Competence coverage matrix

GHENT UNIVERSITY

Bachelor of Science in Engineering

Biomedical Engineering

Academic year 2021-2022

Legend:
T=teaching methods
E=evaluation methods

General Courses

Competence group	Competence	Total	E001142 Basic Mathematics	E070080 Chemical Thermodynamics	E003043 Probability and Statistics	E066012 Materials Technology	E098512 Sustainability, Entrepreneurship and Ethics	E020061 Physics I	E001132 Mathematical Analysis I	E001460 Discrete Mathematics I	E070070 Chemistry: the Structure of Matter	E098513 Modelling, Making and Measuring	E015041 Informatics	E001222 Mathematical Analysis II	E000662 Geometry and Linear Algebra	E090320 Electrical Circuits and Networks	E020220 Physics II	E045120 Transport Phenomena	E001321 Mathematical Analysis III	E076040 Sustainable Business Operations	E040420 Mechanics of Materials	E005020 Analysis of Systems and Signals	E007120 Modelling and Control of Dynamic Systems
Competences in one/more scientific discipline(s)	Have a clear understanding of the basic sciences and basic engineering sciences, and have the ability to apply them in a creative and purposeful way in the chosen specific engineering discipline.	T 28 E 27	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
	Employ the basic sciences and techniques (statistics, ICT, CAD) in a creative and purposeful way.	T 13 E 13							T E	T E		T E	T E		T E			T E					T E
	Knowledge and understanding of the basic concepts and principles from anatomy, (cell) biology, molecular biology, chemistry, physiology, biomechanics, medical and health sciences.	T 5 E 5																					
	Knowledge and understanding of the physical principles (electromagnetism, ionizing and non-ionizing radiation) that form the basis of medical imaging and therapy.	T 3 E 3															T E						
	Knowledge and understanding of the standard methods for quantitative measuring structure and function of biological systems at molecular, organ and system level.	T 2 E 2																					
	Knowledge and understanding of the composition and physicochemical properties of materials, in particular polymers for biomedical applications.	T 2 E 2																			T E		
	Have insight into the basic principles of structural and fluid mechanics and transport physics and apply this to biomechanical and physiological processes and problems.	T 3 E 3																T E			T E		
	Analyse, design (based on well-defined technical specifications) and develop simple electrical circuits for measuring physiological signals.	T 2 E 2														T E							
	Apply mathematical models and numerical techniques for solving biomedical engineering problems.	T 8 E 8																					
Scientific competences	Research and process technical and scientific information in a purposeful way.	T 10 E 8				T E	T E					T E	T E										T
	Employ standard models, methods and techniques in assignments.	T 23 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
	Schematize and model phenomena, processes, and systems.	T 18 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
	Justify decision-making processes on rational grounds.	T 13 E 12		T E	T	T E	T E				T E	T E		T E					T E				T E
Intellectual competences	Understand and structure learning experiences.	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
	Think in a conceptual, analytical, system-oriented, problem-solving and synthesizing way at different levels of abstraction.	T 29 E 27	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
	Show precision, perseverance and critical reflection.	T 21 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
	Show scientific curiosity.	T 15 E 11		T E		T	T E	T			T E	T E		T E			T E			T E		T E	
	Justify further studies or professional opportunities on rational grounds.	T 2 E 1				T																T E	
Competences in cooperation and communication	Master scientific and discipline-specific technical terminology (also in English).	T 22 E 19	T E	T E	T E	T E	T E	T	T E		T	T E		T E	T E		T E	T E	T E				T
	Carry out concrete assignments systematically.	T 11 E 11					T E					T E											
	Work as part of a team.	T 8 E 8					T E					T E											
	Report results verbally, in writing, and graphically.	T 14 E 14				T E	T E					T E											T E
Societal competences	Act in an ethical and social way.	T 5 E 3				T E	T E													T E			
	Be aware of the business aspects of the engineering discipline.	T 2 E 2					T E													T E			
	Be aware of aspects of security and ecology and energy-efficiency in industrial environments.	T 1 E 1																					
	Be aware of the ethical and safety aspects of the biomedical practice.	T 6 E 3																					
			W 6 E 6	W 4 E 4	W 7 E 6	W 12 E 10	W 12 E 12	W 5 E 2	W 8 E 8	W 5 E 5	W 4 E 3	W 11 E 11	W 6 E 6	W 9 E 9	W 8 E 8	W 6 E 6	W 6 E 6	W 6 E 6	W 8 E 8	W 5 E 5	W 5 E 5	W 8 E 8	W 11 E 5

Courses Related to the Main Subject

Competence group	Competence	Total	E092662 From Genome to Organism	E063682 Biomechanics	E032510 Electronic Systems and Instrumentation for Biomedical Engineers	E068661 Biomedical Polymers and Processing	E092735 Medical Physics	E010390 Medical Signal Processing and Statistics	E099070 Cross-Course Project	E021520 Statistical Physics and Molecular Structure	E092621 Modelling of Physiological Systems	E099171 Engineering Project	E002910 Introduction to Numerical Mathematics	E070310 Organic Chemistry	E003230 Statistical Data Processing	E022110 Electromagnetism I	E074011 Quantitative Cell and Tissue Analysis
Competences in one/more scientific discipline(s)	Have a clear understanding of the basic sciences and basic engineering sciences, and have the ability to apply them in a creative and purposeful way in the chosen specific engineering discipline.	T 28 E 27			T E	T E		T E	T E	T E	T			T E		T E	T E
	Employ the basic sciences and techniques (statistics, ICT, CAD) in a creative and purposeful way.	T 13 E 13			T E	T E		T E	T E			T E			T E		
	Knowledge and understanding of the basic concepts and principles from anatomy, (cell) biology, molecular biology, chemistry, physiology, biomechanics, medical and health sciences.	T 5 E 5	T E	T E							T E	T E					T E
	Knowledge and understanding of the physical principles (electromagnetism, ionizing and non-ionizing radiation) that form the basis of medical imaging and therapy.	T 3 E 3					T E									T E	
	Knowledge and understanding of the standard methods for quantitative measuring structure and function of biological systems at molecular, organ and system level.	T 2 E 2									T E						T E
	Knowledge and understanding of the composition and physicochemical properties of materials, in particular polymers for biomedical applications.	T 2 E 2				T E											
	Have insight into the basic principles of structural and fluid mechanics and transport physics and apply this to biomechanical and physiological processes and problems.	T 3 E 3		T E													
	Analyse, design (based on well-defined technical specifications) and develop simple electrical circuits for measuring physiological signals.	T 2 E 2			T E												
	Apply mathematical models and numerical techniques for solving biomedical engineering problems.	T 8 E 8		T E	T E		T E	T E		T E	T E		T E			T E	
Scientific competences	Research and process technical and scientific information in a purposeful way.	T 10 E 8						T	T E	T E		T E					T E
	Employ standard models, methods and techniques in assignments.	T 23 E 22		T E	T E			T	T E	T E	T E	T E		T E	T E	T E	
	Schematize and model phenomena, processes, and systems.	T 18 E 17		T E			T E		T E	T E	T E					T E	
	Justify decision-making processes on rational grounds.	T 13 E 12							T E			T E			T E		T E
Intellectual competences	Understand and structure learning experiences.	T 14 E 13								T E		T E		T E			
	Think in a conceptual, analytical, system-oriented, problem-solving and synthesizing way at different levels of abstraction.	T 29 E 27		T E	T E			T E	T E	T E	T E	T E	T E	T E	T E	T E	
	Show precision, perseverance and critical reflection.	T 21 E 19			T E	T E			T E	T E	T	T E			T E		T E
	Show scientific curiosity.	T 15 E 11				T E			T	T E	T	T E					
	Justify further studies or professional opportunities on rational grounds.	T 2 E 1															
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	Carry out concrete assignments systematically.	T 11 E 11			T E			T E	T E	T E		T E		T E	T E	T E	T E
	Work as part of a team.	T 8 E 8			T E				T E			T E			T E	T E	T E
	Report results verbally, in writing, and graphically.	T 14 E 14		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 and social way.	T 5 E 3							T			T					
	Be aware of the business aspects of the engineering discipline.	T 2 E 2															
	Be aware of aspects of security and ecology and energy-efficiency in industrial environments.	T 1 E 1			T E												
	Be aware of the ethical and safety aspects of the biomedical practice.	T 6 E 3			T E		T E		T		T	T					T E
			W 2 E 2	W 7 E 7	W 13 E 13	W 5 E 5	W 5 E 5	W 8 E 6	W 15 E 12	W 10 E 10	W 11 E 7	W 15 E 13	W 2 E 2	W 7 E 7	W 8 E 8	W 9 E 9	W 11 E 11

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	lecture seminar: coached exercises lecture: plenary exercises	written examination	Being able to perform basic calculations quickly and efficiently by hand. Being able to formulate correctly and with mathematical precision. Being able to make a correct reasoning and to write it down in a structured way. To have a thorough knowledge of the topics matrices, complex numbers, elementary functions and vectors.
E070080 Chemical Thermodynamics	guided self-study seminar: coached exercises lecture	written examination open book examination	Application of the laws of thermodynamics on chemical systems. Calculation of the solubility of ionic compounds in aqueous solutions. Calculation of the pH of aqueous solutions. Understand and apply chemical equilibrium.
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	lecture project	participation assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E020061 Physics I	demonstration lecture	written examination	To understand the physical laws and concepts of the covered chapters. To be able to solve problems by applying these laws and concepts.
E001132 Mathematical Analysis I	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To have acquired insight in the mathematical, geometric and physical interpretation of notions of primitive function, integral, improper integral and integrability. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E001460 Discrete Mathematics I	guided self-study seminar: coached exercises practicum lecture	written examination open book examination	Distinguishing and applying fundamental algebraic and discrete structures. Being fluent in graph algorithms and applying them to real problem situations. Deploying deductively correct reasonings in an independent way. Evaluating logical reasonings with respect to correctness / identifying errors. Deploying mathematical reasoning and proof argumentation. Using basic concepts from set theory, group theory, combinatorics and graph theory.
E070070 Chemistry: the Structure of Matter	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform stoichiometric calculations. Identify and describe the different types of intermolecular interactions. Being able to determine the molecular geometry of covalent compounds. Identify and describe the different types of chemical bonding. Being able to order atoms and ions based on their periodic properties Being able to write the electron configuration of atoms and ions.
E098513 Modelling, Making and Measuring	project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language.
E015041 Informatics	lecture seminar: practical PC room classes	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To design an algorithm solving a given problem, and to assess the complexity of this solution. To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	guided self-study lecture: plenary exercises seminar lecture	open book examination	Having acquired insight in the notions rank, image, kernel, invertability, and determinant of a linear transform. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces. Having acquired insight in the notions vector space, linear dependence and independence, basis and dimension. Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired insight in the mathematical, physical and geometric meaning of eigenvalues and eigenvectors.
E090320 Electrical Circuits and Networks	lecture seminar: coached exercises	written examination	Draw amplitude and phase Bode diagrams for transfer functions and determine the poles and zeros. Analyze basic electrical circuits containing diodes, bipolar transistors and MOSFETs. Determine the balance of active and reactive electrical power in a three-phase electrical network. Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E020220 Physics II	demonstration lecture	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E045120 Transport Phenomena	lecture seminar: practical PC room classes seminar	open book examination	To understand the properties of fluids. To understand the similarities between transport of impulse, heat and mass. To solve problems of stationary heat transport. To know the basic laws of stationary heat transport and to be able to apply them. To understand the law of energy in open and closed systems and to be able to apply it. To master the laws of statics and dynamics and to be able to apply them.

E001321	Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E040420	Mechanics of Materials	seminar: coached exercises	written examination open book examination	To be familiar with the applications of linear elasticity theory. To identify mechanical test methods. Applications of the problem solving methods in elasticity theory. To identify linear and non-linear behaviour. Knowledge of the main techniques for damage control and diagnostics. To be familiar with the basic notions of linear elasticity theory.
E005020	Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120	Modelling and Control of Dynamic Systems	lecture seminar: coached exercises	written examination	Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems. To implement modeling and control on small scale setups by using personal laptop To design of controllers based on the application of root-locus techniques and frequency-response techniques such as Bode, Nyquist. Being able to analyse feedback control systems using several stability criteria. To evaluate in a correct way the results of computer simulations and numerical techniques when designing feedback control systems. To have insight regarding the static and dynamic behaviour of systems and to apply this insight when designing feedback loops. To derive transfer-function models and state-space models of physical systems and comprehend linear and nonlinear behavior.
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	Understand the operation of the basic electronic components Have insight in the acquisition of biopotentials such as in ECG or EEG systems. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice. Analyze basic analog and digital electronic circuits and think about them in a conceptual, analytical and systemoriented way.
E068661	Biomedical Polymers and Processing	demonstration practicum	job performance assessment report	ACQUIRED INSIGHTS: insight in structure-property relationships of biomedical polymers; capability to select most appropriate synthesis method for biomedical polymers; awareness of advantages and disadvantages of polymerization techniques; correlation between polymer structure and biodegradation; insight in suitability of specific polymers to serve biomedical applications; capability to select appropriate characterization techniques to acquire info on the basic properties of biomedical polymers; awareness of polymer compatibility with biomedically relevant processing techniques; insight in physico-chemical properties required to enable polymer processing into targeted scaffold design. Practical knowledge on the synthesis and characterization of biomedically relevant synthetic polymers Practical knowledge on the processing of biomedical polymers using 3D printing Practical knowledge on the functionalization and characterization of biomedically relevant biopolymers
E010390	Medical Signal Processing and Statistics	lecture seminar	written examination report simulation	Python programming skills to apply and implement biomedical signal processing and statistics. Be able to identify which signal processing and statistical methods are suitable for the biomedical dataset at hand. Understand how practical numerical statistical and biomedical signal processing techniques work. Skills to search for and evaluate more advanced biomedical signal processing techniques required in Msc courses.
E099070	Cross-Course Project	microteaching project	oral examination report	Analyse a biomedical engineering problem. Develop a strategy for solving the problem under supervision. Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem.
E021520	Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621	Modelling of Physiological Systems	lecture seminar: practical PC room classes practicum		Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models. Acquire basic knowledge of the anatomy and physiology of organ systems and the organism and insight into physiological processes.
E070310	Organic Chemistry	lecture seminar: coached exercises practicum	written examination report job performance assessment participation	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E022110	Electromagnetism I	lecture seminar: coached exercises project	written examination with open questions report written examination	To be able to describe, understand and discuss wave propagation in free space and in waveguides. To understand and to be able to obtain Green's functions for general free space current sources and for 2D problems. To understand, calculate and determine voltage and current behaviour on transmission lines. To be able to program a numerical technique as applied to a "simple" wave problem.

E074011 Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001132 Mathematical Analysis I	lecture lecture: plenary exercises seminar	written examination	Being able to assess the convergence of numerical series and series of functions. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E001460 Discrete Mathematics I	practicum	written examination	Distinguishing and applying fundamental algebraic and discrete structures. Being fluent in graph algorithms and applying them to real problem situations. Deploying deductively correct reasonings in an independent way. Evaluating logical reasonings with respect to correctness / identifying errors. Deploying mathematical reasoning and proof argumentation. Using basic concepts from set theory, group theory, combinatorics and graph theory.
E098513 Modelling, Making and Measuring	project	participation report	Use of software tools to make simulations and diagrams
E015041 Informatics	lecture seminar: practical PC room classes	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E000662 Geometry and Linear Algebra	guided self-study lecture: plenary exercises seminar lecture	written examination	Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces.
E045120 Transport Phenomena	seminar: practical PC room classes	open book examination	To solve problems of stationary heat transport.
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises	written examination	To evaluate in a correct way the results of computer simulations and numerical techniques when designing feedback control systems.
E032510 Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection.
E068661 Biomedical Polymers and Processing	demonstration practicum	job performance assessment report	Practical knowledge on the processing of biomedical polymers using 3D printing
E010390 Medical Signal Processing and Statistics	lecture seminar	written examination report simulation	Understand how practical numerical statistical and biomedical signal processing techniques work. Be able to identify which signal processing and statistical methods are suitable for the biomedical dataset at hand.
E099070 Cross-Course Project	project	oral examination report	Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Develop a strategy for solving the problem under supervision.
E099171 Engineering Project	group work project	assignment report	Systematic and targeted processing of scientific measurement data and presentation of these data
E003230 Statistical Data Processing	lecture seminar: practical PC room classes seminar: coached exercises	written examination report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E092662 From Genome to Organism	lecture	written examination	Basic knowledge of the structure and physiology of the cell; molecular biology; protein structure. Basic knowledge of the structure of DNA; de genetic code; DNA replication; gene expression; and protein synthesis. Basic knowledge of fertilization and embryogenesis of the human body. Basic knowledge of the anatomy and physiology of the skin, bone, muscle, immune system, nervous system, cardiovascular, respiratory and digestive system of the human body.
E063682 Biomechanics	guided self-study online lecture seminar practicum lecture	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Insight in human biomechanics for both normal and pathological conditions
E092621 Modelling of Physiological Systems	lecture seminar: practical PC room classes practicum	written examination with open questions written examination with multiple choice questions	Acquire basic knowledge of the anatomy and physiology of organ systems and the organism and insight into physiological processes.
E099171 Engineering Project	guided self-study project group work	oral examination peer assessment assignment	To be able to independently look up scientific biomedical oriented information in scientific sources Systematic and targeted processing of scientific measurement data and presentation of these data Dissect a scientific article
E074011 Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

<< **EBingwBIOM1.2 Knowledge and understanding of the physical principles (electromagnetism, ionizing and non-ionizing radiation) that form the basis of medical imaging and therapy.** *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*			
E020220 Physics II	guided self-study lecture: plenary exercises self-reliant study activities seminar practicum lecture demonstration	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E092735 Medical Physics	lecture practicum	written examination with open questions report	Understand physical concepts used in medicine for imaging and therapy To be able to apply the principles of radiation dosimetry Understand how ionizing and non-ionizing radiation interacts with matter
E022110 Electromagnetism I	lecture seminar: coached exercises project	written examination with open questions report written examination	To be able to describe, understand and discuss wave propagation in free space and in waveguides. To understand and to be able to obtain Green's functions for general free space current sources and for 2D problems. To understand, calculate and determine voltage and current behaviour on transmission lines. To be able to program a numerical technique as applied to a "simple" wave problem.

<< **EBingwBIOM1.3 Knowledge and understanding of the standard methods for quantitative measuring structure and function of biological systems at molecular, organ and system level.** *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*			
E092621 Modelling of Physiological Systems	seminar: practical PC room classes	written examination with open questions	Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E074011 Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E040420 Mechanics of Materials	lecture seminar: coached exercises	written examination open book examination	To be familiar with the applications of linear elasticity theory. To identify mechanical test methods. Applications of the problem solving methods in elasticity theory. To identify linear and non-linear behaviour. Knowledge of the main techniques for damage control and diagnostics. To be familiar with the basic notions of linear elasticity theory.
E068661 Biomedical Polymers and Processing	lecture	written examination with open questions	ACQUIRED INSIGHTS: insight in structure-property relationships of biomedical polymers; capability to select most appropriate synthesis method for biomedical polymers; awareness of advantages and disadvantages of polymerization techniques; correlation between polymer structure and biodegradation; insight in suitability of specific polymers to serve biomedical applications; capability to select appropriate characterization techniques to acquire info on the basic properties of biomedical polymers; awareness of polymer compatibility with biomedically relevant processing techniques; insight in physico-chemical properties required to enable polymer processing into targeted scaffold design. KNOWLEDGE OF: basic knowledge of biomedical polymers; synthetic and natural polymers; biomedical polymer synthesis and functionalization; polymer properties, molecular weight, polydispersity; mechanical properties; visco-elastic properties; thermal properties; biocompatible polymerization techniques; biomedical polymer characterization techniques; polymer processing

<< **EBingwBIOM1.5 Have insight into the basic principles of structural and fluid mechanics and transport physics and apply this to biomechanical and physiological processes and problems.** *Competences in one/more scientific discipline(s)*

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E045120 Transport Phenomena	lecture seminar: practical PC room classes seminar	open book examination	To understand the properties of fluids. To understand the similarities between transport of impulse, heat and mass. To solve problems of stationary heat transport. To know the basic laws of stationary heat transport and to be able to apply them. To understand the law of energy in open and closed systems and to be able to apply it. To master the laws of statics and dynamics and to be able to apply them.
E040420 Mechanics of Materials	lecture seminar: coached exercises	written examination open book examination	To be familiar with the applications of linear elasticity theory. Applications of the problem solving methods in elasticity theory. To identify linear and non-linear behaviour. To be familiar with the basic notions of linear elasticity theory.
E063682 Biomechanics	guided self-study online seminar seminar: practical PC room classes seminar practicum lecture demonstration	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Practical knowledge on computational biomechanics (more specifically to run simple cases using computational fluid dynamics) Collecting, processing and analyzing scientific measurement data and computational study results Insight in human biomechanics for both normal and pathological conditions

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E090320	Electrical Circuits and Networks	lecture online seminar seminar: coached exercises	written examination skills test	Draw amplitude and phase Bode diagrams for transfer functions and determine the poles and zeros. Analyze basic electrical circuits containing diodes, bipolar transistors and MOSFETs. Determine the balance of active and reactive electrical power in a three-phase electrical network. Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	Understand the operation of the basic electronic components Have insight in the acquisition of biopotentials such as in ECG or EEG systems. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice. Analyze basic analog and digital electronic circuits and think about them in a conceptual, analytical and systemoriented way.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E063682 Biomechanics	demonstration online seminar: practical PC room classes online seminar seminar: practical PC room classes seminar practicum	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Practical knowledge on computational biomechanics (more specifically to run simple cases using computational fluid dynamics) Collecting, processing and analyzing scientific measurement data and computational study results
E032510 Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice.
E092735 Medical Physics	lecture seminar: coached exercises	written examination with open questions	To be able to apply the principles of radiation dosimetry
E010390 Medical Signal Processing and Statistics	lecture seminar	written examination report simulation	Python programming skills to apply and implement biomedical signal processing and statistics. Be able to identify which signal processing and statistical methods are suitable for the biomedical dataset at hand. Understand how practical numerical statistical and biomedical signal processing techniques work.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621 Modelling of Physiological Systems	lecture seminar: practical PC room classes	written examination with open questions	Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E002910 Introduction to Numerical Mathematics	lecture seminar: practical PC room classes	written examination	A critical usage of algorithms in practical applications using software. Understanding and mastering of standard numerical methods for some basic problems (for (systems of) algebraic equations, initial problems for ODEs, boundary value problems and eigenvalue problems in 1D).
E022110 Electromagnetism I	project	report	To be able to program a numerical technique as applied to a "simple" wave problem.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E098513 Modelling, Making and Measuring	project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language.
E015041 Informatics	seminar: practical PC room classes	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems. To evaluate in a correct way the results of computer simulations and numerical techniques when designing feedback control systems.
E010390 Medical Signal Processing and Statistics	seminar		Skills to search for and evaluate more advanced biomedical signal processing techniques required in Msc courses.
E099070 Cross-Course Project	microteaching project	report	Analyse a biomedical engineering problem. Develop a strategy for solving the problem under supervision.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E099171 Engineering Project	group work project	assignment report	To be able to independently look up scientific biomedical oriented information in scientific sources Systematic and targeted processing of scientific measurement data and presentation of these data Dissect a scientific article
E074011 Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	lecture: plenary exercises seminar: coached exercises	written examination	Being able to perform basic calculations quickly and efficiently by hand. To have a thorough knowledge of the topics matrices, complex numbers, elementary functions and vectors.
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To identify an appropriate probabilistic model for the analysis of an event or experiment
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E001132 Mathematical Analysis I	seminar	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E098513 Modelling, Making and Measuring	project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language. Use of software tools to make simulations and diagrams
E015041 Informatics	lecture seminar: practical PC room classes	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To design an algorithm solving a given problem, and to assess the complexity of this solution. To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	seminar	written examination open book examination	Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces.
E090320 Electrical Circuits and Networks	seminar: coached exercises	written examination	Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E040420 Mechanics of Materials	seminar: coached exercises	open book examination	To be familiar with the applications of linear elasticity theory. Applications of the problem solving methods in elasticity theory.
E005020 Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises practicum	report	Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems. To implement modeling and control on small scale setups by using personal laptop
E063682 Biomechanics	lecture online seminar: practical PC room classes online seminar seminar: practical PC room classes seminar practicum	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Practical knowledge on computational biomechanics (more specifically to run simple cases using computational fluid dynamics) Collecting, processing and analyzing scientific measurement data and computational study results Insight in human biomechanics for both normal and pathological conditions

E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	Analyze basic analog and digital electronic circuits and think about them in a conceptual, analytical and systemoriented way. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice.
E010390	Medical Signal Processing and Statistics	seminar		Python programming skills to apply and implement biomedical signal processing and statistics.
E099070	Cross-Course Project	project	report	Analyse a biomedical engineering problem. Develop a strategy for solving the problem under supervision.
E021520	Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621	Modelling of Physiological Systems	seminar: practical PC room classes	written examination with open questions	Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E099171	Engineering Project	group work project	assignment report	Systematic and targeted processing of scientific measurement data and presentation of these data
E070310	Organic Chemistry	lecture seminar: coached exercises practicum	written examination report job performance assessment participation	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E003230	Statistical Data Processing	seminar: coached exercises seminar: practical PC room classes	written examination report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E022110	Electromagnetism I	project	report	To be able to program a numerical technique as applied to a "simple" wave problem.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To identify an appropriate probabilistic model for the analysis of an event or experiment
E020061 Physics I	demonstration lecture	written examination	To understand the physical laws and concepts of the covered chapters. To be able to solve problems by applying these laws and concepts.
E001132 Mathematical Analysis I	lecture lecture: plenary exercises seminar	written examination	To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems.
E001460 Discrete Mathematics I	guided self-study seminar: coached exercises practicum lecture	written examination open book examination	Distinguishing and applying fundamental algebraic and discrete structures. Being fluent in graph algorithms and applying them to real problem situations. Deploying deductively correct reasonings in an independent way. Evaluating logical reasonings with respect to correctness / identifying errors. Deploying mathematical reasoning and proof argumentation. Using basic concepts from set theory, group theory, combinatorics and graph theory.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	lecture lecture: plenary exercises seminar	written examination open book examination	Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them.
E090320 Electrical Circuits and Networks	lecture seminar: coached exercises	written examination	Draw amplitude and phase Bode diagrams for transfer functions and determine the poles and zeros. Analyze basic electrical circuits containing diodes, bipolar transistors and MOSFETs. Determine the balance of active and reactive electrical power in a three-phase electrical network. Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E020220 Physics II	demonstration lecture	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E076040 Sustainable Business Operations	lecture	written examination with open questions written examination with multiple choice questions	Understand the technique of financial balance sheet reading and be able to apply it practically in simple accounting exercises
E005020 Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems. To derive transfer-function models and state-space models of physical systems and comprehend linear and nonlinear behavior.
E063682 Biomechanics	lecture online seminar: practical PC room classes online seminar online lecture seminar: practical PC room classes seminar practicum	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Practical knowledge on computational biomechanics (more specifically to run simple cases using computational fluid dynamics) Collecting, processing and analyzing scientific measurement data and computational study results Insight in human biomechanics for both normal and pathological conditions
E092735 Medical Physics	lecture	written examination with open questions	To be able to apply the principles of radiation dosimetry
E099070 Cross-Course Project	project	report	Analyse a biomedical engineering problem. Develop a strategy for solving the problem under supervision. Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.

E092621 Modelling of Physiological Systems	lecture seminar: practical PC room classes	written examination with open questions	Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E022110 Electromagnetism I	lecture seminar: coached exercises	written examination with open questions written examination	To be able to describe, understand and discuss wave propagation in free space and in waveguides. To understand and to be able to obtain Green's functions for general free space current sources and for 2D problems. To understand, calculate and determine voltage and current behaviour on transmission lines.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E070080 Chemical Thermodynamics	guided self-study seminar: coached exercises lecture	written examination open book examination	Application of the laws of thermodynamics on chemical systems. Calculation of the solubility of ionic compounds in aqueous solutions. Calculation of the pH of aqueous solutions. Understand and apply chemical equilibrium.
E003043 Probability and Statistics	lecture		To calculate probabilities of events and expectations of random variables
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E070070 Chemistry: the Structure of Matter	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform stoichiometric calculations. Identify and describe the different types of intermolecular interactions. Being able to determine the molecular geometry of covalent compounds. Identify and describe the different types of chemical bonding. Being able to order atoms and ions based on their periodic properties Being able to write the electron configuration of atoms and ions.
E098513 Modelling, Making and Measuring	project	report	Writing reports Oral presentation
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises practicum	written examination report	To have insight regarding the static and dynamic behaviour of systems and to apply this insight when designing feedback loops. To implement modeling and control on small scale setups by using personal laptop To evaluate in a correct way the results of computer simulations and numerical techniques when designing feedback control systems.
E099070 Cross-Course Project	project	oral examination report	Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Show creativity, self-motivation and team spirit when carrying out a project. Collaborate in group. Report and present project progress, results and solutions orally and in writing. Develop a strategy for solving the problem under supervision.
E099171 Engineering Project	group work project	assignment report	Reporting orally and in writing
E003230 Statistical Data Processing	seminar: practical PC room classes	written examination report	Describe trends in data and find correlations using regression analysis Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Decide based on a limited sample, using appropriate hypothesis tests
E074011 Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	seminar: coached exercises	written examination	To have a thorough knowledge of the topics matrices, complex numbers, elementary functions and vectors. Being able to formulate correctly and with mathematical precision. Being able to make a correct reasoning and to write it down in a structured way.
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To perform a linear regression and to interpret its results To understand and to apply methods for hypothesis testing To understand and to apply methods for (parameter) estimation To interpret and to judge the results of statistical sampling, and to represent them in an appropriate form To identify an appropriate probabilistic model for the analysis of an event or experiment To calculate probabilities of events and expectations of random variables
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E001132 Mathematical Analysis I	guided self-study	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To have acquired insight in the mathematical, geometric and physical interpretation of notions of primitive function, integral, improper integral and integrability. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E015041 Informatics	guided self-study seminar: practical PC room classes lecture	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To design an algorithm solving a given problem, and to assess the complexity of this solution. To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	guided self-study	written examination open book examination	Having acquired skills in the manipulation of vectors.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E076040 Sustainable Business Operations	lecture	written examination with open questions written examination with multiple choice questions	Critical, creative thinking and scientific reasoning Be able to think carefully about social, scientific and ethical problems and possible solutions to these problems
E005020 Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120 Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E099171 Engineering Project	group work project	assignment report	Systematic and targeted processing of scientific measurement data and presentation of these data Reporting orally and in writing

E070310 Organic Chemistry	lecture seminar: coached exercises	written examination	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	lecture seminar: coached exercises lecture: plenary exercises	written examination	Being able to make a correct reasoning and to write it down in a structured way.
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To identify an appropriate probabilistic model for the analysis of an event or experiment To calculate probabilities of events and expectations of random variables
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E020061 Physics I	demonstration lecture		To understand the physical laws and concepts of the covered chapters. To be able to solve problems by applying these laws and concepts.
E001132 Mathematical Analysis I	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To have acquired insight in the mathematical, geometric and physical interpretation of notions of primitive function, integral, improper integral and integrability. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E001460 Discrete Mathematics I	guided self-study seminar: coached exercises practicum lecture	written examination open book examination	Distinguishing and applying fundamental algebraic and discrete structures. Being fluent in graph algorithms and applying them to real problem situations. Deploying deductively correct reasonings in an independent way. Evaluating logical reasonings with respect to correctness / identifying errors. Deploying mathematical reasoning and proof argumentation. Using basic concepts from set theory, group theory, combinatorics and graph theory.
E098513 Modelling, Making and Measuring	project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language. Use of software tools to make simulations and diagrams
E015041 Informatics	lecture seminar: practical PC room classes	written examination open book examination	To master the structured programming paradigm and to realize a Python program, using this structured programming paradigm . To master the basic concepts of objectorientation and to realize an objectoriented program in Python.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Having acquired insight in the notions rank, image, kernel, invertability, and determinant of a linear transform. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces. Having acquired insight in the notions vector space, linear dependence and independence, basis and dimension. Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired insight in the mathematical, physical and geometric meaning of eigenvalues and eigenvectors.
E090320 Electrical Circuits and Networks	seminar: coached exercises	written examination	Draw amplitude and phase Bode diagrams for transfer functions and determine the poles and zeros. Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E020220 Physics II	demonstration lecture	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E045120 Transport Phenomena	lecture seminar: practical PC room classes seminar	open book examination	To master the laws of statics and dynamics and to be able to apply them. To solve problems of stationary heat transport. To know the basic laws of stationary heat transport and to be able to apply them. To understand the law of energy in open and closed systems and to be able to apply it.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.
E040420 Mechanics of Materials	seminar: coached exercises	open book examination	To be familiar with the applications of linear elasticity theory. Applications of the problem solving methods in elasticity theory.

E005020	Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120	Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems.
E063682	Biomechanics	guided self-study online seminar: practical PC room classes online seminar online lecture seminar: practical PC room classes seminar practicum lecture	written examination report open book examination	Basic knowledge of the biomechanics of soft tissues, biofluid dynamics, human movement analysis and biomechanics of running Practical knowledge on computational biomechanics (more specifically to run simple cases using computational fluid dynamics) Collecting, processing and analyzing scientific measurement data and computational study results
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	Understand the operation of the basic electronic components Have insight in the acquisition of biopotentials such as in ECG or EEG systems. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice. Analyze basic analog and digital electronic circuits and think about them in a conceptual, analytical and systemoriented way.
E010390	Medical Signal Processing and Statistics	seminar	written examination	Be able to identify which signal processing and statistical methods are suitable for the biomedical dataset at hand.
E099070	Cross-Course Project	project	oral examination report	Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Collaborate in group. Develop a strategy for solving the problem under supervision.
E021520	Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621	Modelling of Physiological Systems	lecture seminar: practical PC room classes	written examination with open questions	Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E099171	Engineering Project	group work project	assignment report	Systematic and targeted processing of scientific measurement data and presentation of these data
E002910	Introduction to Numerical Mathematics	lecture seminar: practical PC room classes	written examination	A critical usage of algorithms in practical applications using software.
E070310	Organic Chemistry	lecture seminar: coached exercises	written examination	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E003230	Statistical Data Processing	seminar: coached exercises seminar: practical PC room classes	written examination report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E022110	Electromagnetism I	project seminar: coached exercises	written examination with open questions report written examination	To be able to program a numerical technique as applied to a "simple" wave problem. To understand, calculate and determine voltage and current behaviour on transmission lines.

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	lecture seminar: coached exercises lecture: plenary exercises	written examination	Being able to formulate correctly and with mathematical precision.
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To perform a linear regression and to interpret its results To understand and to apply methods for hypothesis testing To understand and to apply methods for (parameter) estimation To interpret and to judge the results of statistical sampling, and to represent them in an appropriate form To identify an appropriate probabilistic model for the analysis of an event or experiment To calculate probabilities of events and expectations of random variables
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E001132 Mathematical Analysis I	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To have acquired insight in the mathematical, geometric and physical interpretation of notions of primitive function, integral, improper integral and integrability. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E001460 Discrete Mathematics I	guided self-study seminar: coached exercises practicum lecture	written examination open book examination	Distinguishing and applying fundamental algebraic and discrete structures. Being fluent in graph algorithms and applying them to real problem situations. Deploying deductively correct reasonings in an independent way. Evaluating logical reasonings with respect to correctness / identifying errors. Deploying mathematical reasoning and proof argumentation. Using basic concepts from set theory, group theory, combinatorics and graph theory.
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Having acquired insight in the notions rank, image, kernel, invertability, and determinant of a linear transform. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces. Having acquired insight in the notions vector space, linear dependence and independence, basis and dimension. Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired insight in the mathematical, physical and geometric meaning of eigenvalues and eigenvectors.
E090320 Electrical Circuits and Networks	seminar: coached exercises	written examination	Analyze linear circuits with resistors, (coupled) inductors and capacitors in dc, in the periodic regime and during transients.
E045120 Transport Phenomena	lecture seminar: practical PC room classes seminar	open book examination	To understand the properties of fluids. To solve problems of stationary heat transport. To know the basic laws of stationary heat transport and to be able to apply them. To understand the law of energy in open and closed systems and to be able to apply it. To master the laws of statics and dynamics and to be able to apply them.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.

E005020	Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E007120	Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		To evaluate in a correct way the results of computer simulations and numerical techniques when designing feedback control systems.
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	Analyze basic analog and digital electronic circuits and think about them in a conceptual, analytical and systemoriented way. Have insight in the acquisition of biopotentials such as in ECG or EEG systems. Have the skills to communicate about your own electronic system design via written text and graphs. To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to perform numerical simulations on electronic circuits using standard models and methods, in particular PSpice.
E068661	Biomedical Polymers and Processing	lecture practicum	written examination with open questions job performance assessment	ACQUIRED INSIGHTS: insight in structure-property relationships of biomedical polymers; capability to select most appropriate synthesis method for biomedical polymers; awareness of advantages and disadvantages of polymerization techniques; correlation between polymer structure and biodegradation; insight in suitability of specific polymers to serve biomedical applications; capability to select appropriate characterization techniques to acquire info on the basic properties of biomedical polymers; awareness of polymer compatibility with biomedically relevant processing techniques; insight in physico-chemical properties required to enable polymer processing into targeted scaffold design.
E099070	Cross-Course Project	project	oral examination report	Collaborate in group. Show creativity, self-motivation and team spirit when carrying out a project.
E021520	Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621	Modelling of Physiological Systems	seminar: practical PC room classes		Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models.
E099171	Engineering Project	group work project	assignment report	Systematic and targeted processing of scientific measurement data and presentation of these data Reporting orally and in writing
E003230	Statistical Data Processing	seminar: practical PC room classes	report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E074011	Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E070080 Chemical Thermodynamics	guided self-study seminar: coached exercises lecture	written examination open book examination	Application of the laws of thermodynamics on chemical systems. Calculation of the solubility of ionic compounds in aqueous solutions. Calculation of the pH of aqueous solutions. Understand and apply chemical equilibrium.
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture		To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E020061 Physics I	demonstration lecture		To understand the physical laws and concepts of the covered chapters. To be able to solve problems by applying these laws and concepts.
E070070 Chemistry: the Structure of Matter	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform stoichiometric calculations. Identify and describe the different types of intermolecular interactions. Being able to determine the molecular geometry of covalent compounds. Identify and describe the different types of chemical bonding. Being able to order atoms and ions based on their periodic properties Being able to write the electron configuration of atoms and ions.
E098513 Modelling, Making and Measuring	project	participation report	Concepts: working collaboration in a group, scientific techniques, use of scientific language. Use of software tools to make simulations and diagrams
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E020220 Physics II	demonstration lecture	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E076040 Sustainable Business Operations	lecture	written examination with open questions written examination with multiple choice questions	Understanding sustainability aspects in an economic context
E005020 Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)
E068661 Biomedical Polymers and Processing	practicum	participation report	Practical knowledge on the processing of biomedical polymers using 3D printing
E099070 Cross-Course Project	project		Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Show creativity, self-motivation and team spirit when carrying out a project. Develop a strategy for solving the problem under supervision.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E092621 Modelling of Physiological Systems	practicum seminar: practical PC room classes		Analysis, schematizing and mathematical modelling of physiological processes. Use and development of code (Python) for the analysis and processing of physiological data and the implementation of mathematical models. Acquire basic knowledge of the anatomy and physiology of organ systems and the organism and insight into physiological processes.
E099171 Engineering Project	group work project	assignment report	To be able to independently look up scientific biomedical oriented information in scientific sources Formulate a scientific question Dissect a scientific article

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture		To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E005020 Analysis of Systems and Signals	lecture seminar: coached exercises	written examination with multiple choice questions	To identify systems and signals; to describe them in continuous time and discrete time. To be able to execute the Laplace transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To be able to execute the Z-transform, to calculate its inverse, and to apply when studying systems and signals. (exclusively for the 6 credit points course.) To have understood the sampling theorem and its applications. To have gained insight in the various Fourier transforms. To have gained insight in the impulse response , the frequency response and the transfer function as an alternative description of a linear system, as well as in their mutual relationships. To have gained insight in Fourier series as a basis for the decription of signals and as a basis for transforming signals. To describe linear systems by means of the state model. (exclusively for the 6 credit points course.)

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E001142 Basic Mathematics	lecture seminar: coached exercises lecture: plenary exercises	written examination	To have a thorough knowledge of the topics matrices, complex numbers, elementary functions and vectors. Being able to formulate correctly and with mathematical precision. Being able to make a correct reasoning and to write it down in a structured way.
E070080 Chemical Thermodynamics	guided self-study seminar: coached exercises lecture	written examination open book examination	Application of the laws of thermodynamics on chemical systems. Calculation of the solubility of ionic compounds in aqueous solutions. Calculation of the pH of aqueous solutions. Understand and apply chemical equilibrium.
E003043 Probability and Statistics	guided self-study seminar: coached exercises lecture	written examination with multiple choice questions open book examination	To reason and to work with multi-dimensional random variables To perform a linear regression and to interpret its results To understand and to apply methods for hypothesis testing To understand and to apply methods for (parameter) estimation To interpret and to judge the results of statistical sampling, and to represent them in an appropriate form To calculate probabilities of events and expectations of random variables
E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	lecture project	participation assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E020061 Physics I	demonstration lecture		To understand the physical laws and concepts of the covered chapters. To be able to solve problems by applying these laws and concepts.
E001132 Mathematical Analysis I	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Being able to assess the convergence of numerical series and series of functions. To have acquired insight in the mathematical, geometric and physical interpretation of notions of primitive function, integral, improper integral and integrability. To know the structure of the general solution of a linear differential equation, as well as the lack of a general solution of a non-linear differential equation, to be able to solve specific differential equations and to check the existence and uniqueness conditions for the corresponding initial value problems. Being able to use Fourier series for solving partial differential equation by separation of variables. Being able to perform integral transforms, having acquired insight in their respective properties and being able to use them for solving initial value problems. Being able to construct and manipulate power series and Fourier series. Being able to use power series for solving ordinary differential equations.
E070070 Chemistry: the Structure of Matter	guided self-study seminar: coached exercises lecture		Being able to perform stoichiometric calculations. Identify and describe the different types of intermolecular interactions. Being able to determine the molecular geometry of covalent compounds. Identify and describe the different types of chemical bonding. Being able to order atoms and ions based on their periodic properties Being able to write the electron configuration of atoms and ions.
E098513 Modelling, Making and Measuring	project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language. Oral presentation Writing reports
E001222 Mathematical Analysis II	guided self-study seminar: coached exercises lecture: plenary exercises lecture	written examination open book examination	Being able to perform the chain rules for differentiable functions. Being able to carry out co-ordinate transforms in multiple integrals in two and three dimensions. Being able to compute integrals in two and three dimensions by subsequent integration. Having acquired insight in local, absolute and conditional extremum problems, and being able to solve such problems. Having acquired insight in the mathematical, geometric and physical interpretation of the notions limit, continuity, derivative, partial derivative, differentiability, gradient, multiple integral, Jacobian and co-ordinate transform.
E000662 Geometry and Linear Algebra	guided self-study lecture: plenary exercises seminar lecture	written examination open book examination	Having acquired insight in the notions rank, image, kernel, invertability, and determinant of a linear transform. Having acquired skills in the manipulation of vectors. Being able to write down vector representations of curves and surfaces, and to perform chains of active and passive transforms on them. Being able to construct an orthogonal basis by means of the Gram-Schmidt-procedure, to project a vector orthogonally onto a subspace and to perform a least squares algorithm. Being able to give the matrix representation and the corresponding formulae of an affine or co-ordinate transform in threedimensional space, or of a linear transform between abstract vector spaces. Having acquired insight in the notions vector space, linear dependence and independence, basis and dimension. Being able to write down the respective reduced forms of a matrix and use them for solving systems of linear equations. Having acquired insight in the mathematical, physical and geometric meaning of eigenvalues and eigenvectors.
E020220 Physics II	demonstration lecture	written examination participation	To be able to solve physics problems by applying these laws and concepts. To understand the physical laws and concepts of the covered chapters.
E045120 Transport Phenomena	lecture seminar: practical PC room classes seminar	open book examination	To understand the properties of fluids. To understand the similarities between transport of impulse, heat and mass. To solve problems of stationary heat transport. To know the basic laws of stationary heat transport and to be able to apply them. To understand the law of energy in open and closed systems and to be able to apply it. To master the laws of statics and dynamics and to be able to apply them.
E001321 Mathematical Analysis III	lecture seminar: coached exercises lecture: plenary exercises	written examination	To master the basic theory of curves. To apply the residue theorem in a variety of situations. To calculate complex line integrals both directly and by means of theoretical results. To have insight in the meaning of holomorphic functions and to be able to apply their properties. To calculate line and surface integrals both directly and by means of theoretical results. To have insight in the meaning of the notions line and surface integral and in the theorems of Green, Gauss and Stokes. To have acquired insight in the meaning of the notions scalar and vector potential, rotation and divergence free vector fields, conservative and solenoidal vector fields. To have acquired skills in calculations with the nabla operator.

E007120	Modelling and Control of Dynamic Systems	lecture seminar: coached exercises		Combining the knowledge of several engineering disciplines (electronics, electro-mechanical, physics, chemical engineering) in order to obtain mathematical models of physical dynamic systems. To design of controllers based on the application of root-locus techniques and frequency-response techniques such as Bode, Nyquist.
E092662	From Genome to Organism	lecture seminar	written examination	Basic knowledge of the structure and physiology of the cell; molecular biology; protein structure. Basic knowledge of the structure of DNA; de genetic code; DNA replication; gene expression; and protein synthesis. Basic knowledge of fertilization and embryogenesis of the human body. Basic knowledge of the anatomy and physiology of the skin, bone, muscle, immune system, nervous system, cardiovascular, respiratory and digestive system of the human body.
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	Have the skills to communicate about your own electronic system design via written text and graphs.
E099070	Cross-Course Project	project	oral examination report	Report and present project progress, results and solutions orally and in writing.
E092621	Modelling of Physiological Systems	lecture seminar: practical PC room classes practicum	written examination with open questions written examination with multiple choice questions	Acquire basic knowledge of the anatomy and physiology of organ systems and the organism and insight into physiological processes.
E099171	Engineering Project	group work project	assignment report	Dissect a scientific article Reporting orally and in writing Formulate a scientific question
E070310	Organic Chemistry	lecture seminar: coached exercises	written examination	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E074011	Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	written examination report participation	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E098513 Modelling, Making and Measuring	project	participation report	Concepts: working collaboration in a group, scientific techniques, use of scientific language.
E032510 Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection.
E010390 Medical Signal Processing and Statistics	seminar	simulation report	Python programming skills to apply and implement biomedical signal processing and statistics.
E099070 Cross-Course Project	project	oral examination report	Develop a strategy for solving the problem under supervision. Collaborate in group. Report and present project progress, results and solutions orally and in writing.
E021520 Statistical Physics and Molecular Structure	lecture seminar: coached exercises	written examination	Understand the need for a quantum mechanical description of phenomena at the atomic and molecular scale. Solve the Schrödinger equation for basic potential problems (1D or central). Understand the basic concepts of quantum mechanics (e.g. wave-particle duality, Schrödinger equation, orbital momentum, spherical harmonics). Understand the relation between the macroscopic and microscopic description of matter. Understand the importance of symmetry for spectroscopy. Master the quantum mechanical description of the hydrogen atom. Understand the various statistical distribution functions and apply them to systems with many degrees of freedom. Master and apply the basic concepts of statistical physics. Derive statistical quantities such as partition functions for simple and complex systems and apply them to determine macroscopically observable quantities.
E099171 Engineering Project	group work project	assignment report peer assessment	Systematic and targeted processing of scientific measurement data and presentation of these data Working in a group
E070310 Organic Chemistry	lecture seminar: coached exercises practicum	written examination report job performance assessment participation	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E003230 Statistical Data Processing	seminar: practical PC room classes	report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E022110 Electromagnetism I	project	report	To be able to program a numerical technique as applied to a "simple" wave problem.
E074011 Quantitative Cell and Tissue Analysis	demonstration practicum online discussion group microteaching	participation report	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
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E098512 Sustainability, Entrepreneurship and Ethics	project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E098513 Modelling, Making and Measuring	project	participation report	Concepts: working collaboration in a group, scientific techniques, use of scientific language.
E032510 Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have the skills to communicate about your own electronic system design via written text and graphs.
E099070 Cross-Course Project	project	oral examination report	Collaborate in group. Show creativity, self-motivation and team spirit when carrying out a project.
E099171 Engineering Project	group work project	peer assessment	Working in a group
E003230 Statistical Data Processing	seminar: practical PC room classes	report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E022110 Electromagnetism I	project	report	To be able to program a numerical technique as applied to a "simple" wave problem.
E074011 Quantitative Cell and Tissue Analysis	demonstration practicum online discussion group microteaching	participation report	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

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E066012 Materials Technology	guided self-study seminar: practical PC room classes seminar: coached exercises lecture	written examination	To name materials properties and to be able to distinguish between the different groups of materials To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties To have some basic understanding on the available possibilities to steer the structure of a material and consequently to design a material with the desired properties. To be able to correlate the structure and properties of materials To understand the basic concepts of materials science and engineering and to be able to explain materials behaviour when used in specific situations.
E098512 Sustainability, Entrepreneurship and Ethics	lecture project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E098513 Modelling, Making and Measuring	lecture project	report	Concepts: working collaboration in a group, scientific techniques, use of scientific language. Oral presentation Writing reports
E007120 Modelling and Control of Dynamic Systems	practicum	report	To implement modeling and control on small scale setups by using personal laptop
E063682 Biomechanics	demonstration practicum	report	Collecting, processing and analyzing scientific measurement data and computational study results
E032510 Electronic Systems and Instrumentation for Biomedical Engineers	practicum	skills test	Have the skills to communicate about your own electronic system design via written text and graphs.
E092735 Medical Physics	practicum	report	To be able to apply the principles of radiation dosimetry
E010390 Medical Signal Processing and Statistics	seminar	report	Python programming skills to apply and implement biomedical signal processing and statistics.
E099070 Cross-Course Project	project	oral examination report	Report and present project progress, results and solutions orally and in writing.
E099171 Engineering Project	group work project lecture	assignment report peer assessment	Reporting orally and in writing
E070310 Organic Chemistry	practicum	participation report job performance assessment	Ability to define and describe in detail reaction mechanisms, knowing relation between chemical structure and reactivity, knowing properties of most important organic molecules, describe stereochemistry of organic molecules, describe separation methods of molecules. Showing ability to make use of theory in creative way when designing chemical reactions; ability to use laboratory equipment; solving capability. Having insight in 3D-structure of organic molecules, being able to make relations between chemical structures and properties of organic molecules; being able to develop multi-step reaction sequences.
E003230 Statistical Data Processing	seminar: practical PC room classes	report	Design an experiment Elaborate and interpret a statistical analysis of data, using statistical software Estimate model parameters Be able to carry out analysis of variance and multiple comparison of treatment means Suggest suitable statistical models Analyse the outcome of the experiment using frequency tables and graphical representation Decide based on a limited sample, using appropriate hypothesis tests Describe trends in data and find correlations using regression analysis
E022110 Electromagnetism I	project	report	To be able to program a numerical technique as applied to a "simple" wave problem.
E074011 Quantitative Cell and Tissue Analysis	practicum	participation report	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes

Course	Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*			
E066012 Materials Technology	seminar: practical PC room classes	written examination	To be able to select, by using a material selection software program, the most appropriate material for a specific engineering problem taking into account various material properties
E098512 Sustainability, Entrepreneurship and Ethics	lecture project	participation assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E076040 Sustainable Business Operations	lecture	written examination with open questions written examination with multiple choice questions	Critical, creative thinking and scientific reasoning Be able to think carefully about social, scientific and ethical problems and possible solutions to these problems
E099070 Cross-Course Project	project		Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Develop a strategy for solving the problem under supervision.
E099171 Engineering Project	group work project		Systematic and targeted processing of scientific measurement data and presentation of these data

Course	Teaching methods	Evaluation methods	Course learning outcome
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E098512 Sustainability, Entrepreneurship and Ethics	lecture project	assignment	Having a general knowledge about aspects of sustainability, entrepreneurship and ethics, and being able to apply those in the framework of engineering activities.
E076040 Sustainable Business Operations	lecture	written examination with open questions assignment written examination with multiple choice questions	Understand the technique of financial balance sheet reading and be able to apply it practically in simple accounting exercises Mastering the basic concepts of macroeconomics and microeconomy: law of supply and demand, markets (perfect competition, monopoly, oligopoly, game theory) Understanding the coherence between the different stakeholders of the company Being able to make a simple investment analysis and apply the concept of time value of money in all aspects of investment analysis Being able to make a complete costing for a product or a service Being able to distinguish between fixed, variable, direct and indirect costs Be able to analyze and assess the data of a company's balance sheet Understanding sustainability aspects in an economic context

Course		Teaching methods	Evaluation methods	Course learning outcome
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E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have insight in the acquisition of biopotentials such as in ECG or EEG systems.

Course		Teaching methods	Evaluation methods	Course learning outcome
*Noot: leer- en evaluatievormen voorafgegaan door ** werden niet teruggevonden in de studiefiche*				
E032510	Electronic Systems and Instrumentation for Biomedical Engineers	lecture practicum	written examination skills test	To be able to build and experimentally evaluate analog and digital circuits at breadboard level with the required accuracy, perseverance and critical reflection. Have insight in the acquisition of biopotentials such as in ECG or EEG systems.
E092735	Medical Physics	lecture	written examination with open questions	Understand physical concepts used in medicine for imaging and therapy To be able to apply the principles of radiation dosimetry Understand how ionizing and non-ionizing radiation interacts with matter
E099070	Cross-Course Project	project		Apply theoretical knowledge and skills acquired in other courses on a practical biomedical problem. Develop a strategy for solving the problem under supervision.
E092621	Modelling of Physiological Systems	lecture		Acquire basic knowledge of the anatomy and physiology of organ systems and the organism and insight into physiological processes.
E099171	Engineering Project	group work project		Systematic and targeted processing of scientific measurement data and presentation of these data
E074011	Quantitative Cell and Tissue Analysis	demonstration online lecture practicum online discussion group microteaching lecture	participation report	Understand the working principles of techniques to culture cells and tissues Understand the relation between cell composition and cell function as inferred from the above mentioned technique Understand various quantitative techniques for the quantitative analysis of cell morphology, cell properties, structure and function and be able to apply quantitative analysis Understanding of histology and histological techniques and being able to interpret histological coupes