Academic year 4 Specialization: Design & Development

Term 1 Specialisation: Design & Development

Unit of study	Examination component	Credits
Aerodynamic Design	Aerodynamic Design	5
Control Systems Design	Control Systems Design	5
Space Engineering	Space Engineering	3
Helicopters	Helicopters	2

Term 2 Specialisation: Design & Development

Unit of study	Examination component	Credits
Engineering Entrepreneurship Project	Engineering Entrepreneurship Project	15

Academic year 4 Specialization: Lightweight Structures

Term 1 Specialisation: Lightweight Structures

Unit of study	Examination component	Credits
Aircraft Structures 3	Aircraft Structures	5
Vibrations	Vibrations	3
Fatigue	Fatigue	2
Composites 2	Composites	5

Term 2 Specialisation: Lightweight Structures

Unit of study	Examination component	Credits
Engineering Entrepreneurship Project	Engineering Entrepreneurship Project	15

Specialization: Design & Development

Aerodynamic Design - 1610DD301Z					
Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Aerodynamic Design	No	No	5

Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Aerodynamic Design Exam, 1610DD301A	Grade (10-100)	55	60%	84
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Aerodynamic Design Assignment, 1610DD301B	Grade (10-100)	55	40%	56

Content of unit of study	Aerodynamic Design using modern CFD methods
Phase of Bachelor's programme	In possession of the skills necessary for professi
Competencies	BoKS 3: Aerodynamics & Flight Mechanics
Requirements for participation in units of study (See also Article 29 TER)	None

Compensation (See also Article 127 TER)	No	
Specific details	None	
Module with assessment	Aerodynamic Design Exam	
Test criteria	The student is able to describe and explain the (elements of the) governing equations for fluids. describe and explain turbulence and its parameters and effects. describe the most common turbulence modelling methods including its advantages and disadvantages. describe, explain and apply the numerical methods used in CFD. describe and explain the (elements of the) verification and validation process in CFD.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	12,5	1.5 hours lecture per week and 2 hours exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	
Module with assessment	Aerodynamic Design Assignment	
Test criteria	The student is able to work with a commercial CFD package. set up and perform a CFD simulation correctly. report and document a CFD simulation according to guidelines used in the industry.	
Details of assessments	Other Method	Assignment

	without test session	
Strategies and teaching activities	Workshops	
Contact hours for strategies and teaching activities	7,5	5 x 1.5 hours workshop
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	N/A	

Bewerk

Control Systems Design - 1612DD302Z

Academic year	Term	Name of examination component	With graduation product	Graduation product designation	Study load in credits
4	Term 1	Control Systems Design	No	No	5

Module with test and code	Assessment scale	Required minimum score	Weighting Factor	Number of study hours
Control Theory Exam, 1612DD302A	Grade (10-100)	55	100%	84
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Control Theory Assignment, 1612DD302B	Pass/Fail	Pass	0%	56

Content of unit of study	Understanding of: the concept of steady state error the principles of sketching root locus plots	
Phase of Bachelor's programme	In possession of the skills necessary for professi	
Competencies	BoKS 5: Electronics, Systems & Control	
Requirements for participation in units of study (See also Article 29 TER)	None	
Compensation (See also Article 127 TER)	No	
Specific details	None	
Module with assessment	Control Theory Exam	
Test criteria	The student is able to Determine steady state errors for different input signals and transfer functions Sketch root locus plots for different transfer functions Design simple controllers using the root locus design method	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	23	2 x 1.5 hours of lectures per week and a 2 hour exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	

Module with assessment	Control Theory Assignment	
Test criteria	The student is able to: Calculate steady state errors for different input signals and transfer functions; Sketch root locus plots of different transfer functions; Design simple controllers using the root locus design method	
Details of assessments	Other Method without test session	New assignment every week to solve during the instruction classes. Work in pairs is preferred. Problem to solve in final week regard all subjects previously discussed / dealt with. Lecturer will notify if participation is unsatisfactory. Exclusion is possible in case participant outcome is still unsufficient the week thereafter. No grade. Just sufficient or not.
Strategies and teaching activities	Tutorials	
Contact hours for strategies and teaching activities	10,5	7 x 1.5 hour tutorial Note: In case you are not finished within the time set, you have to finish the final assignment in your own extra time
Compulsory attendance (See also Article 115 TER)	No	Skip 1 class is allowed. However, assignments have to be approved by lecturer at end of each class. Participation is kept track of.
Permitted aids	Open book, so internet etc. can be consulted.	

Bewerk

Space Engineering - 1610DD303Z

Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Space Engineering	No	No	3

Module name and code	Assessment scale	Required minimum score	Weighting Factor	Number of study hours
Space Engineering Exam, 1610DD303A	Grade (10-100)	55	100%	84

Content of unit of study	Space Engineering
Phase of Bachelor's programme	In possession of the skills necessary for professi
Competencies	BoKS 2: Structures & Mechanics BoKS 4: Thermodynamics & Propulsion BoKS 5: Electronics, Systems & Control BoKS 7: Business, Airworthiness & Operations BoKS 8: Research & Design
Requirements for participation in units of study (See also Article 29 TER)	None
Compensation (See also Article 127 TER)	No
Specific details	None
Test criteria	The student is able to Describe the development phases and design philosophy in space projects and describe the different aspects of the space environment and its effects on man and spacecraft. Describe the relationship between mission, orbits, orbit changes and required propellant mass and perform basic orbital mechanics calculations, including transfer orbits.

	Describe the basic characteristics of solid and liquid propellants, the build-up of propulsion systems and most important performance parameters of rocket engines, and calculate chemical rocket engine performance parameters. Describe the build-up of launch vehicles, and launch sequence, and calculate the burn-out velocities of single and multi-stage rockets. Show knowledge of basic on-board spacecraft systems, regarding build-up and function, and select a suitable system for a specific mission.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	12,5	10.5 hours lecture and 2 hours exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	

Bewerk

Helicopters - 1610DD304Z

Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Helicopters	No	No	2

Module name and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**

Helicopters, 1610DD304A	Grade (10-100)	55	100%	56

Content of unit of study	Helicopters	
Phase of Bachelor's programme	In possession of the skills necessary for professi	
Competencies	BoKS 3: Aerodynamics & Flight Mechanics	
Requirements for participation in units of study (See also Article 29 TER)	None	
Compensation (See also Article 127 TER)	No	
Specific details	None	
Test criteria	The student is able to describe the general characteristics of helicopters. identify and describe aerodynamic and stability and control components of helicopters. calculate the performance of helicopters. analyse, verify and validate helicopter performance calculations.	
Details of assessments	Written without test session	Report
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	10,5	1.5 hours lecture per week

Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	N/A	

Specialization: Lightweight Structures

Aircraft Structures 3 - 1615LS301Z					
Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Aircraft Structures	No	No	5

Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Aircraft Structures 3, 1615LS301A	Grade (10-100)	55	100%	98
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
FEM Assignment, 1615LS301B	Pass/Fail	Pass	0%	42

Content of unit of study	Aircraft Structures FEM assignment
Phase of Bachelor's programme	In possession of the skills necessary for professi
Competencies	BoKS 2: Structures & Mechanics
Requirements for participation in units of study (See also Article 29 TER)	None

Compensation (See also Article 127 TER)	No	
Specific details	None	
Module with assessment	Aircraft Structures 3	
Test criteria	The student can Calculate shear flows and normal forces in open and closed multi-cell cross-sections for an idealized wing or an idealized fuselage; Calculate shear flows and normal forces in idealized wing ribs or idealized fuselage frames; Calculate shear flows and normal forces in an idealized wing box or an idealized fuselage with a cut-out.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	23	2 x 1.5 hours of lectures per week and a 2 hour exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	
Module with assessment	FEM Assignment	
Test criteria	The student is able to: Create, run and analyse different FEModels with help of Patran/Nastran and using different types of elements (beam, rod, membrane, shear, shell elements) Interpretate and correct typical analysis warnings and failure messages from Patran/Nastran Correlate theory and practice in FEM analyses w.r.t. strength and stiffness of simplified structures	

	Perform important quality checks to validate FEM results (hand calculations, equilibrium checks, free bodies, deformation checks, checks of log files processing results) Present FEModels and results in a stress report	
Details of assessments	Other Method without test session	Report
Strategies and teaching activities	Lectures & Workshops	
Contact hours for strategies and teaching activities	10,5	2 x 1.5 lecture 5 x 1.5 hour workshop
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	N/a	

Bewerk

Vibrations - 1610LS302Z

Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Vibrations	No	No	3

Module name and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Vibrations, 1610LS302A	Grade (10-100)	55	100%	84

Content of unit of study	Vibrations Introduction to vibrations. Recognising difference between forced and free vibrations; critically damped, underdamped and overdamped systems. Impact of vibrations on aircraft design.	
Phase of Bachelor's programme	In possession of the skills necessary for professi	
Competencies	BoKS 2: Stuctures & Mechanics BoKS 1: Mathematics	
Requirements for participation in units of study (See also Article 29 TER)	None	
Compensation (See also Article 127 TER)	No	
Specific details	None	
Test criteria	The student knows introductory vibrations terminology and notations can model and analyse free vibrations of damped and undamped 1-DOF systems; can model and analyse forced vibrations of damped and undamped 1-DOF systems; can model and analyse free vibrations of undamped 2-DOF systems. can model and analyse forced vibrations of undamped 2-DOF systems.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	

Contact hours for strategies and teaching activities	23	2 x 1.5 hours of lecture per week and 2 hours exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	

Bewerk

Fatigue - 1614LS303Z

Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 1	Fatigue	No	No	2

Module name and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Fatigue, 1614LS303A	Grade (10-100)	55	100%	56

Content of unit of study	Introduction to fatigue
Phase of Bachelor's programme	In possession of the skills necessary for professi
Competencies	BoKS 2: Structures & Mechanics BoKS 6: Materials & Manufacturing
Requirements for participation in units of study (See	None

also Article 29 TER)		
Compensation (See also Article 127 TER)	No	
Specific details	None	
Test criteria	The student is able to: explain the theoretical model for fatigue analysis. He is aware of the surface effects like stress concentrations, residual stresses and surface irregularities that endurance of material life. explain the theoretical model for crackgrowth. He knows the factors (like cracklength and stress intensity) influencing the crackgrowth speed. explain which loads and conditions are be applied for testing. explain which measures shall be taken to enhance the endurance of a design. He can improve a design for fatigue and crackgrowth. use a typical life prediction tool as being used for verification of fatigue and crackgrowth analysis.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lecture + guest lectures	
Contact hours for strategies and teaching activities	14,5	7 x 1.5 lecture hours + 2 guest lecture hours + 2 hours exam
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Ruler, standard non-programmable calculator. Open book: prof Jaap Schijve, Fatigue of structures and materials	

Bewerk

Composites 2 - 1610LS304Z

Academic year	Term	Name of examination component	With graduation product	Graduation product designation	Study load in credits
4	Term 1	Composites	No	No	5

Module with test and code	Assessment scale	Required minimum score	Weighting Factor	Number of study hours
Composites 2, 1610LS304A	Grade (10-100)	55	100%	84

Module with test and code	Assessment scale	Required minimum score	Weighting Factor	Number of study hours
Composites Practical, 1610LS304B	Pass/Fail	Pass	0%	56

Content of unit of study	**Composites 2**: is follow up of Composites 1 and Laminate Theory (year 2/3) covering different topics with more focus on the fundamentals. The lectures cover a range of topics that are outcomes of the research carried out within Inholland Composites. **Practical**: combination of design, manufacturing and testing composite test specimens in relation to course Composites 2. There will be the possibilities of excursions and guest lectures to demonstrate practical applications within companies.
Phase of Bachelor's programme	In possession of the skills necessary for professi
Competencies	BoKS 2: Structures & Mechanics BoKS 6: Materials & Manufacturing BoKS 8: Research & Design

	BoKS 9: Professionalising	
Requirements for participation in units of study (See also Article 29 TER)	None	
Compensation (See also Article 127 TER)	No	
Specific details	None	
Module with assessment	Composites 2	
Test criteria	The student shows how to select the right fibre and matrices combination based on an application or set of requirements; knows quality methods and checks used within composite industry; shows how to design, verify and realize a composite (repaired) structure; knows different repair methods; show how to set-up a test plan for composite structures bases on acquired knowledge of test sequences; knows different test methods and possible outcomes; describes and discusses composite applications and its innovative design methods; knows different design methodologies; shows how to design a composite repair and discusses the variables within this design.	
Details of assessments	Written with test session	Exam
Strategies and teaching activities	Lectures	
Contact hours for strategies and teaching activities	12,5	7 x 1.5 hour lecture plus 2 hours exam

Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	Standard non-programmable calculator	
Module with assessment	Composites Practical	
Test criteria	The student is able to: execute and evaluate a production plan; execute and evaluate damage assessment; execute and evaluate a design plan for a composite repair; execute and evaluate a composite repair; execute and evaluate a test program.	
Details of assessments	Other Method without test session	Report / Presentation (oral)
Strategies and teaching activities	Workshop/practical and excursion	
Contact hours for strategies and teaching activities	21	7 x 3 hours practical/workshop lab
Compulsory attendance (See also Article 115 TER)	Yes	
Permitted aids	N/A	

ENGINEERING ENTREPRENEURSHIP

Engineering Entrepreneurship Project					
Academic year	**Term**	**Name of examination component**	**With graduation product**	**Graduation product designation**	**Study load in credits**
4	Term 2	Engineering Entrepreneurship Project	No	No	15

Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Research proposal,	Pass/Fail	Pass	0%	42
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Technical Feasibility,	Grade (10-100)	55	70%	250
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Business Feasibility	Grade (10-100)	55	30%	126
Module with test and code	**Assessment scale**	**Required minimum score**	**Weighting Factor**	**Number of study hours**
Personal Feasibility,	Pass/Fail	Pass	0%	2

Content of unit of study	Each team is obliged to start this program with a self-chosen technology. This self-chosen technology has to be **realistic**, **entrepreneurial** and **represent** who you are as a team. The following requirement could be used to assess which idea is a strong starting point: You have to be able to design and build (part) of the technology yourself in order to proof technical feasibility (i.e. realistic) by making a prototype. The technology has to be accomplished with an implementation strategy, (i.e. entrepreneurial); The technology has to fit your passions and interests as a team (i.e. passionate). You will test / validate the technological and market feasibility of your idea, and finally pitch this idea to an external jury.
Phase of Bachelor's programme	In possession of the skills necessary for professili
Competencies	Competence 1. Analysis Competence 2. Design Competence 3. Realisation Competence 4. Control Competence 5. Management Competence 6. Advice Competence 7. Research Competence 8. Professionalisation
Requirements for participation in units of study (See also Article 29 TER)	None
Compensation (See also Article 127 TER)	No
Specific details	None

Module with assessment	Research proposal		
Test criteria	Formulate the main research question and sub questions for the technical feasibility study.		
Details of assessments	Written without test session	Assignment	
Strategies and teaching activities	Tutorial		
Contact hours for strategies and teaching activities	4		
Compulsory attendance (See also Article 115 TER)	No		
Permitted aids	N/A		
Module with assessment	Technical Feasibility		
Test criteria	This report should be a technical report in which you explain in detail all the technological aspects. Your idea: Value Proposition What is the idea and the technology that forms the basis of your Business feasibility plan? This should include: Vision: Which problem are you going to solve? Mission: Why and How are you going to solve this problem? Ambition: What are your goals? What do you want to achieve?		
Details of assessments	Written without test session	Technical report	The result will be determined within 20 working days (Also see art. 131 TER)
Strategies and teaching activities	Project		

Contact hours for strategies and teaching activities	10		
Compulsory attendance (See also Article 115 TER)	No		
Permitted aids	N/A		
Module with assessment	Business Feasibility		
Test criteria	The second part explains several practical tools that will help you work out a business plan for implementation of your idea for a product or service. To goal is to gain insight in the many different aspects that influence your business idea. For this report you have to use the Business Model Canvas of Alexander Osterwalder.		
Details of assessments	Written without test session	Business feasibility report	The result will be determined within 20 working days (Also see art. 131 TER)
Strategies and teaching activities	Workshops / masterclasses		
Contact hours for strategies and teaching activities	40		
Compulsory attendance (See also Article 115 TER)	No		
Permitted aids	N/A		
Module with assessment	Personal Feasibility		
Test criteria	For the third part you will give a personal pitch. For this pitch you have to answer the question 'why should we hire you'?		

	To answer this question you use the insights (self-reflection) that you have gathered about yourself during this project and/or in the other years of this educational program	
Details of assessments	Other Method without test session	Presentation
Strategies and teaching activities	Project	
Contact hours for strategies and teaching activities	10	
Compulsory attendance (See also Article 115 TER)	No	
Permitted aids	N/A	