Competence coverage	matrix				, .	Course			r's Disse tation
HENT			d Methods			a Processing	Optimization		
INIVERSITY laster of Science in Ind	E004255 Operations Research Models and Methods	E005741 Simulation of Stochastic Systems	onomy	E076340 Information Technology and Data Processing	E004241 Industrial Systems Modelling and Optimization	E004152 Heuristics and Search Methods	tation		
cademic year 2021-20	22		ations Re	llation of S	E076950 Engineering Economy	mation Tec	strial Syste	istics and	E091103 Master's Dissertation
egend:			4255 Opeı	5741 Simu	3950 Engi	3340 Infor	4241 Indus	4152 Heur	1103 Mast
=teaching methods =evaluation methods									
ompetences in ne/more scientific		T 7 E 7	E	T E	T E	E	T E	T E	E
iscipline(s)		T 2 E 2		T E		T E			
	Have a thorough knowledge of fundamental fields of industrial	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	T 3 E 3			T E	T E			T E
	industrial production, logistics, service sectors and administrative	T 1 E 1							T E
	statistical foundations of production systems and business	T 4 E 4	T E	T E			T E		T E
	processes. Master and apply advanced operational research techniques to the field of production and logistic systems and in operational business		T E	T E			T E	T E	T E
cientific competences		T 5	Т	Т			Т	Т	Т
	research questions.	E 5 T 3	E	Е		Т	E	Е	E
	,	E 3	Т	Т	Т	E	E		E
	techniques.	E 5	E	E	Ē		E		Ē
	Develop and validate mathematical models and methods.	T 4 E 4	T E	E			T E	E	
	,	T 4 E 3		Т		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	E	E	E		E		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		E	E	E			E
	Autonomously develop optimisation and simulation models for complex industrial systems.	T 5 E 5	E	T E			T E	E	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
ntellectual	Independently form an opinion on complex situations and	T 6	_	Т	T	Т	Т	Т	Т
ompetences	problems, and defend this point of view. Apply knowledge in a creative, purposeful and innovative way to	E 6 T 4		E T	E	E T	E	E	E T
	research, conceptual design and production. Critically reflect on one's own way of thinking and acting, and	E 4 T 3		E T		Е		E	E
	understand the limits of one's competences.	E 2						Ē	Е
	Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.	T 2 E 1		Т					E
	Readily adapt to changing professional circumstances.	T 3 E 2		Т	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							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
ompetences in operation and	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
cooperation and communication	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	T 2		T		Т			-
	Provide a training in the developed working methods to the	E 1	-			Е			
Pagiatel account	involved assisting staff, bearing in mind multidisciplinary aspects.	To							-
Societal competences		T 2 E 2 T 2 E 2			T E	T E T E			E

Competence coverage matrix

GHENT UNIVERSITY Master of Science in Inc. Academic year 2021-20	dustrial Engineering and Operations Research		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	
Legend: T=teaching methods E=evaluation methods			E004255 (E005741 \$	E076950 F	E076340 I	E004241	E004152 H	E091103 P	
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			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		Т		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	Т			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 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 35 E 35	
EMinaw	ALG1 1 Master and apply advanced knowle	dao								i in

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

Competences in one/more scientific discipline(s)

EwilligwALGT.1 waster and apply	advanced knowledge in the ow	in engineering discipline	ii 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 terug	gevonden 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 mathem problems and recognize their deterministic or stochastic nature and its impact; Understand and master the fundamental optimization techniques urelated 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 Being aware of the limitations of Monte Carlo simulation: rare ever Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DE Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, procedure accordingly Having fundamental knowledge of the basic principles and method correlation, variance, simulation length and replications influence the reliability (bias, MS)	estremely large state space, etc. ES simulation tool stationarity, regenerative properties and adjust the estimation ds concerning Monte Carlo estimation, in particular of how
E076950 Engineering Economy	guided self-study self-reliant study activities seminar	written examination	Develop a spreadsheet model in order to compare different engine	eering 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 arch Understanding the operation and role of network protocol architect Distinguishing database models and approaching SQL-based relational sessing the structure and performance of computer architecture Appreciating the capabilities and limitations of ICT applications.	tures and information security principles. onal databases from the user 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;
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 A	ided Engineering (CAE) tools	and advanced communic	ation instruments in a creative and purposeful way.	Competences in one/more scientific discipline(s)
Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	gevonden 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,s Being aware of the limitations of Monte Carlo simulation: rare events Being able to interpret simulation results correctly Being able to model and study a realistic system with a general DES Know how general discrete-event simulation software works Being able to classify simulation models with regard to ergodicity, staprocedure accordingly Having fundamental knowledge of the basic principles and methods correlation, variance, simulation length and replications influence the reliability (bias, MSE)	s, extremely large state space, etc. S simulation tool ationarity, regenerative properties and adjust the estimation concerning Monte Carlo estimation, in particular of how
E076340 Information Technology and Data Processing	seminar: practical PC room classes	written examination with open questions	Distinguishing database models and aproaching SQL-based relation	,

<<		me study and methods engine	eering, operations researc	engineering such as company- and production Competences in one/more scientific discipline(seh, quality measurement techniques and ICT.
Course	**	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en e	evaluatievormen voorafgegaan door ** werden niet terugg	evonaen in de studietiche		
E004255 O	perations 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;
	mulation 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 mode 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 In	formation 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.
	dustrial 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 H	euristics 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 M	aster's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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analysis, project management an Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden 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.

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EMingwIEOR1.3 Master and apply advanced industrial engineering techniques in industrial production, logistics, service sectors and administrative and management processes.

Competences in one/more scientific discipline(s)

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** we	erden 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 processes.	knowledge of the advanced	mathematical and statistica	If foundations of production systems and business Competences in one/more scientific discipline(s)
Course	•	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en	evaluatievormen voorafgegaan door ** werden niet terugg	evonden in de studiefiche		
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 S	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 I	ndustrial 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 M	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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Course	business processes.	Teaching methods	Evaluation methods	Course learning outcome
	valuatievormen voorafgegaan door ** werden niet terugge	_	Evaluation methods	Course learning outcome
Ξ004255 Ο _Ι	perations 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 as related decision-making problems;
E005741 Si	mulation 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 mo 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 Ind	dustrial 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;
	euristics 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 M	aster'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
loot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	_		9
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.
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work	written examination assignment participation	related decision-making problems; Being able to capture a realistic manufacturing, production, logistic, services process or system into an abstract simulation mode 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,
E004241 Industrial Systems Modelling and Optimization	guided self-study seminar: coached exercises project lecture group work	written examination with open questions report oral examination	simulation length and replications influence the reliability (bias, MSE) of the estimation 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.

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

Scientific competences

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

EMingwALG2.3 Select and apply the appropriate models, methods and techniques.

Scientific competences

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

EMingwALG2.4 Develop and validate mathematical models and methods.

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Scientific competences

Course	Teaching methods	Evaluation methods	Course learning outcome
loot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	evonden 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

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

Scientific competences

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

optimisation, simulation and stati		Evaluation methods	Course learning outcome
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden in de studietiche		
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 an 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 mod 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.

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data into account adequately.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden 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	e 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.

EMingwIEOR2.3 Autonomously develop optimisation and simulation models for complex industrial systems.

Scientific	competences
Coloriumo	compotentee

EMingwIEOR2.3 Autonomously develop optimisation and simulation models for complex industrial systems.			industrial systems. Scientific co	Scientific competences
Course	Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	gevonden 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 optoproblems 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, simplificate assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant parameters on the conclusions, the simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fundamental engineering optimizated decision-making problems;	ations and e modelling
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 simulating 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 procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte Carlo estimation, in particular correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation	e 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 id imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and control models of large scale systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques for large scale industrial e systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then investigate and analyze effect these reformulations; Being able to develop valid optimization models to support design, operations and control decisions in industrial engages.	e industrial ngineering tiveness of
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 fea 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	sibility of
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 laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.	

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EMingwIEOR2.4 Creatively develop optimisation and simulation models for realistic industrial systems.

Scientific (competences
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<< EMingwlEC	R2.4 Creatively develop	o optimisation and simulation	models for realistic indus	trial systems.	Scientific competences
Course		Teaching methods	Evaluation methods	Course learning outcome	
Noot: leer- en evaluatievormen voo	rafgegaan door ** werden niet terugg	evonden in de studiefiche			
E004255 Operations Resea	arch 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 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 assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant paramesimplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these fur related decision-making problems;	sponding decisions, simplifications and eters on the conclusions, the modelling
E005741 Simulation of Stoo	chastic 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 Being aware of the limitations of Monte Carlo simulation: rare events, extremely large so 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, regeneral procedure accordingly Having fundamental knowledge of the basic principles and methods concerning Monte correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation	tate space, etc.
E004241 Industrial Systems	s 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 imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and systems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition technique systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then in these reformulations; Being able to develop valid optimization models to support design, operations and continuous systems;	control models of large scale industrial es for large scale industrial engineering es scale industrial engineering envestigate and analyze effectiveness of
E004152 Heuristics and Se	arch 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 su Independently being able to translate a realistic optimization problem into a mathematic different search methods Being able to analyse a solution method in terms of stability and optimality of the solution Being able to describe the different classes of modern search methods and their applicated the search methods and their applicated the search methods.	cal model and assess the feasibility of on found
E091103 Master's Disserta	ion	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, in Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the executopical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results Find an appropriate methodology, in accordance with the applicable scientific norms of	them, both to colleagues as to cution of research (literature search, conclusions,).

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< EMingwALG3.1 Independently for	n an opinion on complex si	tuations and problems, a	nd defend this point of view. Intellectual competence
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	gevonden 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 mode 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.

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

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

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

ntellectua	l competences
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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden nie	et 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.

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

Intellectual competences

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

EMingwALG3.5 Readily adapt to changing professional circumstances.

Intellectual co	mpetences
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Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden nie	et 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 mode 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.

EMingwlEOR3.1 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.

Intellectual competences

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

EMingwIEOR3.2 Show a holistic conception about the role of technology in business processes in order to effectively put the planned process improvements into practice.

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Intellectual competences

improvements into practic	e.		
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werd	en 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.

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

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

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project,	Tanahim munatha da	Francisco mathada	Course learning automa
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden 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 mode 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 Competences in cooperation and communication supervisory responsibilities.

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

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

< EMingwIEOR4.1 Work together	EMingwIEOR4.1 Work together with colleagues from the own and other fields of expertise as well as with technical and assisting staff. Competences in cooper				
Course	Teaching methods	Evaluation methods	Course learning outcome		
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet te	ruggevonden in de studiefiche				
E005741 Simulation of Stochastic Systems	guided self-study seminar: coached exercises lecture group work		Being aware of the limitations of Monte Carlo simulation: rare of Being able to interpret simulation results correctly Being able to model and study a realistic system with a general Know how general discrete-event simulation software works	al DES simulation tool city, stationarity, regenerative properties and adjust the estimation thods concerning Monte Carlo estimation, in particular of how	
E076340 Information Technology and Data Processing	g project	peer assessment	Assessing a prospective ICT offer on the market from a technology	·	

report

< EMingwlEOR4.2 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

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

Societal competences

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

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

Societal competences

Course	Teaching methods	Evaluation methods	Course learning outcome
	•	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden 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
E076340 Information Technology and Data Processing	lecture	written examination with open	Appreciating the capabilities and limitations of ICT applications.
	project	questions	Understanding the operation and role of network protocol architectures and information security principles.
		report	Assessing a prospective ICT offer on the market from a techno-economic perspective.

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

Societal competences

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

EMingwlEOR5.1 Integrate social and societal impacts of new industrial and technological developments into business strategies, systems and

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Societal competences

processes.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terug	gevonden 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		
Jourse Joot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg		Lvaluation methods	Course rearring outcome		
werden niet terugg	evonden III de Stadienone				
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 further problems and recognize their deterministic or stochastic nature and its impact; Being able to critically interpret the results obtained and validate or invalidate the corresp assumptions that were made; Being able to carry out a sensitivity analysis to assess the impact of the relevant paramet simplifications and assumptions that were made; Understand and master the fundamental optimization techniques used to solve these funrelated decision-making problems;	eonding decisions, simplifications and ters on the conclusions, the modelling	
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 so Being aware of the limitations of Monte Carlo simulation: rare events, extremely large stated 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 procedure accordingly. Having fundamental knowledge of the basic principles and methods concerning Monte Correlation, variance, simulation length and replications influence the reliability (bias, MSE) of the estimation.	te space, etc. ve properties and adjust 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, imbedded recognizable subproblems; Being able to develop approximate and heuristic solution methods for optimization and consystems, taking the stochastic aspects into account; Being able to select and apply appropriate optimization and/or decomposition techniques systems, taking possible stochastic aspects into account; Being able to develop possible reformulations for these optimization models and then involved these reformulations; Being able to develop valid optimization models to support design, operations and control systems;	ontrol models of large scale industrial for large scale industrial engineering estigate and analyze effectiveness of	
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, initiself-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the executopical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, or Find an appropriate methodology, in accordance with the applicable scientific norms of the	them, both to colleagues as to ution of research (literature search, conclusions,).	

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EMingwALG6.2 Reconcile conflicting specifications and prior conditions in a highquality and innovative concept or process.

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	competence

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

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

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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			
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.			

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EMingwALG6.4 Possess sufficient ready knowledge and understanding to evaluate the results of complex calculations, or make approximate

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Profession-specific competence

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

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

Profession-specific competence

Course Teaching methods Evaluation methods Course learning outcome

Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche

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

Profession-specific competence

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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 m	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		

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EMingwALG6.7 Pay attention to all aspects of reliability, safety, and ergonomics.

Profession-specific competence

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

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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 terugg	evonden 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.

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

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Profession-specific competence

Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden niet terugg	gevonden in de studiefiche		
E076340 Information Technology and Data Processing	project	peer assessment	Appreciating the capabilities and limitations of ICT applications.
		report	Assessing a prospective ICT offer on the market from a techno-economic perspective.
E091103 Master's Dissertation	master's dissertation	oral examination	Define, study and analyse the research problem in a specific domain.
		assignment	Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance.
		-	Self-assessment with adequate and critical self-correction and objectivity.
			Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople.
			Render and synthesise the results concisely.
			Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the
			reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,).
			Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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<<	EMingwIEOR6.1 Continuously and business processes.	critically analyse and optimis	se the stages a product co	mpletes in order to improve the efficiency of Profession-specific competend
Course	addinose processor	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- e	n evaluatievormen voorafgegaan door ** werden niet terugg	evonden 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 mod 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.

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EMingwIEOR6.2 Design and improve operational systems that generate products and services, based on scientific principles.

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

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EMingwIEOR6.3 Plan and clearly describe operational duties that employees have to perform, taking into consideration the necessary

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Profession-specific competence

machinery and resources.			
Course	Teaching methods	Evaluation methods	Course learning outcome
Noot: leer- en evaluatievormen voorafgegaan door ** werden nie	t 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 mode 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

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EMingwlEOR6.4 Develop methods that allow to design new goods and services, avoiding any waste of resources.

Profession-specific competence

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

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