Competence coverage matrix

GHENT UNIVERSITY

Master of Science in Civil Engineering

Academic year 2021-2022

Legend:
T=teaching methods
E=evaluation methods

			General Courses														Majors											Master's Dissertation
			E044940 FEM and Constitutive Material Laws in Structural Engineering	E050923 Structural Reliability and Risk Analysis	E054920 Coastal Engineering and Harbour Construction	E044821 Advanced Bridge and Tunnel Engineering	E050100 Design of Civil Structures	E040661 Structural Dynamics	E045621 Groundwater and Contaminant Flow	E044311 Structural Stability	E045860 Water Management and Environment	E052621 Concrete Structures: Prestressed Concrete and Slabs	E054820 Inland Waterways and Locks	E052210 Geotechnics	E053560 Specialised Road Engineering and Mobility	E055044 Introduction to Maritime Technology (partim)	E044666 Offshore Structures	E055400 Coastal Hydrodynamics	E044671 Offshore Foundations	E054680 Dredging: Techniques and Processes	E061502 Spatial Structures	E044571 Non-linear and Plastic Methods of Structural Analysis	E044902 Conceptual Design	E044930 Seismic Design	E044631 Glass and Facade Structures	E091103 Master's Dissertation
Competences in one/more scientific discipline(s)	Master and apply advanced knowledge in the own engineering discipline in solving complex problems.	T 19 E 19	T E	T E	T E	T E	T E	T E	T E	T E		T E	T E	T E	T E			T E	T E	T E		T E	T E	T E		T E
	Apply Computer Aided Engineering (CAE) tools and advanced communication instruments in a creative and purposeful way.	T 8 E 8	T E	T E		T E	T E	T	T E						E				T E				T E			
	Innovative use of expert knowledge in the field of the finite element methods and structural dynamics.	T 9 E 5	T E			T E	T	T E	T			T E			E								T	T		T E
	Apply knowledge about roads and bridges (use of materials, way of construction and integration in the environment), bearing in mind the environmental effects.	T 5 E 4				T E	T					T E			T E											T E
	Having the attitude to use social sciences in an inventive or innovative way during the process of design and research.	T 8 E 7				T E	T E					T E			T E					T E			T E	T		T E
	Use profound civil engineering knowledge in order to analyse and solve complex civil engineering problems.	T 15 E 12	T E			T E	T E		T	T E		T		T E	T E				T E	T E	T E		T	T E	T E	T E
	Analyse and solve new and complex civil engineering problems by means of advanced calculation methods.	T 13 E 12	T E	T E		T E	T E		T E	T E					T		T E		T E	T E			T E	T E		T E
	Be familiar with behaviour of materials, models of materials and the application of materials in complex constructions.	T 13 E 11	T E			T E	T E		T					T E	T E				T		T E	T E	T E	T E	T E	T E
	To critically apply knowledge of flowing water and its mathematical formulation to hydraulic engineering constructions and problems concerning integral water management.	T 6 E 6			T E				T E		T E		T E			T E		T E								
Scientific competences	Analyse complex problems and translate them into concrete research questions.	T 14 E 13	T E	T E		T E	T E	T E	T E	T E				T E	T E	T E			T E	T E			T			T E
	Consult the scientific literature as part of the own research.	T 5 E 5				T E					T E				T E						T E					T E
	Select and apply the appropriate models, methods and techniques.	T 22 E 22	T E	T E	T E	T E	T E	T E	T E	T E	T E	T E	T E		T E	T E	T E			T E	T E	T E	T E	T E	T E	T E	T E
	Develop and validate mathematical models and methods.	T 7 E 5	T E	T E		T E	T E							T E					T				T E			
	Interpret research findings in an objective and critical manner.	T 6 E 4	T E			T E	T								T E								T			T E
	Contribute to the conception and design of constructions and examine the stability of advanced constructions.	T 17 E 17	T E	T E	T E	T E	T E		T E	T E		T E			T E		T E		T E		T E	T E	T E	T E	T E	T E
	Apply design and research methods and techniques to highly advanced ideas and applications in various civil engineering sectors.	T 8 E 6				T E	T E		T						T E					T E			T E	T		T E
	Assess, design, calculate and evaluate every building from foundations to construction in an integrated and multidisciplinary way.	T 9 E 8			T E	T E	T E							T E	T E			T E	T E				T			T E
Intellectual competences	Independently form an opinion on complex situations and problems, and defend this point of view.	T 9 E 8	T E	T E		T E	T E			T					T E					T E			T E			T E
	Apply knowledge in a creative, purposeful and innovative way to research, conceptual design and production.	T 12 E 11			T E	T E	T E					T		T E	T E			T E	T E	T E			T E		T E	T E
	Critically reflect on one's own way of thinking and acting, and understand the limits of one's competences.	T 9 E 9	T E			T E	T E				T E				T E		T E						T E	T E		T E
	Stay uptodate with the evolutions in the discipline to elevate the own competences to expert level.	T 13 E 9	T E			T E	T		T	T E		T			T E					T E	T E	T E	T		T E	T E
	Readily adapt to changing professional circumstances.	T 5 E 3				T E	T								T E									T		T E
Competences in cooperation and communication	Have the ability to communicate in English about the own field of specialisation.	T 20 E 20	T E	T E		T E	T E	T E		T E		T E	T E	T E	T E	T E	T E		T E	T E	T E	T E	T E	T E	T E	T E
	Project management: have the ability to formulate objectives, report efficiently, keep track of targets, follow the progress of the project,...	T 9 E 9			T E	T E	T E	T							E	T E			T E				T E	T E		T E
	Have the ability to work as a member of a team in a multi disciplinary workingenvironment, as well as being capable of taking on supervisory responsibilities.	T 6 E 4	T E			T E	T								E				T		T E		T			
	Report on technical or scientific subjects verbally, in writing and using graphics.	T 19 E 18	T E		T E	T E	T E	T		T E	T E		T E	T E	T E	T E	T E	T E	T E	T E	T E		T E	T E		T E
Societal competences	Act in an ethical, professional and social way.	T 7 E 5				T E	T					T E			T E					T E			T	T E		T E
	Recognize the most important business and legal aspects of the own engineering discipline.	T 7 E 6				T E	T				T E				T E	T E	T E			T E						
	Understand the historical evolution of the own engineering discipline and its social relevance.	T 6 E 4				T E									T	T E				T E				T		T E
Profession-specific competence	Master the complexity of technical systems by using system and process models.	T 10 E 10	T E	T E	T E	T E	T E	T E							T E					T E			T E			T E
	Reconcile conflicting specifications and prior conditions in a high quality and innovative concept or process.	T 6 E 6				T E	T E								T E			T E					T E			T E
	Synthesize incomplete, contradictory or redundant data into useful information.	T 12 E 12	T E			T E	T E						T E	T E	T E	T E	T E				T E		T E	T E		T E
	Possess sufficient ready knowledge and understanding to evaluate the results of complex calculations, or make approximate estimates.	T 17 E 15	T E	T E		T E	T E	T E	T	T E				T E	T E		T E		T E	T E	T E		T	T E	T E	T E

Competence coverage matrix

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Legend:
T=teaching methods
E=evaluation methods

			E044940 FEM and Constitutive Material Laws in Structural Engineering	E050923 Structural Reliability and Risk Analysis	E054920 Coastal Engineering and Harbour Construction	E044821 Advanced Bridge and Tunnel Engineering	E050100 Design of Civil Structures	E040661 Structural Dynamics	E045621 Groundwater and Contaminant Flow	E044311 Structural Stability	E045860 Water Management and Environment	E052621 Concrete Structures: Prestressed Concrete and Slabs	E054820 Inland Waterways and Locks	E052210 Geotechnics	E053560 Specialised Road Engineering and Mobility	E055044 Introduction to Maritime Technology (partim)	E044666 Offshore Structures	E055400 Coastal Hydrodynamics	E044671 Offshore Foundations	E054680 Dredging: Techniques and Processes	E061502 Spatial Structures	E044571 Non-linear and Plastic Methods of Structural Analysis	E044902 Conceptual Design	E044930 Seismic Design	E044631 Glass and Facade Structures	E091103 Master's Dissertation
Profession-specific competence	Pay attention to entire life cycles of systems, machines, and processes.	T 2 E 2														T E				T E						
	Pay attention to sustainability, energyefficiency, environmental cost, use of raw materials and labour costs.	T 4 E 4				T E										T E					T E				T E	
	Pay attention to all aspects of reliability, safety, and ergonomics.	T 8 E 5		T E		T E	T			T E							T E						T	T	T E	
	Have insight into and understanding of the importance of entrepreneurship.	T 2					T																T			
	Show perseverance, innovativeness, and an aptitude for creating added value.	T 6 E 6				T E	T E			T						E				T E			T E			T E
	Be able to perform design and/or research independently in a broad range of advanced civil engineering working situations.	T 5 E 4				T E	T E									T E							T			T E
	Be aware of the social responsibility of a civil engineer.	T 9 E 5		T		T E	T E		T		T E					T E							T	T		T E
			W 20 E 20	W 13 E 12	W 9 E 9	W 37 E 37	W 35 E 24	W 10 E 7	W 14 E 7	W 13 E 11	W 7 E 7	W 10 E 7	W 5 E 5	W 12 E 12	W 31 E 33	W 10 E 10	W 9 E 9	W 6 E 6	W 18 E 16	W 18 E 18	W 11 E 11	W 6 E 6	W 32 E 18	W 20 E 13	W 10 E 10	W 31 E 31

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

Competences in one/more scientific discipline(s)

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen vooraf gegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination report oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E054920 Coastal Engineering and Harbour Construction	group work lecture	oral examination report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes. Describe and argue the coastal hydrodynamic processes, in particular waves and (tidal) currents and their interaction with coastal structures. Report (written and oral) the results from a design project.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	guided self-study seminar: coached exercises practicum lecture	written examination oral examination	Apply modelstructure preserving reduction techniques. Apply Matlab for structural dynamics. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature. Design of vibration isolation and vibration absorption devices. Model structures based on Lagrange's technique.

E045621	Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311	Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052621	Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E054820	Inland Waterways and Locks	guided self-study seminar project lecture	oral examination report	Being familiar with the most important terminology of (maritime and inland) navigation and with the CEMT classification of inland waterways Knowing the different types of lock filling-emptying systems and having insight into their respective range of applicability Having insight into the respective mode of operation of mitre gates and rolling gates and into the load transfer Being able to discern the major components of mitre gates and rolling gates Being able to discern the major components of a navigation lock and knowing their function Having insight into the role of the water balance and the soil balance in the design of a canal Knowing the different means of infrastructural measures to improve the navigability of a river (river training, normalization, canalization) and their respective range of applicability Having insight into factors influencing the geometrical characteristics of a waterway, including lock-complexes
E052210	Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications
E053560	Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055400	Coastal Hydrodynamics	lecture	open book examination report	To have knowledge of and insight in basic engineering usage of coastal hydrodynamics (waves, currents and sediment transport) as loading conditions for nearshore and offshore structures. Analyse physical model testing in the laboratory wave flume and wave tank. Apply wave propagation modelling tools as design tool.
E044671	Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680	Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044571	Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902	Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930	Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	seminar	open book examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3.
E044821 Advanced Bridge and Tunnel Engineering	lecture online lecture PDE tutorial microteaching	oral examination report peer assessment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	practicum		Apply Matlab for structural dynamics.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E053560 Specialised Road Engineering and Mobility		assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	lecture seminar: coached exercises practicum	written examination oral examination	Apply modelstructure preserving reduction techniques. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature. Design of vibration isolation and vibration absorption devices.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
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.

<< **EMingwCIVI1.2 Apply knowledge about roads and bridges (use of materials, way of construction and integration in the environment), bearing in mind the environmental effects.** *Competences in one/more scientific discipline(s)*

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E044821	Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100	Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E052621	Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E053560	Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E091103	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture		Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502 Spatial Structures	lecture seminar: coached exercises	written examination open book examination	Analyse and design spatial structures using simplified methods.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.

E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination report oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E053560 Specialised Road Engineering and Mobility	guided self-study lecture		The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671 Offshore Foundations	group work lecture		The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E061502 Spatial Structures	lecture seminar: coached exercises	written examination report assignment open book examination	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044571 Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E054920 Coastal Engineering and Harbour Construction	group work lecture	oral examination report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes. Describe and argue the coastal hydrodynamic processes, in particular waves and (tidal) currents and their interaction with coastal structures. Report (written and oral) the results from a design project.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E054820 Inland Waterways and Locks	guided self-study seminar project lecture	oral examination report	Being familiar with the most important terminology of (maritime and inland) navigation and with the CEMT classification of inland waterways Knowing the different types of lock filling-emptying systems and having insight into their respective range of applicability Having insight into the respective mode of operation of mitre gates and rolling gates and into the load transfer Being able to discern the major components of mitre gates and rolling gates Being able to discern the major components of a navigation lock and knowing their function Having insight into the role of the water balance and the soil balance in the design of a canal Knowing the different means of infrastructural measures to improve the navigability of a river (river training, normalization, canalization) and their respective range of applicability Having insight into factors influencing the geometrical characteristics of a waterway, including lock-complexes
E055044 Introduction to Maritime Technology (partim)	lecture	oral examination	Reason out the manoeuvring behaviour of a ship. Distinguish the most important characterstics of a ship's steering equipment (rudder). Define the main techniques used to determine and evaluate a ship' smanoeuvring behaviour. Distinguish the most important physical causes of a ship's resistance. Reason out the most important parameters on which a ship's resistance depends. Define and recognise the most usual technologies used for a ship's propulsion. Get acquinted with the specific hydrodynamic behaviour of a ship in shallow and confined navigation areas. Give an explanation for the dynamic behaviour of a floating structure in waves. Be able to use professional terminology with respect to the behavviour of floating structures in waves. Gain insight into hydrostatics and stability of floating structures.
E055400 Coastal Hydrodynamics	lecture	open book examination report	To have knowledge of and insight in basic engineering usage of coastal hydrodynamics (waves, currents and sediment transport) as loading conditions for nearshore and offshore structures. Analyse physical model testing in the laboratory wave flume and wave tank. Apply wave propagation modelling tools as design tool.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	lecture seminar: coached exercises practicum	written examination oral examination	Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature. Perform a modal analysis of a structure and formulate structural modifications.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	seminar: coached exercises	open book examination report	Analyse specific problems concerning hydrostatics and stability of a simple floating structure.
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,...). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E061502 Spatial Structures	seminar: coached exercises	report	Analyse and design spatial structures using simplified methods. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,...). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E054920 Coastal Engineering and Harbour Construction	group work	report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	guided self-study seminar: coached exercises practicum lecture	written examination oral examination	Apply modelstructure preserving reduction techniques. Apply Matlab for structural dynamics. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature. Design of vibration isolation and vibration absorption devices. Model structures based on Lagrange's technique.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications

E053560	Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044	Introduction to Maritime Technology (partim)	guided self-study seminar: coached exercises	open book examination report	Analyse specific problems concerning hydrostatics and stability of a simple floating structure. Execute hydrostatic calculations and stability calculations for a pontoon by means of specialised software.
E044666	Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044671	Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680	Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502	Spatial Structures	lecture seminar: coached exercises	written examination report open book examination	Analyse and design spatial structures using simplified methods.
E044571	Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902	Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930	Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631	Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study lecture	oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E044940	FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923	Structural Reliability and Risk Analysis	seminar	report	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E054920	Coastal Engineering and Harbour Construction	group work lecture	oral examination report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes.
E044821	Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100	Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621	Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work	oral examination report	DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311	Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052621	Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E053560	Specialised Road Engineering and Mobility	guided self-study lecture	oral examination	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044666	Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044671	Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E061502	Spatial Structures	lecture seminar: coached exercises	written examination report assignment open book examination	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.

E044571	Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902	Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930	Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631	Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen vooraf gegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E054920 Coastal Engineering and Harbour Construction	group work lecture	oral examination report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes. Describe and argue the coastal hydrodynamic processes, in particular waves and (tidal) currents and their interaction with coastal structures.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055400 Coastal Hydrodynamics	lecture	open book examination	To have knowledge of and insight in basic engineering usage of coastal hydrodynamics (waves, currents and sediment transport) as loading conditions for nearshore and offshore structures.
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	oral examination report	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E044311 Structural Stability	guided self-study seminar: coached exercises lecture		To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E054920 Coastal Engineering and Harbour Construction	group work lecture	oral examination report	Design coastal structures along the coastline and in the sea, in particular breakwaters, and understand the construction processes. Describe and argue the coastal hydrodynamic processes, in particular waves and (tidal) currents and their interaction with coastal structures.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture		Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055400 Coastal Hydrodynamics	lecture	open book examination	To have knowledge of and insight in basic engineering usage of coastal hydrodynamics (waves, currents and sediment transport) as loading conditions for nearshore and offshore structures.
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E044940	FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821	Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100	Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621	Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311	Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052621	Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture		Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E053560	Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680	Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502	Spatial Structures	lecture seminar: coached exercises	written examination report assignment open book examination	Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044571	Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902	Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination report oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	lecture	oral examination	Apply modelstructure preserving reduction techniques. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature. Design of vibration isolation and vibration absorption devices. Model structures based on Lagrange's technique.
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052621 Concrete Structures: Prestressed Concrete and Slabs	guided self-study seminar: coached exercises lecture	oral examination	Elucidate the verification of the ultimate limit state of flexure. Clearly identify the underlying basic assumptions and material laws. Analyse the different types of splitting actions in the anchorage zones of prestressed concrete girders. Analyse the secondary moments that are caused by prestressing. Derive a procedure for the design of statically indeterminate systems. Discuss the criteria for the determination of the tendon profile over the length of a beam. Derive the forces exerted by a prestressing tendon on a concrete beam. Derive the the stress conditions in a critical section in service conditions. Demonstrate how the prestressing force and the eccentricity can be determined by a stepwise procedure. Have insight in the general design philosophy of prestressed concrete structures in the framework of the semi-probabilistic safety format. Identify and characterize the relevant limit states. Substantiate the influence of prestressing on the shear resistance of beams. Describe the different prestressing systems and concepts. Substantiate the advantages and disadvantages.
E054820 Inland Waterways and Locks	guided self-study seminar project lecture	oral examination report	Being familiar with the most important terminology of (maritime and inland) navigation and with the CEMT classification of inland waterways Knowing the different types of lock filling-emptying systems and having insight into their respective range of applicability Having insight into the respective mode of operation of mitre gates and rolling gates and into the load transfer Being able to discern the major components of mitre gates and rolling gates Being able to discern the major components of a navigation lock and knowing their function Having insight into the role of the water balance and the soil balance in the design of a canal Knowing the different means of infrastructural measures to improve the navigability of a river (river training, normalization, canalization) and their respective range of applicability Having insight into factors influencing the geometrical characteristics of a waterway, including lock-complexes
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms

E055044	Introduction to Maritime Technology (partim)	guided self-study seminar: coached exercises lecture	open book examination report oral examination	Reason out the manoeuvring behaviour of a ship. Distinguish the most important characterstics of a ship's steering equipment (rudder). Define the main techniques used to determine and evaluate a ship' smanoeuvring behaviour. Execute hydrostatic calculations and stability calculations for a pontoon by means of specialised software. Distinguish the most important physical causes of a ship's resistance. Reason out the most important parameters on which a ship's resistance depends. Define and recognise the most usual technologies used for a ship's propulsion. Analyse specific problems concerning hydrostatics and stability of a simple floating structure. Get acquinted with the specific hydrodynamic behaviour of a ship in shallow and confined navigation areas. Give an explanation for the dynamic behaviour of a floating structure in waves. Be able to use professional terminology with respect to the behavviour of floating structures in waves. Describe the main actors in the shipping world. Get acquainted with professional terminology concerning types, external characteristics, structure and primary members of maritime constructions. Gain insight into hydrostatics and stability of floating structures.
E044666	Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044671	Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680	Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502	Spatial Structures	seminar: coached exercises	written examination report assignment open book examination	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044571	Non-linear and Plastic Methods of Structural Analysis	lecture seminar	open book examination oral examination	Have insight in the basic principles of limit analysis. Demonstrate the differences with a linear elastic analysis. Perform a step by step calculation of the collapse load with estimation of the deflections just prior to collapse. Explain the notions: plastic hinge, collapse mechanism, safe and statically admissible distribution of bending moments, kinematically possible mechanism, the real collapse mechanism. Demonstrate the basic principles of the yield line theory. Derive kinematically admissible yield line patterns for isotropic and orthotropic slabs. Asses the factors which influence the plastic rotation capacity of reinforced concrete sections. Derive simplified ductility conditions. Elucidate the basic principles of moment redistribution in continuous reinforced concrete beams. Substantiate the influence on the reinforcement distribution. Direct calculation of the ultimate load of simple continuous beams and frames.
E044902	Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930	Seismic Design	lecture seminar: coached exercises project	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631	Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103	Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E054920 Coastal Engineering and Harbour Construction	group work	report	Report (written and oral) the results from a design project.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	assignment report peer assessment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	practicum		Apply Matlab for structural dynamics.
E053560 Specialised Road Engineering and Mobility		assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	guided self-study seminar: coached exercises	open book examination report	Analyse specific problems concerning hydrostatics and stability of a simple floating structure. Execute hydrostatic calculations and stability calculations for a pontoon by means of specialised software.
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	project seminar: coached exercises	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E044940	FEM and Constitutive Material Laws in Structural Engineering	seminar: practical PC room classes	assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821	Advanced Bridge and Tunnel Engineering	microteaching PDE tutorial	assignment report peer assessment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100	Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560	Specialised Road Engineering and Mobility		assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671	Offshore Foundations	group work lecture		The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E061502	Spatial Structures	seminar: coached exercises	assignment report	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044902	Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	seminar: practical PC room classes	assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E054920 Coastal Engineering and Harbour Construction	group work	report	Report (written and oral) the results from a design project.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	practicum		Apply Matlab for structural dynamics.
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E054820 Inland Waterways and Locks	guided self-study seminar project lecture	oral examination report	Being familiar with the most important terminology of (maritime and inland) navigation and with the CEMT classification of inland waterways Knowing the different types of lock filling-emptying systems and having insight into their respective range of applicability Having insight into the respective mode of operation of mitre gates and rolling gates and into the load transfer Being able to discern the major components of mitre gates and rolling gates Being able to discern the major components of a navigation lock and knowing their function Having insight into the role of the water balance and the soil balance in the design of a canal Knowing the different means of infrastructural measures to improve the navigability of a river (river training, normalization, canalization) and their respective range of applicability Having insight into factors influencing the geometrical characteristics of a waterway, including lock-complexes
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	seminar: coached exercises	report	Analyse specific problems concerning hydrostatics and stability of a simple floating structure. Execute hydrostatic calculations and stability calculations for a pontoon by means of specialised software.
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E055400 Coastal Hydrodynamics	lecture	open book examination report	Apply wave propagation modelling tools as design tool. Analyse physical model testing in the laboratory wave flume and wave tank.
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502 Spatial Structures	seminar: coached exercises	assignment report	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

E044930 Seismic Design	project seminar: coached exercises	written examination with open questions report open book examination	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study lecture	oral examination	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture project	written examination with open questions report open book examination	To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study lecture	oral examination	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	lecture	oral examination	Describe the main actors in the shipping world.
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study microteaching	oral examination	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E053560 Specialised Road Engineering and Mobility	lecture		The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	lecture	oral examination	Describe the main actors in the shipping world. Distinguish the most important physical causes of a ship's resistance. Reason out the most important parameters on which a ship's resistance depends. Define and recognise the most usual technologies used for a ship's propulsion.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,...). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination oral examination	Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications. Being able to apply fault and event trees to structural engineering applications.
E054920 Coastal Engineering and Harbour Construction	group work	report	Describe and argue the coastal hydrodynamic processes, in particular waves and (tidal) currents and their interaction with coastal structures.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	lecture seminar: coached exercises	written examination oral examination	Apply modelstructure preserving reduction techniques. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Model structures based on Lagrange's technique.
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055400 Coastal Hydrodynamics	lecture	open book examination report	To have knowledge of and insight in basic engineering usage of coastal hydrodynamics (waves, currents and sediment transport) as loading conditions for nearshore and offshore structures. Apply wave propagation modelling tools as design tool.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E054820 Inland Waterways and Locks	guided self-study seminar project lecture	oral examination report	Being familiar with the most important terminology of (maritime and inland) navigation and with the CEMT classification of inland waterways Knowing the different types of lock filling-emptying systems and having insight into their respective range of applicability Having insight into the respective mode of operation of mitre gates and rolling gates and into the load transfer Being able to discern the major components of mitre gates and rolling gates Being able to discern the major components of a navigation lock and knowing their function Having insight into the role of the water balance and the soil balance in the design of a canal Knowing the different means of infrastructural measures to improve the navigability of a river (river training, normalization, canalization) and their respective range of applicability Having insight into factors influencing the geometrical characteristics of a waterway, including lock-complexes
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E055044 Introduction to Maritime Technology (partim)	guided self-study seminar: coached exercises	open book examination report	Analyse specific problems concerning hydrostatics and stability of a simple floating structure. Execute hydrostatic calculations and stability calculations for a pontoon by means of specialised software.
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E061502 Spatial Structures	seminar: coached exercises	assignment report	Analyse and design spatial structures using simplified methods. Use three-dimensional thinking with respect to structural design and analysis. Understand the behaviour, formfinding, design and erection methods of spatial structures.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	project	report	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

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

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044940 FEM and Constitutive Material Laws in Structural Engineering	guided self-study seminar: practical PC room classes lecture	written examination assignment	Be able to make appropriate choices with respect to the element mesh and solution method. Gain an insight into the working and possibilities of finite element methods. Be able to execute a FEM analysis of a simple application and be able to perform a critical assessment of the obtained results Know and be able to differentiate the different material laws and be able to indicate their suitability for different structural engineering applications. Gain a critic insight about the application possibilities of different types of elements for structural engineering applications.
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination report oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E040661 Structural Dynamics	seminar: coached exercises	written examination	Apply modelstructure preserving reduction techniques. Identify modal parameters from experiments. Perform a modal analysis of a structure and formulate structural modifications. Calculate vibration levels of civil structures when they are subjected to dynamic loads of different nature.
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E052210 Geotechnics	guided self-study seminar: coached exercises lecture	written examination	Evaluating deep foundations Designing deep foundations Designing common ground improvement techniques applications Evaluating common ground improvement techniques applications
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044666 Offshore Structures	group work lecture	open book examination report oral examination	CONCEPTS: design of offshore structures; wave forces on piles; scour; offshore wind energy; renewable energy SKILLS: design of offshore structures INSIGHTS: distinction between breaking and non-breaking waves w.r.t. wave loading on piles; insight in potential and problems related to offshore constructions; renewable energies
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E061502 Spatial Structures	lecture seminar: coached exercises	written examination report assignment open book examination	Analyse and design spatial structures using simplified methods.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

E044930 Seismic Design	project	report	Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study lecture	oral examination	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E054680 Dredging: Techniques and Processes	lecture seminar: coached exercises	written examination open book examination	Insight in the loosening processes of importance during dredging: breaching, jetting and cutting Knowledge of dredging processes, pumps as used on dredging ships, and ecological aspects Knowledge of different contracts forms, pricing and project approach for dredging contracts. Understanding how various subprocesses are linked to each other and sees the dependencies. Calculating the production for the different types of dregders depeding on dredger type, installed power and soil conditions.
E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E050923 Structural Reliability and Risk Analysis	guided self-study seminar lecture	open book examination report oral examination	Being able to apply Monte Carlo simulations for the determination of failure probabilities. Being able to apply Bayesian decision theory to structural engineering applications. Understanding the difference between structural reliability methods of level 1, 2 and 3. Being able to determine the failure probability of simple, but realistic, limit state equations using structural reliability methods of level 2 and 3. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes. Understanding the influence of uncertainties in structural design. Being able to apply fault and event trees to structural engineering applications. Understanding specific properties of series and parallel systems and being able to apply such schematisation in structural applications.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching lecture	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E044311 Structural Stability	guided self-study seminar: coached exercises lecture	written examination oral examination open book examination	To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E055044 Introduction to Maritime Technology (partim)	lecture	oral examination	Reason out the manoeuvring behaviour of a ship. Distinguish the most important characterstics of a ship's steering equipment (rudder). Define the main techniques used to determine and evaluate a ship' smanoeuvring behaviour. Get acquinted with the specific hydrodynamic behaviour of a ship in shallow and confined navigation areas. Gain insight into hydrostatics and stability of floating structures.
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
E044631 Glass and Facade Structures	lecture	oral examination	Design conceptually and structurally correct glass structures and facade structures. Recognise and apply basic principles of holistic facade design Recognise, denominate and explain frequent glass pathologies. Perform strength and stability checks of elementary glass and facade components and connections. Explain construction and structural concepts.

<< **EMingwALG6.8 Have insight into and understanding of the importance of entrepreneurship.** *Profession-specific competence*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E050100 Design of Civil Structures	project		Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E044311 Structural Stability	guided self-study seminar: coached exercises lecture		To be able to design and to calculate a frame taking into account geometrically non linear behaviour. To perceive possible instabilities and being able to find out the nature of the equilibrium (stable, indifferent or unstable). To understand the effect of imperfections on the behaviour of structures. Being able to solve basic instability problems. Being able to design a twofold compression member. Being able to calculate the resistance of a structural element subjected to warping torsion, lateral torsional buckling, folding and excentric compression. To understand and to be able to apply the theory of non linear behaviour of structures.
E053560 Specialised Road Engineering and Mobility		assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044671 Offshore Foundations	group work lecture	oral examination report assignment	The possibility to combine the knowledge in a project with analytical and numerical calculations. What soil mechanical investigation is needed and how parameters relevant for offshore foundations are determined, some knowledge on the calculation standards. Knowledge of the various offshore foundation concepts and how to design these.
E044902 Conceptual Design	group work lecture	open book examination report assignment	Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E044821 Advanced Bridge and Tunnel Engineering	guided self-study PDE tutorial microteaching	oral examination report peer assessment assignment	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E091103 Master's Dissertation	master's dissertation	oral examination assignment	Define, study and analyse the research problem in a specific domain. Give proof of independency, motivation, dedication, drive to innovation and creativity, initiative and perseverance. Self-assessment with adequate and critical self-correction and objectivity. Communicate adequately on the research, the results and problems, present and found them, both to colleagues as to laypeople. Render and synthesise the results concisely. Critically analyse, formulate, study, execute and/or process different aspects in the execution of research (literature search, topical study, research and the reflection on the research, experiments, experimentations, designs, simulations, results, conclusions,…). Find an appropriate methodology, in accordance with the applicable scientific norms of the specific field of study.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E050923 Structural Reliability and Risk Analysis	guided self-study lecture		Understanding the influence of uncertainties in structural design. Having insight into the background of the semi-probabilistic methodology used in the Structural Eurocodes.
E044821 Advanced Bridge and Tunnel Engineering	guided self-study lecture	oral examination	Understand the impact on the overall design of certein elements from codes, construction methods, etc. Understand the influence of several boundary conditions from a technical as well as non-technical nature. Being able to understand and discuss research material relevant to the course subject. Discuss this with others and develop an opinion about the subject. Understand the main principles of the design and construction of steel bridges (welds, bolts, distortion of box girders, local and general buckling, suspension bridges, arch bridges, movable bridges, seismic and dynamic design, tolerances, wind loads, ...) composite bridges (connectors, stay cable bridges, different concepts, ...) and tunnel engineering (cut-and-cover tunneling, TBM tunneling, ...) Designing a bridge in the most suited software package. Being able to reoport about this and knowing how to refine the initial concept. Knowing the crucial elements of the design and understanding them.
E050100 Design of Civil Structures	project	oral examination report	Design constructions autonomously ; analyse and calculate independently components of a structure. Detect the function and use of construction parts and place them in the whole structure Apply independently the knowledge acquired from other courses to real structures
E045621 Groundwater and Contaminant Flow	guided self-study seminar: coached exercises lecture group work		DEFINITIONS: porous medium, presence of water in the ground, direct flow; Flow lines, equipotential height; capillarity, suction stress, Retention curve; erosion; criteria for filters; control of groundwater flow, advection, diffusion, retardation, multiphase flow, soil mechanical behavior of unsaturated soils. SKILLS: modelling of transport of groundwater, design of granular filters; concept and design of water extraction; determination of flow characteristics out of pump tests; design of barriers against the transport of contaminants INSIGHTS : application of numerical models; determination of the risk and causes of erosion, impact of the groundwater pressure and the saturation degree on the stability of the soil and underground structures, mass transport of contaminants in groundwater and coupled flow, multiphase flow, transient flow
E045860 Water Management and Environment	guided self-study seminar: coached exercises lecture group work	open book examination report oral examination	INSIGHT: Schelde estuary SKILLS: Simulation of tides in a river INSIGHT: sediment transport INSIGHT: tides and tides in rivers SKILLS: Regulation of flood waves CONCEPTS: Flood management, water quality, hydrology of wetlands INSIGHT: waves CONCEPTS: European Water Framework Directive; environmentally friendly structures SKILLS: Design of sandtraps
E053560 Specialised Road Engineering and Mobility	guided self-study lecture	oral examination assignment	The student must be able to choose the most efficient materials The student must be able to grasp the design problems for non-standard design situations The student must be able to understand tender documents. The student must be able to design the layer composition of the road structure The student must be able to apply mobility design concepts and to substantiate and to clarify them, based on the understanding of the relationship between mobility, infrastructure and space and on the knowledge of relevant paradigms
E044902 Conceptual Design	group work lecture		Determine the list of requirements for a structure; develop basic concepts; assess experimentally physical model Give sufficient attention to generate alternatives for structures; persuing originality and additional value in basic concepts Derive requirements for a concept, developed one-self; design a numerical model; use advanced software for structural analysis; build a physical model of an advanced concept; develop original concepts for structures
E044930 Seismic Design	lecture seminar: coached exercises project		Understand the differences, advantages and drawbacks of low dissipative and dissipative seismic design To be able to apply EN 1998-1 in a suitable way To be able to incorporate the probability of extreme earthquakes in the design such that collapse of the construction is prevented. To be able to ensure elastic behavior of a steel and concrete construction under a moderate earthquake such that functionality is preserved during the life of the structure.
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.