical PC room classes project	written examination with open questions report	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing the structure and performance of computer architectures. Appreciating the capabilities and limitations of ICT applications.

E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	seminar: practical PC room classes	written examination with open questions	Distinguishing database models and aproaching SQL-based relational databases from the user perspective.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	lecture seminar: practical PC room classes	written examination with open questions report	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Deciding on an appropriate system development methodology in the ICT domain. Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing the structure and performance of computer architectures. Appreciating the capabilities and limitations of ICT applications.
E004241 Industrial Systems Modelling and Optimization	group work seminar: coached exercises project lecture	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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.

<< **EMingwIEOR1.2 Have a thorough knowledge of supporting fields of industrial systems engineering such as cost price evaluation, investment analysis, project management and ergonomics.** *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*			
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Identify cost–volume–profit relationships for technological products or services Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects Explain the main concepts related to estimating costs and benefits Substantiate an investment decision for a technological project, in the private as well as the public sector
E076340 Information Technology and Data Processing	lecture project	written examination with open questions report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
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.

<< **EMingwIEOR1.4 Have a thorough knowledge of the advanced mathematical and statistical foundations of production systems and business processes.** *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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
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.

<< **EMingwIEOR1.5 Master and apply advanced operational research techniques to the field of production and logistic systems and in operational business processes.** *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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E076340 Information Technology and Data Processing	project	report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study self-reliant study activities	participation	Develop a spreadsheet model in order to compare different engineering alternatives from an economic perspective Have the attitude to read popularizing texts on economic and business topics
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project	peer assessment report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study seminar lecture	participation	Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: practical PC room classes seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Identify cost–volume–profit relationships for technological products or services Explain the main concepts related to estimating costs and benefits Substantiate an investment decision for a technological project, in the private as well as the public sector
E076340 Information Technology and Data Processing	project	report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: practical PC room classes seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: practical PC room classes seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	seminar	participation	Substantiate an investment decision for a technological project, in the private as well as the public sector Develop a spreadsheet model in order to compare different engineering alternatives from an economic perspective
E076340 Information Technology and Data Processing	project	peer assessment report	Appreciating the capabilities and limitations of ICT applications. Assessing a prospective ICT offer on the market from a techno-economic perspective.
E004241 Industrial Systems Modelling and Optimization	group work	report	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems;
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project seminar: practical PC room classes	written examination with open questions report	Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing a prospective ICT offer on the market from a techno-economic perspective.
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study	participation	Have the attitude to read popularizing texts on economic and business topics
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*			
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*			
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Substantiate an investment decision for a technological project, in the private as well as the public sector
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Identify cost–volume–profit relationships for technological products or services Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects Explain the main concepts related to estimating costs and benefits Have the attitude to read popularizing texts on economic and business topics Develop a spreadsheet model in order to compare different engineering alternatives from an economic perspective Substantiate an investment decision for a technological project, in the private as well as the public sector
E076340 Information Technology and Data Processing	lecture seminar: practical PC room classes project	written examination with open questions report	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Deciding on an appropriate system development methodology in the ICT domain. Assessing a prospective ICT offer on the market from a techno-economic perspective. Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing the structure and performance of computer architectures. Appreciating the capabilities and limitations of ICT applications.
E004152 Heuristics and Search Methods	Only evaluation	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project	peer assessment report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project	peer assessment report	Assessing a prospective ICT offer on the market from a techno-economic perspective.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project	report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
E004241 Industrial Systems Modelling and Optimization	group work	report	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems;
E004152 Heuristics and Search Methods	Only evaluation	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	project	peer assessment report	Assessing a prospective ICT offer on the market from a techno-economic perspective.

<< **EMingwIEOR4.2 Provide a training in the developed working methods to the involved assisting staff, bearing in mind multidisciplinary aspects.** *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*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E076340 Information Technology and Data Processing	lecture project	written examination with open questions report	Appreciating the capabilities and limitations of ICT applications. Understanding the operation and role of network protocol architectures and information security principles. Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Identify cost–volume–profit relationships for technological products or services Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects Explain the main concepts related to estimating costs and benefits Substantiate an investment decision for a technological project, in the private as well as the public sector
E076340 Information Technology and Data Processing	lecture project	written examination with open questions report	Appreciating the capabilities and limitations of ICT applications. Understanding the operation and role of network protocol architectures and information security principles. Assessing a prospective ICT offer on the market from a techno-economic perspective.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E076340 Information Technology and Data Processing	lecture	written examination with open questions	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing the structure and performance of computer architectures. Appreciating the capabilities and limitations of ICT 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*			
E076950 Engineering Economy	guided self-study self-reliant study activities seminar lecture	written examination with multiple choice questions participation written examination	Substantiate an investment decision for a technological project, in the private as well as the public sector Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects
E076340 Information Technology and Data Processing	lecture project	written examination with open questions report	Appreciating the capabilities and limitations of ICT applications. Understanding the operation and role of network protocol architectures and information security principles. Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
E004255 Operations Research Models and Methods	lecture seminar: coached exercises self-reliant study activities	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: practical PC room classes seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	lecture	written examination with open questions	Appreciating the capabilities and limitations of ICT applications. Distinguishing database models and aproaching SQL-based relational databases from the user perspective. Assessing the structure and performance of computer architectures.
E004152 Heuristics and Search Methods	Only evaluation	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*

<< **EMingwALG6.6 Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.** *Profession-specific competence*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E076950 Engineering Economy	guided self-study	written examination with multiple	Identify cost–volume–profit relationships for technological products or services
	self-reliant study activities	choice questions	Evaluate the impact of risk and uncertainty of economic parameters on a decision making process for technological projects
	seminar	participation	Explain the main concepts related to estimating costs and benefits
	lecture	written examination	Substantiate an investment decision for a technological project, in the private as well as the public sector

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E076340 Information Technology and Data Processing	lecture seminar: practical PC room classes project	written examination with open questions report	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Distinguishing database models and aproaching SQL-based relational databases from the user perspective.
E004152 Heuristics and Search Methods	guided self-study research project seminar lecture	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods

<< **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*			
E076950 Engineering Economy	seminar	participation	Substantiate an investment decision for a technological project, in the private as well as the public sector
E076340 Information Technology and Data Processing	lecture	written examination with open questions	Assessing the structure of various wired and wireless network architectures. Understanding the operation and role of network protocol architectures and information security principles. Deciding on an appropriate system development methodology in the ICT domain. Assessing the structure and performance of computer architectures. Appreciating the capabilities and limitations of ICT applications.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E076340 Information Technology and Data Processing	project	peer assessment report	Appreciating the capabilities and limitations of ICT applications. Assessing a prospective ICT offer on the market from a techno-economic perspective.
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*			
E004255 Operations Research Models and Methods	guided self-study seminar: coached exercises self-reliant study activities lecture	written examination with open questions report	Being able to develop linear, nonlinear and mixed-integer mathematical models for the fundamental engineering optimization problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresponding decisions, simplifications and assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the modelling simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimization and related decision-making problems;
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: practical PC room classes seminar: coached exercises project lecture group work	written examination with open questions report oral examination	Being able to analyze industrial engineering systems (manufacturing, production, logistic, service processes) and identify any imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale industrial systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial engineering systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effectiveness of these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engineering systems;
E004152 Heuristics and Search Methods	Only evaluation	assignment report	Awareness of the influence of operators and representation Assess the suitability of a specific (class of) search methods for a given problem and suggest better alternatives Independently being able to translate a realistic optimization problem into a mathematical model and assess the feasibility of different search methods Being able to analyse a solution method in terms of stability and optimality of the solution found Being able to describe the different classes of modern search methods and their application areas Having a thorough knowledge of heuristics and approximation methods
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*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation
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.

<< **EMingwIEOR6.3 Plan and clearly describe operational duties that employees have to perform, taking into consideration the necessary machinery and resources.** *Profession-specific competence*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	Being able to capture a realistic manufacturing, production, logistic,services process or system into an abstract simulation model Being aware of the limitations of Monte Carlo simulation: rare events, extremely large state space, etc. Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES simulation tool Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, stationarity, regenerative properties and adjust the estimation procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular of how correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation

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