Study Program 2018 - 2019
Mathematical Engineering
Amsterdam/Diemen

Courses open to exchange students

08-02-2018

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Introduction

An exchange student can compose his/her own program choosing any courses described in this document. However, when choosing courses from higher years we expect students to have the knowledge and skills from previous years. Also, when selecting courses from different years, the courses might have an overlap in scheduling making it difficult to attend both.
Furthermore, the sending university (home university of the student) may impose restrictions on the program.

One term consists of 10 weeks. A program for a semester of 20 weeks (2 terms) consists of 30 credits (15 credits per term). In this document you can see which course will be scheduled in which term.

- Term 1: September - November
- Term 2: November - January
- Term 3: February - April
- Term 4: April – June/July

Ms. Margje Penning is the coordinator of the Exchange Students at Mathematical Engineering Amsterdam/Diemen. If you have any questions about the exchange program, if you want to consult about your possible program or if you need more information, please feel free to contact her.

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Summary

Year 1

Term 1

Unit of Study	Name of Examination Component	Credits
Introduction to IT	Professionalization	3
Introduction to Networks (CCNA 1)	Routing and Switching	3
English 1	Professionalization	2
Introduction to Programming with Python	Software Engineering	3
Precalculus	Mathematics	4

Term 2

Unit of Study	Name of Examination Component	Credits
Calculus 1	Mathematics	4
Advanced Programming with Python	Software Engineering	3
Project Casual Graphics	Software Engineering	4
Logic	Mathematics	3

Term 3

Unit of Study	Name of Examination Component	Credits
Research 1	Research	2
DBMS 1	Data	4
Routing and Switching Essentials (CCNA 2)	Routing and Switching	3
Calculus 2	Mathematics	4
English 2	Professionalization	2

Term 4

Unit of Study	Name of Examination Component	Credits
Object Oriented Programming 1	Software Engineering	3
Project Databases	Data	3
DBMS 2	Data	3
Statistics 1	Mathematics	2
Linear Algebra	Mathematics	3

Condition(s) for Participation
Introduction to Networks (CCNA 1) is prerequisite for Routing and Switching Essentials (CCNA 2)

Year 2

Term 1

Unit of Study	Name of Examination Component	Credits
Scaling Networks (CCNA 3)	Routing and Switching	3
English 3	Professionalization	2
Object Oriented Programming 2	Software Engineering	5
Probability Theory	Mathematics	5

Term 2

Unit of Study	Name of Examination Component	Credits
Project Application Development	Software Engineering	5
Software Engineering	Software Engineering	3
UML	Software Engineering	4
English 4	Professionalization	2

Term 3

Unit of Study	Name of Examination Component	Credits
Connecting Networks (CCNA 4)	Routing and Switching	3
Geometry	Mathematics	3
Graph Theory	Mathematics	4
Algorithms & Datastructures 1	Mathematics	3
Research 2	Research	2

Term 4

Unit of Study	Name of Examination Component	Credits
Project Web Science	Mathematics	5
Numerical Analysis	Mathematics	4
Algorithms & Datastructures 2	Mathematics	3
English 5	Professionalization	2

Condition(s) for Participation
Routing and Switching Essentials (CCNA 2) is prerequisite for Scaling Networks (CCNA 3) Scaling Networks (CCNA 3) is prerequisite for Connecting Networks (CCNA 4)

Year 3

Term 3

Unit of Study	Name of Examination Component	Credits
Research 3	Research	2
Statistics 2	Mathematics	3
Operations Research	Mathematics	4
Routing (CCNP 1)	Networking	3
Switching (CCNP 2)	Networking	3
Mobile Development 1	Software Engineering	6

Term 4

Unit of Study	Name of Examination Component	Credits
Project Engineering Entrepreneurship	Professionalization	10
Troubleshooting (CCNP 3)	Networking	4
Mobile Development 2	Software Engineering	4

Condition(s) for Participation
All Routing and Switching courses (CCNA 1, 2, 3 and 4) are prerequisite for all CCNP courses. Routing (CCNP 1) and Switching (CCNP 2) are prerequisite for Troubleshooting (CCNP 3) Mobile Development 1 is prerequisite for Mobile Development 2

Year 4

Term 1

Unit of Study	Name of Examination Component	Credits
Advanced Data Disclosure	Data	5
Distributed Systems and Parallel Computing	Data	3
Advanced Programming in Java	Software Engineering	5
Research 4	Research	2

Term 2

Unit of Study	Name of Examination Component	Credits
Project Big Data	Data	5
Data Warehousing and Business Intelligence	Data	2
Data Mining & Analysis	Data	4
Cryptography	Mathematics	3

Description of Units of Study

Year 1

Term 1

Introduction to IT - 3713IT112Z/3715EX001Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 1	Professionalization		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Introduction to IT, 3713IT112A/3715EX001A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	At Inholland Applied University Mathematical Engineering has chosen for the Information Technology (IT) as specialization. So the students need to get an idea what IT is today, for sure in relation to Mathematics. For each field of IT (like Hardware, Middleware, Methods & Technics, Project) an introduction to an advanced topic will be part of the class.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Manage, Professionalize				
Condition(s) for Participation	None.				
Other details	None.				
Examination criteria	Understanding IT concepts				
Details on examination formats	Written exam				
Instructional formats and education activities	Instructor-led theory sessions, self-tuition session and labs				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Introduction to Networks (CCNA 1) - 3714IT111Z/3715EX003Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 1	Networking		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Introduction to Networks (CCNA 1), 3714IT111A/3715EX003A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	Introduction to Networks: Introduces the architecture, structure, functions, components, and models of the Internet and computer networks. The principles of IP addressing and fundamentals of Ethernet concepts, media, and operations are introduced to provide a foundation for the curriculum. By the end of the course, students will be able to build simple LANs, perform basic configurations for routers and switches, and implement IP addressing schemes.	
Stage in the Bachelor programme	Suitable for the profession	
Competencies	Analyze,Design,Realize,Maintain	
Condition(s) for Participation	Skills exam is only open for students which has passed the theory exam	
Other details	None	
Examination criteria	Understand and describe the devices and services used to support communications in data networks and the Internet Understand and describe the role of protocol layers in data networks Understand and describe the importance of addressing and naming schemes at various layers of data networks in IPv4 and IPv6 environments Design, calculate, and apply subnet masks and addresses to fulfill given requirements in IPv4 and IPv6 networks Explain fundamental Ethernet concepts such as media, services, and operations Build a simple Ethernet network using routers and switches Use Cisco command-line interface (CLI) commands to perform basic router and switch configurations Utilize common network utilities to verify small network operations and analyze data traffic	
Details on examination formats	On-line theory test.	
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	N/A	

English 1 - 3713IT114Z/3715EX002Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 1	Professionalization		Yes	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
English 1, 3713IT114A /3715EX001A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	Most students enrolling in this course can be both from the Netherlands and abroad and in general will have a good command of the English language in order to be able to follow the courses of IT which are all taught in the English language. Nevertheless, English is an important language in the field of technology, especially information technology. Communication forms an even importance as IT staff needs to communicate with fellow staff and clients in the IT who are far from being an expert in computer science. During all five courses the emphasis will be on reading, writing, listening, speaking and communicating. The courses start with an emphasis on rehearsing the basics in grammar and will subsequently focus on speaking and writing. Especially writing will be the focus of attention and be presented in the form of letters, memos and reports in order to prepare the student not only for the final thesis, but also for the professional work field. The courses aim at for level C1 but preferably C2 of the CEFR.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Consultancy, Professionalize				
Condition(s) for Participation	None.				
Other details	Prerequisites: none, except that the level of English should at least be on B1, but preferably B2, of the CEFR (Common European Framework for References of Languages).				
Examination criteria	**GRAMMAR & WRITING EXAM** **Further details about assessment**: The exam consists of 60 questions based upon grammar, either by ticking the correct answer, or completing a field, counting for 60% of the grade. Furthermore a written assignment counting for 40%. Both assignments need to be above 55% of their applicable individual score. **Assessment criteria** Grammar questions in exam: Students pass at least 33 of the 60 questions of the grammar test (max 60 pts); Written assignment in exam: Students pass at least for a minimum of 22 points for the written test in the exam, based upon the following criteria (max. 40 pts): - Style (max. 8 pts) - Conventions of a memo (max. 8 pts) - Grammar (max. 8 pts) - Use of language, such as complete and full sentences, academic vocabulary (max. 8 pts)				

	- Overall impression, including noticing pitfalls and providing extra details (max. 8 pts). **PRESENTATION** The assignment consists of a group presentation on a designated topic, lasting 15 – 20 minutes including feedback and questions from class, in which each students speaks at least for 3 minutes, hence covering an equally divided balance between students in participation. The result needs to be above 55% of the applicable individual score. **Assessment criteria** The presentation is assessed on the following criteria: - Used aids in media, such as PowerPoint, Prezi, Rocket Slide etc, attractiveness of the presentation (max. 10 pts) - Topic, complexness or execution of the assignment (max. 20 pts) - Pronunciation (max. 25 pts) - Structured presentation: head, body, tail, conclusion, including introduction of members, table of contents, attitude in from of class, meeting conventions for presentations (max. 25 pts) - Interaction with class during questions (max. 20 pts) Students attending the presentation are required to ask questions, have a participating attitude and a keen eye for facts versus opinions.	
Details on examination formats	Exam and in-term presentation	
Instructional formats and education activities	The instructional format and educational activities consist of 7 x 4 classes in the form of workshops and lectures in which an proactive, participating attitude is expected; an in-term group presentation which forms part of the final grade, followed by an individual exam.	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	Reading requirements as indicated, dictionary.Exam: none. Presentation: to be decided by student(s).	

Introduction to Programming with Python - 3714IT113Z/3715EX004Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 1	Software Engineering		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Introduction to Programming with Python, 3714IT113A/3715EX004Z		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This course gives a first introduction to programming in general and more specific to Python. Good programming is about logical structuring and algorithmic thinking. Algorithms have to be designed in a systematic and structured way, in order to make the code easily readable and well maintainable. After successfully completing this course, the student understands the importance of good structuring in programming and the 'divide and conquer' principle. The student can apply this by creating a simple application using Python.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze, realize and design				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	For programming in general, the student - understands and applies the division of responsibilities between files and functions (2.1.3), - uses a proper lay-out and informative comment lines (3.1.2), - understands what a variable is, what the scope and type of a variable is, why typing is important and what loosely typed means (3.1.2), - can construct a Nassi Schneidermann Diagram (NSD) from a given problem choosing the correct control structures and nesting the structures correctly (1.1.3). - can translate NSD to Python functions and vice versa (2.1.2),.				
Details on examination formats	During the exam the student will answer open questions on paper and do programming assignments on the computer.				
Instructional formats and education activities	The contact hours are divided in lectures with exercises (1.5 hours each week) and lab sessions where the student will work on programming assignments (3 hours each week). The students are expected to prepare the lectures by studying the chapters and to prepare the lab sessions by making the exercises as indicated in the week overview.				
Contact hours for instructional formats and education activities	45	Lectures, lab session, self-study and working on assignments			
Compulsory attendance	No				
Aids permitted	N.a				

Precalculus - 3714IT116Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 1	Mathematics		Yes	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Precalculus, 3714IT116A		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	Starting this course has two aims. The first aim is to bridge the possible gap between high school mathematics and the level of mathematics used during your study. The second aim is to accustom students from different nationalities to a common use of mathematical notation and language. To achieve this aim the following topics will certainly be covered: fractions, basic algebra, function, first and second degree equations, logarithms and exponentials. Continuing the course will introduce two important concepts, namely function, and limit.	
Stage in the Bachelor programme	Suitable for the profession	
Competencies	Analyze and Realize	
Condition(s) for Participation	None	
Other details	None	
Examination criteria	Basic calculus rules, functions, and limits.	
Details on examination formats	Written exam.	
Instructional formats and education activities	Teaching method: tutorials, without calculator The teacher gives a short explanation of the theory, and explains homework questions The student practices problems during tutorials and makes homework according to the schedule, prepares questions for the teacher, practices with the trial exam **Attendance is not mandatory, but is strongly recommended; the students responsibility is to keep track of treated theory, solved problems and instructions of the teacher**	
Contact hours for instructional formats and education activities	45	
Compulsory attendance	No	
Aids permitted	None	

Term 2

Calculus 1 - 3714IT121Z/3715EX020Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 2	Mathematics		No	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Calculus 1, 3714IT121A /3715EX001A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Every engineer must be able to apply the ideas of calculus in his later working career. In this course, the concepts of Derivative and Integration are introduced. Maple will help to understand and calculate these concepts				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze and Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Derivatives and Integration				
Details on examination formats	Written exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	45				
Compulsory attendance	No				
Aids permitted	None				

Advanced Programming with Python - 3714IT122Z/3715EX005Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 2	Software Engineering		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Web Programming 2, 3714IT122A/3715EX005A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This course continues on the course Introduction to Programming in Python. Good programming is about logical structuring and algorithmic thinking. Algorithms have to be designed in a systematic and structured way, in order to make the code easily readable and well maintainable. After successfully completing this course, the student will be able to create an application in Python using Math libraries.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze, realize and design				
Condition(s) for Participation	None, but it is advised to do the course Introduction to Programming in Python first.				
Other details	None				
Examination criteria	For programming in general, the student: - applies the 'divide and conquer' principle correctly by using include files and dividing code between files and functions (2.1.3); - uses a proper lay-out and informative comment lines (3.1.2); - can construct a Nassi Schneidermann Diagram (NSD) from a given problem choosing the correct control structures and nesting the structures correctly (1.1.3); - can convert a NSD to correct Python code and vice versa (2.1.; - can build a application using Python with Math libraries (3.1.1). - uses given functions correctly and knows how to find information on predefined Python functions and libraries (3.1.2).				
Details on examination formats	During the exam the student will answer open questions on paper and do programming assignments on the computer.				
Instructional formats and education activities	The contact hours are divided in lectures with exercises (1.5 hours each week) and lab sessions where the student will work on programming assignments (3 hours each week). The students are expected to prepare the lectures by studying the chapters and to prepare the lab sessions by making the exercises as indicated in the week overview.				
Contact hours for instructional formats and education activities	45	Lectures, lab work, self-study and working on assignments			
Compulsory attendance	No				
Aids permitted	N.a				

Project Casual Graphics - 3714IT123Z/3715EX022Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 2	Software Engineering		No	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Project Casual Games, 3714IT123A /3715EX022A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	In this 'first' project you will apply what you learned so far in a 5-6 member team setting. This project is divided in four phases: Idea, Proof of Concept, Alpha release, Beta release. It will address project skills (planning, deadlines, meetings, and releases), professional skills (communication, presenting or demonstrating results) and technical skills (software development, math).				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze and design				
Condition(s) for Participation	None.				
Other details	None.				
Examination criteria	Demonstrate the ability to deliver sufficient product quality using Python. Manage your project and maintain process quality. Be able to use math in a Python application.				
Details on examination formats	Your final grade will be the average of a (group) product grade and an individual (process) grade.				
Instructional formats and education activities	Workshops, project and tutor meetings.				
Contact hours for instructional formats and education activities	32	Lectures and group (progress) meetings			
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.			
Aids permitted	All available relevant sources				

Logic - 3714IT124Z/3715EX023Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 2	Mathematics		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Logic, 3714IT124A /3715EX023Z		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Logic is the fundamental part of Mathematics. Logic helps Information Technology as well. This course introduces the topics Logic and Sets. After that it will be applied for the program design and proven program correctness. Other applications of Logic and Sets in IT will be mentioned too.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Design,Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Logic, Sets, and, design and proven program correctness				
Details on examination formats	Written Exam				
Instructional formats and education activities	Class hours will be on average 1/3 theory presentation + 2/3 solution explanation of homework exercises				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Term 3

Routing and Switching Essentials (CCNA 2) - 3713IT132Z/3715EX026Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 4	Networking		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Routing and Switching Essentials (CCNA 2), 3713IT132A /3715EX001A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	Routing and Switching Essentials: Describes the architecture, components, and operations of routers and switches in a small network. Students learn how to configure a router and a switch for basic functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with RIPv1, RIPv2, single-area and multi-area OSPF, virtual LANs, and inter-VLAN routing in both IPv4 and IPv6 networks.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze, Design, Realize				
Condition(s) for Participation	CCNA 1 Introduction to Networks Skills exam is only open for students which has passed the theory exam				
Other details	None.				
Examination criteria	Understand and describe basic switching concepts and the operation of Cisco switches Understand and describe the purpose, nature, and operations of a router, routing tables, and the route lookup process Understand and describe how VLANs create logically separate networks and how routing occurs between them Understand and describe dynamic routing protocols, distance vector routing protocols, and link-state routing protocols Configure and troubleshoot static routing and default routing (RIP and RIPng) Configure and troubleshoot an Open Shortest Path First (OSPF) network Understand, configure, and troubleshoot access control lists (ACLs) for IPv4 and IPv6 networks Understand, configure, and troubleshoot Dynamic Host Configuration Protocol (DHCP) for IPv4 and IPv6 networks Understand, configure, and troubleshoot Network Address Translation (NAT) operations				
Details on examination formats	On-line theory test, group based practical test				
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab				
Contact hours for instructional formats and education activities	31				

Compulsory attendance	No	
Aids permitted	N/A	

Research 1 - 3713IT131Z/3715ERAS1Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 3	Research		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Research 1, 3713IT131A /3715ERAS1A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	In any but the most simple situations, you need to think before you can create something. It may not always be clear what the problem is, it may not be clear what the solution is. But it can run deeper; there may be alternatives to be considered. A great risk when faced with a question is that the solution seems to be easy, leading the engineer to implement it without considering all aspects of the situation. This may lead to a solution which is unmaintainable, does not give				

	the best way to solve the problem, turns out to be the wrong answer, or is ethically unacceptable. During this introductory course in applied research, you will learn a structured way to solve a problem. You will also start the road to a scientific way of reasoning in solving practical problems, and build some understanding of the ethical aspects which may be involved.
Stage in the Bachelor programme	Suitable for the profession
Competencies	Research and professionalize
Condition(s) for Participation	None.
Other details	None.
Examination criteria	After successfully completing this module, the student is able to: - Describe and identify the phases in a structured applied research - Create a summarized plan for each phase in a given, structured research situation - Identify the kind of scientific reasoning needed or neglected in a given situation - Assess the ethical implications in a research proposal and give your reasoned opinion on it.
Details on examination formats	The module will be examined with a written, partly case-based exam. The case(s) used on the exam will be made available on blackboard one week before the exam date, so students can prepare themselves. On the exam, question will be asked pertaining to the case(s), as well as more theoretical questions.
Instructional formats and education activities	There will be one class a week. During this, the teacher introduces the theme of that week and illustrates it by showing selections from literature, but also from other sources. A subject like this is best learned by discussing it. Much time will be spent discussing the subjects, looking into both good and bad examples etc.
Contact hours for instructional formats and education activities	17
Compulsory attendance	No
Aids permitted	None

DBMS 1 - 3714IT134Z/3715EX008Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 3	Data		No	4
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
DBMS 1, 3714IT134A/3715EX008A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Data are facts, in themselves and without context without meaning. Combining them gives information, facts in context conveying meaning. Nowadays, information is the lifeblood of most if not all organizations. Databases are widely used to organize and store structured data and retrieve information.				

	Analyzing this data and converting it to information is an important part of the skillset of a mathematical engineer, who will often use his mathematical and IT skills to supply the organization with the insights necessary to act on circumstances. This course treats the fundamentals of databases and database management systems. In addition, the student learns to manipulate and query databases using the database query language SQL and how to access the database from a programming language. The skills gained will be used in many other courses and projects afterwards.	
Stage in the Bachelor programme	Suitable for the profession	
Competencies	Design, Realize and Advise	
Condition(s) for Participation	None	
Other details	None	
Examination criteria	After successfully completing this module, the student is able to: - Explain the role of databases in information systems - Explain the architecture used in relational database management systems - Write statements for querying and manipulating databases - Connect the database to Java or PHP and access the data from there	
Details on examination formats	The exam consists of a written, more theoretical part, and a practical part done on the computer. The written part tests the students' understanding of goals and architecture of a database management system, whereas the computer part tests the ability to manipulate the database and extract information from it.	
Instructional formats and education activities	Instructions and lab sessions.	
Contact hours for instructional formats and education activities	45	
Compulsory attendance	No	
Aids permitted	A computer running MySQL	

Calculus 2 - 3714IT136Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 3	Mathematics		No	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Calculus 2, 3714IT136A		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	Calculus 2 builds on the concepts of Calculus 1. The type of numbers will be extended by the Complex numbers, so more equations can be solved. Sequences and Series is a new topic. Differential equations will apply the topics of differentiation and integration. Functions of more than one variable complete Calculus 2. Further the Mathematical toolset of the student will be build up by the Maple software product.	
Stage in the Bachelor programme	Suitable for the profession	
Competencies	Analyze and Realize	
Condition(s) for Participation	None	
Other details	None	
Examination criteria	Complex Numbers, Sequences and Series, Differential Equations, Functions of more variables	
Details on examination formats	Written Exam	
Instructional formats and education activities	Lectures	
Contact hours for instructional formats and education activities	45	
Compulsory attendance	No	
Aids permitted	None	

English 2 - 3713IT144Z/3715EX009Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 3	Professionalization		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
English 2, 3713IT144A //3715EX001A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	Most students enrolling in this course can be both from the Netherlands and abroad and in general will have a good command of the English language in order to be able to follow the courses of IT which are all taught in the English language. Nevertheless, English is an important language in the field of technology, especially information technology. Communication forms an even importance as IT staff needs to communicate with fellow staff and clients in the IT who are far from being an expert in computer science. During all five courses the emphasis will be on reading, writing, listening, speaking and communicating. The courses start with an emphasis on rehearsing the basics in grammar and will subsequently focus on speaking and writing. Especially writing will be the focus of attention and be presented in the form of letters, memos and reports in order to prepare the student not only for the final thesis, but also for the professional work field. The courses aim at for level C1 but preferably C2 of the CEFR.
Stage in the Bachelor programme	Suitable for the profession
Competencies	Consultancy & Professionalize.
Condition(s) for Participation	None.
Other details	Prerequisites: none, except that the level of English should at least be on B1, but preferably B2, of the CEFR (Common European Framework for References of Languages). Having completed ENG1 is preferred. Students are expected to have full knowledge of all aspects shared in these courses.
Examination criteria	**GRAMMAR & WRITING EXAM** **Further details about assessment**: The exam consists of 60 questions based upon grammar, either by ticking the correct answer, or completing a field, counting for 60% of the grade. Furthermore a written assignment counting for 40%. Both assignments need to be above 55% of their applicable individual score. **Assessment criteria** Grammar questions in exam: Students pass at least 33 of the 60 questions of the grammar test (max 60 pts); Written assignment in exam: Students pass at least for a minimum of 22 points for the written test in the exam, based upon the following criteria (max. 40 pts): - Style (max. 8 pts) - Conventions of a memo (max. 8 pts) - Grammar (max. 8 pts)

	- Use of language, such as complete and full sentences, academic vocabulary (max. 8 pts) - Overall impression, including noticing pitfalls and providing extra details (max. 8 pts). **PRESENTATION** The assignment consists of a group presentation on a designated topic, lasting 15 – 20 minutes including feedback and questions from class, in which each students speaks at least for 3 minutes, hence covering an equally divided balance between students in participation. The result needs to be above 55% of the applicable individual score. **Assessment criteria** The presentation is assessed on the following criteria: - Used aids in media, such as PowerPoint, Prezi, Rocket Slide etc, attractiveness of the presentation (max. 5 pts) - Topic, complexness or execution of the assignment (max. 25 pts) - Pronunciation (max. 20 pts) - Structured presentation: head, body, tail, conclusion, including introduction of members, table of contents, attitude in from of class, meeting conventions for presentations (max. 25 pts) - Interaction with class during questions (max. 25 pts) Students attending the presentation are required to ask questions, have a participating attitude and a keen eye for facts versus opinions.	
Details on examination formats	Exam and in-term presentation	
Instructional formats and education activities	The instructional format and educational activities consist of 7 x 4 classes in the form of workshops and lectures in which an proactive, participating attitude is expected; an in-term group presentation which forms part of the final grade, followed by an individual exam.	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	Reading requirements as indicated, dictionary. Exam: none. Presentation: to be decided by student(s).	

Term 4

Object Oriented Programming 1 - 3714IT133Z/3715EX007Z

Study Year	Education Period	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Period 3	Software Engineering		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Object Oriented Programming 1, 3714IT133A /3715EX007A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	In the first semester, students learned the basics of programming structures. These basics are sufficient for small applications handling small amounts of data. Serious applications handling large amounts of data with complicated algorithms are developed with more powerful tools and techniques however. During this course, a start will be made with one of the most powerful tools available for developing this kind of programs: object orientation. In object orientation, the problem at hand is divided into smaller 'objects' with a certain degree of independency. There is no main program; instead the objects will cooperate to achieve the goal.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Design and realise				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	After successfully completing this module, the student is able to: Apply Java constructs in creating a basic application Use both basic and advanced OO concepts in developing desktop software Design classes according to industry-standard guidelines				
Details on examination formats	This module will be examined by a practical exam. In this exam, students will program one or more (small) applications containing most of the techniques learned.				
Instructional formats and education activities	Class will start with a presentation on the subjects of that day. After that, the teacher will write a short demonstration application, using the ideas and input from the students attending. The idea here is to show the way of thinking used in object orientation, so this part of the lesson will have little preparation from the teacher, relying on ideas from the students! After the ideas have been demonstrated, students will work on assignments given, finishing them between classes.				
Contact hours for instructional formats and education activities	45				
Compulsory attendance	No				
Aids permitted	During the exam, it is allowed to use the Java API (online) and Java books (such as the course book) without notes, either hardcopy or as a pdf. Other sources (for example StackOverflow) are not allowed.				

Project Databases - 3713IT141Z/3715EX012Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 4	Data		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Project Databases, 3713IT141A /3715EX012A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	The second project of year 1 integrates many of the courses previously (and during this term) taught, and adds the element of a real client to it. It focuses on the use of research techniques to solve a real-world problem. As the courses of terms 3 and 4 have been focusing on database technology, whereas terms 1 and 2 involved web programming, the project combines those two aspects and asks the student to create a web application with a database. The goal of this project is to provide the client with an application which will allow the faculty to offer negotiated study units, students to enroll in them, with the application supporting the desired workflow.
Stage in the Bachelor programme	Suitable for the profession
Competencies	Analyze, Design, Realise, Maintain, Manage, Advise, Professionalize and Research
Condition(s) for Participation	None, but students are expected to have knowledge and skills of databases equivalent to *DBMS 2, 3714IT143A* (or follow this course) and web-programming skills equivalent to *Web Programming 2, 3714IT122A* .
Other details	None.
Examination criteria	After successfully finishing this project, the student can: - Create and work with a project plan, using a prestructured research and development structure - Analyse the needs of the client and translate the results of this analysis to a web-based application - Design this web application using prescribed methods and technologies - Implement the design including the database, using prescribed methods and techniques - Use a version control system to coordinate the work within the team - Create and maintain basic functional and technical documentation for the application Besides these specific criteria, students will be assessed on general project skills (Advise, Professionalize and Research)
Details on examination formats	Students are assessed on the quality of the product, the quality of the report and the quality of their project work. All three aspects should be a Pass mark. Furthermore, they are assessed on their individual contribution to the final results; this also has to be a pass. If students fail either the product or the presentation, they can redo this a week later. Failing the process or individual contribution cannot be repaired during a resit; the whole project will have to be redone.

Instructional formats and education activities	Developing a (web-based) application for a ‘real’ client.	
Contact hours for instructional formats and education activities	32	
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.
Aids permitted	All	

DBMS 2 - 3714IT143Z/3715EX011Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 4	Data		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
DBMS 2, 3714IT143A /3715EX011Z		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	Data are facts, in themselves and without context without meaning. Combining them gives information, facts in context conveying meaning. Nowadays, information is the lifeblood of most if not all organizations. Databases are widely used to organize and store structured data and retrieve information. In the course DBMS1, students learned how to manipulate the data stored in a database and how to handle it to get information. The other side of using a database management system is the ability to design, implement and optimize a database. The scope in this is quite broad; as a mathematical engineer, your focus will be on developing and optimizing the physical implementation rather than analyzing the data to be stored in the database. That does not mean you do not have to learn how to do a basic information analysis, however, in practice, the more complex data structures will be analyzed by a specialist, the results to be used by the engineer in designing the actual database. In this course, students will learn how to convert the results of an information analysis into the necessary logical and physical models, implement these in a database, and optimize this database for the expected usage. Part of this is writing triggers and stored procedures to support the retrieval of complex information and to keep the database consistent.
Stage in the Bachelor programme	Suitable for the profession
Competencies	Design and Realize
Condition(s) for Participation	None, but students are expected to have knowledge and skills of databases equivalent to *DBMS 1 - 3714IT134Z*
Other details	None
Examination criteria	After successfully completing this module, the student is able to: - Create a simple database model given a clear context and information need - Transform the results of this information analysis to a database design - Optimize the database design in terms of consistency and performance - Implement the database design in the MySQL DBMS - Write MySQL triggers and stored procedures to support the usage of the database
Details on examination formats	The exam consists of a written part on database design, and a practical part done on the computer.
Instructional formats and education activities	Instructions and lab sessions.
Contact hours for instructional formats and education activities	31
Compulsory attendance	No
Aids permitted	A computer running MySQL

Statistics 1 - 3714IT145Z/3715ERAS8Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 4	Mathematics		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Statistics 1, 3714IT145A /3715ERAS8A		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	We use data all the time, varying from comparing grocery prices to figuring out who's going to win the next elections. When we have all data, analyzing it might still not be easy, but at least it's clear how to proceed. But often we do not have all data; it's infeasible to gather all prices from all supermarkets, so how to decide the cheapest one? Or it's just plain impossible to gather all data; we just cannot ask all people in the USA who they are going to vote for next month. Whenever we have a lot of (often incomplete) data and need to draw conclusions, we use statistics. That means statistics are everywhere; economics (what is the current inflation?), politics (opinion polling), networking (error analysis), software development (test coverage.) The list goes on. Not only is knowledge of statistics useful for the engineer because of its usage in analyzing the technical systems he's working on, statistics forms the foundation of many big data techniques. Last but not least: statistics are quite often used to mask the truth. We call that 'lying with statistics'. It is very useful, and often quite fun, to see through those attempts at manipulating your behavior in a direction you might not want to.
Stage in the Bachelor programme	Suitable for the profession
Competencies	Analyze and Realize
Condition(s) for Participation	None
Other details	None
Examination criteria	After successfully completing this module, the student is able to: - Explain the basic goals and concepts of statistics - Describe a data set in statistical terms - Draw a graphical representation of a data set - Work with probability theory to describe simple and compound chances - Apply elements of probability theory to descriptive statistics
Details on examination formats	Written Exam
Instructional formats and education activities	Class consists of a mixture of explaining the fundamentals and doing exercises. Between classes, assignments are given to practice. Answers can be compared to the answers given in the text book. At the beginning of the next class, questions about the assignments can also be asked. Special attention will be given to the misuse and abuse of (descriptive) statistics; not because it's more important, but because it is a good way to gain insight in what statistical analysis actually means.The last class is different from the others. While analysing small amounts of data can be done manually, doing so for large data sets would become prohibitively time-consuming and

	error-prone. Analyses are usually done using statistical software packages such as SPSS and R. During the last class, all previous materials will be rehearsed using SPSS, thereby both reinforcing understanding of the principles and learning how to use SPSS itself. Usage of SPSS is not part of the exam however.	
Contact hours for instructional formats and education activities	24	
Compulsory attendance	No	
Aids permitted	On this exam, apart from pens, pencils etc, only the materials provided as part of the exam are allowed. A basic hand calculator will be provided; bringing your own calculator is not allowed.	

Linear Algebra - 3714IT146Z

Study Year	Education Term	Name of Examination Component		Qualitative requirement BSR norm	Study Load in Credits
1	Term 4	Mathematics		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Linear Algebra, 3714IT146A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Linear Algebra helps you to understand more dimensions. Solving linear equations and mappings can be done by the theory of Linear Algebra. This class will introduce Vectors and Matrices. Basic topics are: Determinants, Inverse, and Eigenvalue. Matlab will be the software tool for calculation help.				
Stage in the Bachelor programme	Suitable for the profession				
Competencies	Analyze and Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Vectors, Matrices, Determinants, Inverse, Eigenvalue, Solving Linear systems, Basis				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Year 2

Term 1

Scaling Networks (CCNA 3) - 3713IT211Z/3715EX015A

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 1	Networking			3
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Scaling Networks (CCNA 3), 3713IT211A/3715EX015A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Describes the architecture, components, and operations of routers and switches in a large and complex network. Students learn how to configure routers and switches for advanced functionality. By the end of this course, students will be able to configure and troubleshoot routers and switches and resolve common issues with OSPF, EIGRP, STP, and VTP in both IPv4 and IPv6 networks. Students will also develop the knowledge and skills needed to implement DHCP and DNS operations in a network.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realize, Maintain				
Condition(s) for Participation	CCNA1 Introduction to Networks CCNA2 Routing and Switching Essentials Skills exam is only open for students which has passed the theory exam				
Other details	None				
Examination criteria	Understand, configure and troubleshoot enhanced switching technologies such as VLANs, Rapid Spanning Tree Protocol (RSTP), Per VLAN Spanning Tree Plus Protocol (PVST+), and EtherChannel Understand, configure, and troubleshoot first hop redundancy protocols (HSRP) in a switched network Understand, configure, and troubleshoot wireless routers and wireless clients Configure and troubleshoot routers in a complex routed IPv4 or IPv6 network using single-area OSPF, multiarea OSPF, and Enhanced Interior Gateway Routing Protocol (EIGRP) Manage Cisco IOS® Software licensing and configuration files				
Details on examination formats	On-line theory test, group based practical test				
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	N/A				

English 3 - 3713IT212Z/3715EX016A

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 1	Professionalization			2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
English 3, 3713IT212A /3715EX016A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	Most students enrolling in this course can be both from the Netherlands and abroad and in general will have a good command of the English language in order to be able to follow the courses of IT which are all taught in the English language. Nevertheless, English is an important language in the field of technology, especially information technology. Communication forms an even importance as IT staff needs to communicate with fellow staff and clients in the IT who are far from being an expert in computer science. During all five courses the emphasis will be on reading, writing, listening, speaking and communicating. The courses start with an emphasis on rehearsing the basics in grammar and will subsequently focus on speaking and writing. Especially writing will be the focus of attention and be presented in the form of letters, memos and reports in order to prepare the student not only for the final thesis, but also for the professional work field. The courses aim at for level C1 but preferably C2 of the CEFR.
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Consultancy, Professionalize
Condition(s) for Participation	None. However, the student is expected to be familiar with the contents provided in ENG1 and ENG2.
Other details	Prerequisites: none, except that the level of English should at least be on B1, but preferably B2, of the CEFR (Common European Framework for References of Languages). Having completed ENG1 and ENG2 is preferred. Students are expected to have full knowledge of all aspects shared in these courses.
Examination criteria	**GRAMMAR & WRITING EXAM** **Further details about assessment**: The exam consists of two writing assignments and subsequent questions, (1) assignment on summarizing an article and (2) assignment on writing letters to a prosperous client. The exam needs to be above 55% of the applicable individual score. **Assessment criteria** Summary: Summarizing the article within the given number of words Answering the questions on the article Summarizing the article by selecting the essential information, which should not be copy-pasted but written in own words.

	Use of language, such as complete and full sentences, academic vocabulary Meeting grammar and style conventions. Letters: Answering the questions on the article Meeting conventions of a letter; addressee, references etc Tone of language towards client Suggested solution to the posed problem Use of language, such as complete and full sentences, academic vocabulary **PORTFOLIO** The assignment consists of 4 assignments, to be discussed during the lectures and to be completed at home, according to the conventions of writing indicators. **Assessment criteria** Summary: Summarizing the article within the given number of words Answering the questions on the article Summarizing the article by selecting the essential information, which should not be copy-pasted but written in own words. Use of language, such as complete and full sentences, academic vocabulary Meeting grammar and style conventions. Letters: Answering the questions on the article Meeting conventions of a letter; addressee, references etc Tone of language towards client Suggested solution to the posed problem Use of language, such as complete and full sentences, academic vocabulary **PRESENTATION** The assignment consists of a group presentation on a designated topic, lasting 15 – 20 minutes including feedback and questions from class, in which each students speaks at least for 3 minutes, hence covering an equally divided balance between students in participation. **Assessment criteria** The presentation is assessed on the following criteria: Used aids in media, such as PowerPoint, Prezi, Rocket Slide etc, attractiveness of the presentation (max. 5 pts) Topic, complexness or execution of the assignment (max. 25 pts) Pronunciation (max. 20 pts) Structured presentation: head, body, tail, conclusion, including introduction of members, table of contents, attitude in from of class, meeting conventions for presentations (max. 25 pts) Interaction with class during questions (max. 25 pts) Students attending the presentation are required to ask questions, have a participating attitude and a keen eye for facts versus opinions.
Details on examination formats	Exam, portfolio, in-term presentation

Instructional formats and education activities	The instructional format and educational activities consist of 7 x 4 classes in the form of workshops and lectures in which an proactive, participating attitude is expected; an in-term group presentation which forms part of the final grade, followed by an individual exam and portfolio.	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	Reading requirements as indicated, dictionary. Exam: none. Presentation: to be decided by student(s). Portfolio: to be decided by student(s).	

Object Oriented Programming 2 - 3713IT213Z/3715EX017Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 1	Software Engineering			5
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Object Oriented Programming 2, 3713IT213A /3715EX017A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	In the first year, students learned the basics of programming structures. These basics are sufficient for small applications handling small amounts of data. Serious applications handling large amounts of data with complicated algorithms are developed with more powerful tools and techniques however. Object Oriented Programming 1 started with the concepts of object orientation and its design and implementation using Java. After finishing that course, students were expected to be able to use Java correctly, including the basics principles behind object orientation. During this course, we will expand on the knowledge from OOP1 and introduce some advanced features of Java, thereby gaining a deeper understanding of the concepts behind object orientation. Fundamental in this are several design patterns. Also covered are reflection, networking and streams. The final part of the course is an introduction to building graphical interfaces using JavaFX. After successfully finishing this module, the student will be able to create a fully functional server application.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Design and Realise				
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Object Oriented Programming 1, 3714IT133A*				
Other details	None				
Examination criteria	After successfully completing this module, the student is able to: Design an application in a way fitting with the purpose and environment of it Make use of design patterns to create flexibility in the implementation of the algorithms used Make full use of multithreading, including but not limited to synchronization and interthread communication Use the Collections framework and Generics Create a functional GUI with JavaFX				
Details on examination formats	During the last class, students will be a set of functional specifications. They will, individually, create the application using the given classes and specifications. Grading will be done by checking whether all techniques learned were used correctly to solve the problem set. When failing the assignment, the student will receive feedback. After that, he can hand in an improved version during the resit Term.				
Instructional formats and education activities	Class will start with a presentation on the subjects of that day. After that, the teacher will write a short demonstration application, using the ideas				

	and input from the students attending. The idea here is to show the way of thinking used in object orientation, so this part of the lesson will have little preparation from the teacher, relying on ideas from the students! After the ideas have been demonstrated, students will work on assignments given, finishing them between classes.	
Contact hours for instructional formats and education activities	45	
Compulsory attendance	No	
Aids permitted	The student may use any means, provided that they make their own assesment and the student must be clear in their source	

Probability Theory - 3713IT232Z/3715EX018Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 1	Mathematics			5
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Probability Theory, 3713IT232A /3715EX018A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Probability Theory is the fundament for many applied Mathematical topics like Statistics and Operations Research. In this class the definition of Probability will be based on uncertainly in the real world. So Probability Theory is related to the real world too. Further the class will cover all calculation details about probability. An introduction to Markov chains (a special Stochastic Process, which we meet in our daily life) will be the interesting end of this class.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze,Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Probability theory				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Term 2

Project Application Development - 3713IT221Z/3715EX019Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 2	Software Engineering			5
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Project Application Development, 3713IT221A/3715EX019A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	An important application of mathematical engineering is building a model of a real-life situation in order to make predictions and find desirable solutions to a problem. In this, two major approaches can be distinguished. In one, a full mathematical model is developed. This model the is used to make predictions. Usually, when the situation modelled is complex or extensive, the model is transformed into a computer application and this application is used to do the predictions. We call this the mathematical solution, although creating an application to do the calculations is still involved. The second major approach is to create an application simulating the real-life situation, and build the behaviour into this model. This involves less advanced mathematical modelling than the first option, but creating and running the application is more difficult. We call this the simulation solution, although you still need a significant amount of mathematics to understand and implement the behaviour. The question which of those two options is best cannot generally be answered, as it depends on the specific circumstances. In this project, one of those real-life situations will be examined from both angles, as to gain some understanding of the way this kind of problems can be tackled. In this project, you will work in a project group of about five students on one the two mentioned approaches. Another project group will work on the same case study, but use the other angle to solve it. near the end, the two groups compare their results and draw a conclusion on the pros and cons of both angles and decide what would be the best way to make predictions on the subject given.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realise, Maintain, Manage, Advise, Professionalize and Research				
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Object Oriented Programming 2, 3713IT213A*				
Other details	None				
Examination criteria	After successfully finishing this project, the student can: Use a version control system to coordinate the work within the team Choose a software development method suitable to the situation at hand Analyse the math involved in problems of ecology Transform the math to either a simulation or an algorithm				

	Implement the design made in the previous step in software Create and maintain technical documentation for the application Besides these specific criteria, students will be assessed on general project skills (Advise, Professionalize and Research)	
Details on examination formats	Developing a computer application	
Instructional formats and education activities	Developing a computer application	
Contact hours for instructional formats and education activities	32	
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.
Aids permitted	The student may use any means, provided that they make their own assessment and the student must be clear in their source	

Software Engineering - 3712IT233Z/3715EX024Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 2	Software Engineering			3
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Software Engineering, 3712IT233A /3715EX024A		Written	No	Grade (10-100)	100%

Content of Unit of Study	Very small information systems can be developed on the fly; usually the client is clear, might even be the same as the developer, and the requirements can be easily understood. It already becomes more complicated if the algorithms involved are non-trivial, and when system grows larger and needs to be maintainable as well, the 'code as you go' approach ceases to produce usable results. Another problem you run into is the need to adapt the information system to changing needs, or expand it to accommodate new requirements. The difference between a programmer and a software engineer is the ability to take al these – often conflicting – requirements and follow a path to the analysis, design and implementation of an information system which stays useful and used over time. This course addresses the systematic (agile) approach to the design and development of (large) IT systems. It will cover classic requirements and design techniques such as OO concepts, type systems, subsystem design and reusable patterns. Besides traditional development methodologies some agile principles such as refactoring, code quality and test driven development will be discussed.
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Analyse, design, manage, research and professionalize
Condition(s) for Participation	None.
Other details	None.
Examination criteria	After successfully completing this module, the student is able to: Translate the information needs of a client to functional specifications Apply reusable patterns in designing the architecture of a new information system Modify an existing application, keeping the architecture in line with the requirements from the requirements analysis Choose a software development method and modeling technique suitable for the problem at hand Work systematically from vaguely defined information needs to an application able to fulfill those Combine reusable patterns in new ways to accommodate future changes to an application
Details on examination formats	
Instructional formats and education activities	
Contact hours for instructional formats and education activities	31
Compulsory attendance	No
Aids permitted	

UML - 3713IT224Z/3715EX006Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 2	Software Engineering			4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
UML, 3713IT224A /3715EX006A		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	Modelling is a central part of the development of applications beyond the trivial. Models are needed for various reasons: to communicate the desired structure and behavior of the system with all parties involved; to visualize and control the system's architecture; to better understand the system being build; to expose opportunities for simplification and reuse; to manage risk. The Unified Modeling Language is the major notation for object oriented information systems. Students will learn the principles of UML and learn to understand the link between software design and code. Students will learn to gather relevant information to create and understand UML diagrams and use case descriptions for requirement elicitation, design and documentation of an application.
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Analyze, design and realize
Condition(s) for Participation	None, but students following this course are expected to have the knowledge and skills of: ▪ 3714IT133A – Object Oriented Programming 1 and ▪ 3713IT213A – Object Oriented Programming 2 or an equivalent in object oriented programming.
Other details	None
Examination criteria	After successfully completing this course, the student can: - create, read and interpret use case diagrams and use case descriptions (i.e. with name, pre- and post-conditions, primary actors, main success scenario and alternative flows, with the user starting and stopping the use case) (1.2.3); - create read and interpret system sequence diagrams (1.2.3); - create read and interpret domain models (conceptual classes) (1.2.3); - create read and interpret class diagrams (software classes) (2.2.3); - create, read and interpret interaction diagrams and can convert a sequence diagram in a collaboration diagram and vice versa (2.2.3); - apply collections, owner (parent child) and descriptive versus sample relations in class diagrams/domain models (2.2.3); - apply the controller, supply, demand, transaction sections in domain models (1.2.3); - apply the GRASP patterns Information expert, Creator, Controller and High Cohesion/Low Coupling (2.2.3);

	- convert class diagrams and/or communication diagrams to Java-code and vice versa (3.2.1).	
Details on examination formats	Written exam	
Instructional formats and education activities	The contact hours are in the form of lectures of 2 hours twice a week where the theory but also exercises will be discussed. The students are expected to prepare the lectures by studying the chapters and by making the exercises as indicated in the Student Guide on blackboard.	
Contact hours for instructional formats and education activities	31	Lectures,self-study and working on assignments
Compulsory attendance	No	
Aids permitted	N.a	

English 4 - 3713IT245Z/3715EX021Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 2	Professionalization			2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
English 4, 3713IT245A /3715EX021A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	Most students enrolling in this course can be both from the Netherlands and abroad and in general will have a good command of the English language in order to be able to follow the courses of IT which are all taught in the English language. Nevertheless, English is an important language in the field of technology, especially information technology. Communication forms an even importance as IT staff needs to communicate with fellow staff and clients in the IT who are far from being an expert in computer science. During all five courses the emphasis will be on reading, writing, listening, speaking and communicating. The courses start with an emphasis on rehearsing the basics in grammar and will subsequently focus on speaking and writing. Especially writing will be the focus of attention and be presented in the form of letters, memos and reports in order to prepare the student not only for the final thesis, but also for the professional work field. The courses aim at for level C1 but preferably C2 of the CEFR.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Consultancy, Professionalize.				
Condition(s) for Participation	None.				
Other details	Prerequisites: none, except that the level of English should at least be on B1, but preferably B2, of the CEFR (Common European Framework for References of Languages). Having completed ENG1, ENG2 and ENG3 is preferred. Students are expected to have full knowledge of all aspects shared in these courses.				
Examination criteria	**CURRICULUM VITAE** **Further details about assessment**: The assignment consist of drafting a CV and hand it in for feedback. After feedback, student needs to adapt the CV according to the given comments and hand in the final version. **Assessment criteria** Draft CV: Meeting detailed conventions of a proper CV Correct use of the English language Proper layout Handed in digitally Final CV: Meeting detailed conventions of a proper CV Correct use of the English language Proper layout Processed feedback and comments Handed in digitally **LINKED IN ACCOUNT** **Further details about assessment**:				

	The creation of a Linked In account, completing it and connecting with lecturer. The creation counts for a pass. **Assessment criteria** Creation: Creating the account for Linked In Correct use of the English language Completing the required information on Linked In Connecting: Connecting with lecturer **PORTFOLIO** **Further details about assessment**: The assignment consists of comparing a number of job advertisements 4 assignments according to specified criteria, placed in a matrix plus reflection in accordance with the writing indicators. **Assessment criteria** Comparing the job descriptions by careful selection of essential information according to the given criteria, such as career perspectives, tasks, requirements for knowledge and skills; tone and usage of language; reflection on the offered position, all placed in a matrix. Use of the English language, such as complete and full sentences, academic vocabulary Meeting grammar and style conventions. **PRESENTATION** The assignment consists of a group presentation on a designated topic, lasting 15 – 20 minutes including feedback and questions from class, in which each students speaks at least for 3 minutes, hence covering an equally divided balance between students in participation. **Assessment criteria** The presentation is assessed on the following criteria: Used aids in media, such as PowerPoint, Prezi, Rocket Slide etc, attractiveness of the presentation (max. 5 pts) Topic, complexness or execution of the assignment (max. 35 pts) Pronunciation (max. 20 pts) Structured presentation: head, body, tail, conclusion, including introduction of members, table of contents, attitude in from of class, meeting conventions for presentations (max. 20 pts) Interaction with class during questions (max. 20 pts) Students attending the presentation are required to ask questions, have a participating attitude and a keen eye for facts versus opinions.
Details on examination formats	Portfolio and in-term presentation
Instructional formats and education activities	The instructional format and educational activities consist of 7 x 4 classes in the form of workshops and lectures in which an proactive, participating attitude is expected; an in-term group presentation which forms part of the final grade, followed by an individual portfolio.
Contact hours for instructional formats and education activities	31
Compulsory attendance	No
Aids permitted	Reading requirements as indicated, dictionary. Presentation: to be decided by student(s). Portfolio: to be decided by student(s).

Term 3

Connecting Networks (CCNA 4) - 3713IT231Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 3	Networking			3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Connecting Networks (CCNA 4), 3713IT231A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This course discusses the WAN technologies and network services required by converged applications in a complex network. The course enables participants to understand the selection criteria of network devices and WAN technologies to meet network requirements. Participants learn how to configure and troubleshoot network devices and resolve common issues with data link protocols. Participants will also develop the knowledge and skills needed to implement virtual private network (VPN) operations in a complex network.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realize, Maintain				
Condition(s) for Participation	CCNA1 Introduction to Networks CCNA2 Routing and Switching Essentials CCNA3 Scaling Networks Skills exam is only open for students which has passed the theory exam				
Other details	None				
Examination criteria	Understand and describe different WAN technologies and their benefits Understand and describe the operations and benefits of virtual private networks (VPNs) and tunneling Understand, configure, and troubleshoot Serial connections Broadband connections Tunneling operations Network Address Translation (NAT) operations Monitor and troubleshoot network operations using syslog, SNMP, and NetFlow Understand and describe network architectures: Borderless networks Data centers and virtualization Collaboration technology and solutions				
Details on examination formats	On-line theory test, group based practical test				
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	N/A				

Geometry - 3713IT223Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 3	Mathematics			3
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Geometry, 3713IT223A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Geometry is part of our real life. So it must be part of the Mathematical Engineer too. Many algorithms make use of Geometry, and many real world problems can only be solved in IT with Geometry. The class gives the student an introduction in the four different views of Geometry.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze and Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Geometry				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	24				
Compulsory attendance	No				
Aids permitted	Straightedge (Ruler), Pair of Compasses				

Graph Theory - 3713IT214Z/3715EX025Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 3	Mathematics			4
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Graph Theory, 3713IT214A /3715EX025A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Graph Theory is nowadays a very important Mathematical 'Tool' to understand our society. Information Technology has given Graph Theory the possibility to solve the Coloring problem, and vice versa Graph Theory has given IT a lot more possibilities too, like e.g. Internet. Also Social Networks have benefits of Graph Theory. This class will do the introduction of Graph theory with an emphasis on algorithms. The class will prepare for the applications of Graphs in mathematical related fields like IT and Operations Research.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design and Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	(Algorithms of) Graphs				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Algorithms & Datastructures 1 - 3713IT234Z/3715EX010Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 3	Mathematics			3
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Algorithms & Datastructures 1, 3713IT234A /3715EX010A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This course is about data structures and algorithms as used in computer programming. A data structure is an arrangement of data in the computer's memory (or on a disk). An algorithm describes the procedure a program uses to manipulate the data in this structure in a specific way. Almost all programs use data structures and algorithms. For simple programs with small amounts of data, a straightforward approach might be all you need. However, for programs of a more complex nature or when dealing with large amounts of data, more sophisticated techniques are necessary. In this course various basic algorithms and data structures are explained, such as linked lists, stacks, queues, heaps, binary search trees, and sorting algorithms. The course focuses on the working of the algorithms, the application to various types of problems, and the implementation in Java.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze and design				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	The student can: explain the role of algorithms and data structures in applications; explain the working of a number of basic algorithms and data structures; explain the strong and weak points of a number of basic algorithms and data structures; compute the computational complexity of algorithms and operations on data structures; implement a number of basic algorithms and data structures; choose appropriate algorithms and data structures for applications using a set of basic algorithms and data structures.				
Details on examination formats	The written exam consists of open questions.				
Instructional formats and education activities	Classes consist of instructions and programming exercises.				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Research 2 - 3713IT235Z/3715ERAS2Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 3	Research			2
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Research 2, 3713IT235A /3715ERAS2A		Written	No	Grade (10-100)	100%
Content of Unit of Study	IIn the research courses the student develops the soft skills needed for successfully conducting applied research projects during their studies and in their professional life. The focus of this course is on writing and using project plans.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Research				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	The student can: analyze a simple real world problem and transform it into a research problem; formulate a main research questions for a research problem; split a main research question into a set of subquestion; select a research methodology to answer a subquestion; create a planning for a research project; identify risks in a methodology and describe possible solutions; write a research plan; conduct a small-scale study according to a research plan; reflect on the strengths and weaknesses of a research plan;				
Details on examination formats	The grade will be based on two assignments, one individual and one a group assignment.				
Instructional formats and education activities	Instructions and working on group assignments and individual assignments.				
Contact hours for instructional formats and education activities	17				
Compulsory attendance	No				
Aids permitted	All				

Term 4

Project Web Science - 3713IT241Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 4	Mathematics			5
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Project Web Science, 3713IT241A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	The World Wide Web is without doubt the single most important source of information that has ever been available. At the same time it is also the least controlled and understood source. How is all this information structured? Who are its users? How is it used? Web Science aims to answer these questions by studying the techniques, users, and structure of the web. Web science is practiced out of pure curiosity as well as for gaining strategic advantage. For example, companies monitor their online presence by analyzing Twitter conversations in which they are mentioned. Search engines analyze link structure to identify authoritative web sites. News agencies crawl blogs and social media to get real-time information about unexpected events. In this project students will research part of the web by application of various web science methods. The theoretical foundation of these methods were laid in the courses on Graph Theory and Algorithms and Data Structures. For the practical application software development skills are needed as covered in the courses ULM, Software Development, and Object Oriented Programming. Finally, this course requires the skills developed in the Research courses.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realize, Manage, Research, Professionalize				
Condition(s) for Participation	None, but student are expected to have knowledge of Graph Theory equivalent to *Graph Theory - 3713IT214Z*				
Other details	None				
Examination criteria	The student is able to: translate a question of a client into a web science problem; identify ethical aspects of a web science project; model (part of) the world wide web as a graph; select appropriate data structures and algorithms for a web science problem; select graph theoretical concepts appropriate for solving a web science question; create an efficient implementation of graph theoretical concepts; analyze graphs that are too large to be visualized in full; evaluate the consequences of graph theoretical properties for real world graphs; work according to a project plan; perform managing tasks within a project group;				

	communicate effectively and efficiently with all parties involved; divide work within a project team; effectively collaborate in a project team; write a well-structured report about a project; find relevant literature and use the literature during a project; critically reflect on the effectively of the chosen methods.	
Details on examination formats	The grade will be based on the quality of the analysis, the report, and the individual performance of the student.	
Instructional formats and education activities	Instructions and group work.	
Contact hours for instructional formats and education activities	32	
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.
Aids permitted	None	

Numerical Analysis - 3713IT243Z/3715EX027Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 4	Mathematics			4
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Numerical Analysis, 3713IT243A/3715EX027A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This Class helps the student to understand what numerical algorithms will do. The topics are Errors, Approximations, Interpolations, Numerical Integration and Linear Equations. The mathematical theory behind these topics will be studied, so that good Algorithms can be found.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design and Realize				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Errors, Approximations, Interpolations, Numerical Algorithms and Linear Equations				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures, Labs				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Algorithms & Datastructures 2 - 3713IT244Z/3715EX013Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 4	Mathematics			3
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Algorithms & Datastructures 2, 3713IT244A/3715EX013A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This course covers data structures and algorithms as used in computer programming. A data structure is an arrangement of data in the computer's memory or on disk. An algorithm describes the procedure a program uses to manipulate the data in this structure in a specific way. Almost all programs use data structures and algorithms. For simple programs with small amounts of data, a straightforward approach might be all you need. However, for programs of a more complex nature or when dealing with large amounts of data, more sophisticated techniques are necessary. In this course various advanced algorithms and data structures are explained, including binary search trees, self-balancing trees, hashes, string processing algorithms, regular expressions, and compression algorithms. The course focuses on the working of the algorithms, analysis of the complexity of algorithms, the application to various types of problems, and the implementation in Java. Programming skills were developed in the courses Introduction to programming 1 and 2 and Object Oriented Programming. The course Algorithms and data structures 1 covered the basic algorithms and data structures. This course builds upon these courses and bridges the gap between algorithms and programming.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realize				
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Algorithms & Datastructures 1, 3713IT234A*				
Other details	None				
Examination criteria	After successfully completing this module, the student is able to: for the following data structured: binary search trees, self-balancing trees, hashes implement various representations of the data structures in memory; manually execute the algorithms for manipulating these data structures; compare the strong and weak points of the data structures; for string processing algorithms, regular expressions, and compression algorithms manually execute the algorithms; compare the strong and weak points of the algorithms; compute the worst-case computational complexity of the algorithms; construct regular expressions for string finding problems; convert between regular expressions and non-deterministic finite-state automata;				

	construct algorithms for real-world problems using appropriate existing advanced algorithms and data structures.	
Details on examination formats	Written exam of 120 minutes consisting of open questions.	
Instructional formats and education activities	Classes consist of instructions and exercises.	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	None	

English 5 - 3713IT246Z/3715EX014Z

Study Year	Education Term	Name of Examination Component			Study Load in Credits
2	Term 4	Professionalization			2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
English 5, 3713IT246A /3715EX014A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	Most students enrolling in this course can be both from the Netherlands and abroad and in general will have a good command of the English language in order to be able to follow the courses of IT which are all taught in the English language. Nevertheless, English is an important language in the field of technology, especially information technology. Communication forms an even importance as IT staff needs to communicate with fellow staff and clients in the IT who are far from being an expert in computer science. During all five courses the emphasis will be on reading, writing, listening, speaking and communicating. The courses start with an emphasis on rehearsing the basics in grammar and will subsequently focus on speaking and writing. Especially writing will be the focus of attention and be presented in the form of letters, memos and reports in order to prepare the student not only for the final thesis, but also for the professional work field. The courses aim at for level C1 but preferably C2 of the CEFR.
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Management, Consultancy & Professionalize.
Condition(s) for Participation	None.
Other details	Prerequisites: none, except that the level of English should at least be on B1, but preferably B2, of the CEFR (Common European Framework for References of Languages). Having completed ENG1, ENG2, ENG3 and ENG4 is preferred. Students are expected to have full knowledge of all aspects shared in these courses.
Examination criteria	**DOCUMENTATION ON WEB SCIENCE** **Further details about assessment**: The assignment consist of weekly drafting an agenda and minutes of meeting for Web Science. After feedback sessions, students need to take this into consideration and improve the agenda and minutes. Furthermore, drafts of the report for Web Science are send it around week 3, after which these will receive feedback, which students need to adapt into the report according to the given comments. At the end of the term, 7 agenda's, 7 minutes and a final version of the report will be handed in a group portfolio. The portfolio needs to be above 55% of the applicable group score. **Assessment criteria** Agenda and minutes Correct agenda, including the conventions of an agenda Proper taking of minutes based upon the agenda Correct use of the English language Proper layout Digitally handed in on a weekly basis Final report Correct use of the English language Proper layout

	Digitally handed in on a weekly basis as of week 3. Meeting conventions of writing a report Meeting conventions of details by lecturers Web Science Final portfolio containing Report with processed feedback as a final version Covering 7 weeks: 7 agendas and 7 minutes of meetings. **PORTFOLIO ON BUSINESS** **Further details about assessment**: The assignment consists of a research portfolio on how to set up a company in the Netherlands, including a written report on the research and drafting an invoice and a quotation, a SWOT-analysis and specifically focussing on the use of Social Media. Furthermore aspects such as other required documentation, taxpaying, payroll, premises and book keeping are to be considered. **Assessment criteria** Setting up a company with group members and description of services offered Consider a name and a logo – research on using names, style and colours through BIOP. Research on necessary certificates and diplomas Research on financial matters: payroll, taxpaying, book keeping, other payments Considering renting a property If needed: a possible business plan, but a SWOT analysis must be part of the portfolio Documentation such as an invoice, proposal and a leaflet Use of Social Media, including examples. The above will be placed in a group portfolio and handed in digitally at the end of the term. **PRESENTATION** The assignment consists of a group presentation on a designated topic, lasting 15 – 20 minutes including feedback and questions from class, in which each students speaks at least for 3 minutes, hence covering an equally divided balance between students in participation. **Assessment criteria** The presentation is assessed on the following criteria: Used aids in media, such as PowerPoint, Prezi, Rocket Slide etc, attractiveness of the presentation (max. 5 pts) Topic, complexness or execution of the assignment (max. 35 pts) Pronunciation (max. 20 pts) Structured presentation: head, body, tail, conclusion, including introduction of members, table of contents, attitude in from of class, meeting conventions for presentations (max. 20 pts) Interaction with class during questions (max. 20 pts) Students attending the presentation are required to ask questions, have a participating attitude and a keen eye for facts versus opinions.
Details on examination formats	In-term presentation and writing assignments, portfolio
Instructional formats and education activities	The instructional format and educational activities consist of 7 x 4 classes in the form of workshops and lectures in which an proactive, participating attitude is expected; an in-term group presentation which forms part of the final grade, followed by a group portfolio.
Contact hours for instructional formats and education activities	31
Compulsory attendance	No
Aids permitted	Reading requirements as indicated, dictionary. Presentation: to be decided by student(s). Portfolio: to be decided by student(s).

Year 3

Term 3

Research 3 - 3712IT332Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
3	Term 3	Research		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Research 3, 3712IT332A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	In the research courses the student develops the soft skills needed for successfully conducting applied research projects during their studies and in their professional life. The focus of this course is quantitative research. Quantitative research methodologies are discussed and put into practice in a small-scale study.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Research				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	The student can: select an appropriate quantitative research methodology for a research problem; independently conduct a small quantitative study; draw conclusions from quantitative results; write a research report about a quantitative study				
Details on examination formats	The grade will be based on the quality of the research paper and the presentation.				
Instructional formats and education activities	Instructions and working on assignment.				
Contact hours for instructional formats and education activities	17				
Compulsory attendance	No				
Aids permitted	All				

Statistics 2 - 3712IT333Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
3	Term 3	Mathematics		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Statistics 2, 3712IT333A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	This Class will give the student the Mathematical fundaments for Statistics. Hypotheses, Estimating and Confidence Intervals are the topics. Also building and use Models will be an important part of this Class				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design, Realize, Advice, Research				
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Statistics 1, 3714IT145A*				
Other details	None				
Examination criteria	Models, Hypotheses, Estimating and Confidence Intervals				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	24				
Compulsory attendance	No				
Aids permitted	None				

Operations Research - 3713IT334Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
3	Term 3	Mathematics		No	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Operations Research, 3713IT334A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	TThere are a lot of algorithms for optimizing problems. In Operations Research we will have a look at some of the Mathematical programming: Graphical/Simplex method, Inventory Models, Branch & Bound, Integer programming, some of General Models.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyse,Design,Advise				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Graphical/Simplex method, Inventory Models, Branch & Bound, Integer programming, some of General Models (Lagrange).				
Details on examination formats	Written exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				

Routing (CCNP 1) - 3712IT331Z

Study Year		Education Term	Graduation product designation	Study Load in Credits
3		**Term 3**	No	3
Examination Name and Code	Examination Format	Examination session	Examination Scale	Weighting Factor
Routing (CCNP 1), 3712IT331A	Written	Yes	Grade (10-100)	100%

Content of Unit of Study	CCNP equips students with the knowledge and skills needed to plan, implement, secure, maintain, and troubleshoot converged enterprise networks. The CCNP curriculum was designed to reflect the job skills and responsibilities that are associated with professional-level job roles such as network engineer, systems engineer, network support engineer, network administrator, network consultant , and system integrator. Implementing IP Routing is one of the three courses. This course teaches students how to implement, monitor, and maintain routing services in an enterprise network. Students will learn how to plan, configure, and verify the implementation of complex enterprise LAN and WAN routing solutions, using a range of routing protocols in IPv4 and IPv6 environments. The course also covers the configuration of secure routing solutions to support branch offices and mobile workers. Comprehensive labs emphasize hands-on learning and practice to reinforce configuration skills.	
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation	
Competencies	Design, Realize, Maintain	
Condition(s) for Participation	All Routing and Switching courses (CCNA 1, 2, 3 and 4) are prerequisite for all CCNP courses. Skills exam is only open for students which has passed the theory exam.	
Other details	None	
Examination criteria	Implement an EIGRP Based Solution, Given a Network Design and a Set of Requirements (25%) Implement a Multi-Area OSPF Network, Given a Network Design and a Set of Requirements (25%) Implement an eBGP Based Solution, Given a Network Design and a Set of Requirements (5%) Implement an IPv6 based solution, given a network design and a set of requirements (15%) Implement an IPv4 or IPv6 based redistribution solution, given a network design and a set of requirements (15%) Implement Layer 3 Path Control Solution (10%) Implement basic teleworker and branch services (5%)	
Details on examination formats	On-line theory test, individual practical test	
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	N/A	

Switching (CCNP 2) - 3712IT335Z/3715ERAS3Z

Study Year	Education Term		Graduation product designation	Study Load in Credits
3	Term 3		No	3
Examination Name and Code	**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Switching (CCNP 2), 3712IT335A /3715ERAS3A	Written	Yes	Grade (10-100)	100%
Content of Unit of Study	CCNP equips students with the knowledge and skills needed to plan, implement, secure, maintain, and troubleshoot converged enterprise networks. The CCNP curriculum was designed to reflect the job skills and responsibilities that are associated with professional-level job roles such as network engineer, systems engineer, network support engineer, network administrator, network consultant , and system integrator. This course teaches students how to implement, monitor, and maintain switching in converged enterprise campus networks. Students will learn how to plan, configure, and verify the implementation of complex enterprise switching solutions. The course also covers the secure integration of VLANs, WLANs, voice, and video into campus networks. Comprehensive labs emphasize hands-on learning and practice to reinforce configuration skills.			
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation			
Competencies	Design, Realize, Maintain			
Condition(s) for Participation	All Routing and Switching courses (CCNA 1, 2, 3 and 4) are prerequisite for all CCNP courses. Skills exam is only open for students which has passed the theory exam.			
Other details	None			
Examination criteria	Implement VLAN Based Solution, Given a Network Design and a Set of Requirements (50%) Implement a Security Extension of a Layer 2 Solution, Given a Network Design and a Set of Requirements (12%) Implement Switch Based Layer 3 Services, Given a Network Design and a Set of Requirements (14%) Prepare Infrastructure to Support Advanced Services (5%) Implement High Availability, Given a Network Design and a Set of Requirements (19%)			
Details on examination formats	On-line theory test, individual practical test			
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab			
Contact hours for instructional formats and education activities	31			
Compulsory attendance	No			
Aids permitted	N/A			

Mobile Development 1 - 3713MBDV1Z/3715ERAS6Z

Study Year	Education Term		Graduation product designation	Study Load in Credits
3	Term 3		No	6
Examination Name and Code	**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Mobile Development 1, 3713MBDV1A3715ERAS6A	Written	No	Grade (10-100)	100%
Content of Unit of Study	The role of mobile computing devices in modern society can hardly be underestimated. In the Netherlands, about 30 percent of the families has one or more tablets. About sixty percent of the Dutch owns and uses a smartphone. This means the role of computing is changing drastically; information technology has become something you have in your pocket and use for things undreamt of twenty years ago. For professionals in Mathematical Engineering or Information Technology this means they have to have some skills in developing applications for these mobile devices. The kind of applications will differ widely, but the basics are the same. During this course, students will learn how to write applications for the Android platform. At the end, they will have written a full-fledged application which uses the hardware available.			
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation			
Competencies	Analyze, Design, Realize and Research			
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Object Oriented Programming 2, 3713IT213A*			
Other details	None			
Examination criteria	After successfully completing this module, the student is able to: Research the market and come up with an idea for a new mobile application Take an idea for a mobile application and translate this into a high-level design Develop the architecture of an Android application Implement the mobile application using a variety of tools Search and find resources to improve the application beyond the already known			
Details on examination formats	This module will be examined by a practical exam. During the first term of the course, each student designs an Android application at a very high level (wireframes etc.) This design is evaluated by the teacher. After approval, the exam consists of creating this application during the second term, using the techniques learned during the first term. The application should use at least some of the specialized hardware available in a mobile device, such as GPS, gyroscope or camera. The deadline for the assignment is the Friday of the second exam week of the second term during which the course was taught. The deadline for the resit is the Friday of the second exam week of the exam Term after this.			

	Handing in after the deadline is an automatic fail of the assignment, with no feedback given.	
Instructional formats and education activities	This course is split over two terms, with the examination being in the second term. During the first term, class will start with a presentation on the subjects of that day. After that, the teacher will write a short demonstration application, using the ideas and input from the students attending. The main idea here is to explore the possibilities of the technology, so this part of the lesson will have little preparation from the teacher. When this explorative phase is finished, students will work on assignments given, finishing them between classes. Also during the first term, students have to come up with an idea for a mobile application they would like to build themselves. They set up the rough idea by drawing some wireframes and describing the functionality envisioned in a few paragraphs. The final idea has to be approved by the teacher. During the second term, classes only consist of working on the application with the teacher being available for consultancy. The final result is a mobile app using the hardware of the mobile device.	
Contact hours for instructional formats and education activities	31	31 (first term), 31 (second term)
Compulsory attendance		No
Aids permitted	N/A	

Term 4

Project Engineering Entrepreneurship - 3713IT341Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
3	Term 4	Professionalization		No	10
Examination Name and Code		Examination Format	Examination session	Examination Scale	Weighting Factor
Project Engineering Entrepreneurship, 3713IT341A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	During a Term of ten weeks, the Engineering Entrepreneurship (EE) program challenges you to develop a business of your own technological idea. You will test the technological, personal and market feasibility of your idea, and finally present it to experts from the future profession. Through the Mathematical Engineering programme we deliver good and competent engineers to future employers. In conversations with the same future employers / the work field, we discovered there might be another asset we might incorporate in the programme. And so we did. Many companies told us that in addition to having technical knowledge, it is also imperative that technical students obtain entrepreneurial skills. This doesn't mean that we want you to become an entrepreneur. When working for a company, it is also important to have entrepreneurial skills and show entrepreneurial behaviour. Some of you might consider starting your own company. During the Engineering Entrepreneurship program, you will work on your own business idea by conducting a business feasibility study that describes how your technological idea could be implemented in the market. Your assignment will be two-fold. You will work on entrepreneurial aspects of your idea. Besides that you will be working on the technological development of your 'product'. In addition to obtaining entrepreneurial skills, this program also aims at being able to work in a team and reflect on yourself and your team members. The teams have to consist of a minimum of four students and a maximum of six. As a team you have your own coach from ME-IT who is assigned to guide you on the technical subject as well as on the progress of your project. We will also arrange guest lectures and coaches who are experienced in entrepreneurship or specific entrepreneurship-related topics. We strongly advise you to ask them for feedback on your plans, and ask them about the challenges you face. 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 build (part) of the technology yourself in order to proof technical feasibility (i.e. realistic); The technology has to be accomplished with an implementation strategy, so it would help if you already have an idea of who would pay for this (i.e. entrepreneurial);				

	The technology has to fit your passions and interests as a team, because you will have to work hard on it and pitch your outcomes with passion (i.e. passionate). At the start of the programme we will organize a brainstorm session. During this session you will get the opportunity to formulate your team and chose your technologies(s). If you haven't been able to form a team or come up with your own idea during this session, you will be classified in teams by the coordinators of the programme. Your team will then follow a series of lectures to become acquainted with the different entrepreneurial topics. In addition to the lectures you will be working on your entrepreneurial assignment and make a real life prototype of the technology in order to test the technical feasibility of your idea. During the whole program you will be regularly coached by Inholland lecturers.	
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation	
Competencies	Professionalization	
Condition(s) for Participation	None	
Other details	None	
Examination criteria	See project guide Engineering Entrepreneurship on Blackbaord	
Details on examination formats	Your assignment consists of a **business feasibility study** (60%), a **technical feasibility study** (25%) and a **personal feasibility pitch** (15%). These reports should focus on determining the technical and entrepreneurial feasibility of a self-chosen technology	
Instructional formats and education activities	See project guide Engineering Entrepreneurship on Blackbaord	
Contact hours for instructional formats and education activities	26	
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.
Aids permitted		

Troubleshooting (CCNP 3) - 3710IT424Z/3715ERAS4Z

Study Year	Education Term		Graduation product designation	Study Load in Credits
3	Term 4		No	4
Examination Name and Code	**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Troubleshooting (CCNP 3), 3710IT424A /3715ERAS4A	Written	Yes	Grade (10-100)	100%

Content of Unit of Study	This course teaches students how to monitor and maintain complex, enterprise routed and switched IP networks. Skills learned include the planning and execution of regular network maintenance, as well as support and troubleshooting using technology-based processes and best practices, in a systematic and ITIL-compliant approach. Extensive labs emphasize hands-on learning and practice to reinforce troubleshooting techniques
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Realize, Maintain, Research, Professionalize
Condition(s) for Participation	Routing (CCNP 1) Switching (CCNP 2) Skills exam is only open for students that have passed the theory exam
Other details	None.
Examination criteria	Implement an EIGRP Based Solution, Given a Network Design and a Set of Requirements (25%) Implement a Multi-Area OSPF Network, Given a Network Design and a Set of Requirements (25%) Implement an eBGP Based Solution, Given a Network Design and a Set of Requirements (5%) Implement an IPv6 based solution, given a network design and a set of requirements (15%) Implement an IPv4 or IPv6 based redistribution solution, given a network design and a set of requirements (15%) Implement Layer 3 Path Control Solution (10%) Implement basic teleworker and branch services (5%)
Details on examination formats	On-line theory test, individual practical test.
Instructional formats and education activities	Instructor-led theory sessions and hands-on exercises in the lab
Contact hours for instructional formats and education activities	31
Compulsory attendance	No
Aids permitted	N/A

Mobile Development 2 - 3713MBDV2Z/3715ERAS7Z

Study Year	Education Term		Graduation product designation	Study Load in Credits
3	Term 4		No	4
Examination Name and Code	**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Mobile Development 2, 3713MBDV2A/3715ERAS7A	Written	No	Grade (10-100)	100%
Content of Unit of Study	The role of mobile computing devices in modern society can hardly be underestimated. In the Netherlands, about 30 percent of the families has one or more tablets. About sixty percent of the Dutch owns and uses a smartphone. This means the role of computing is changing drastically; information technology has become something you have in your pocket and use for things undreamt of twenty years ago. For professionals in Mathematical Engineering or Information Technology this means they have to have some skills in developing applications for these mobile devices. The kind of applications will differ widely, but the basics are the same. During this course, students will learn how to write applications for the Android platform. At the end, they will have written a full-fledged application which uses the hardware available.			
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation			
Competencies	Analyze, Design, Realize and Research			
Condition(s) for Participation	None, but students are expected to have the knowledge and skills of *Mobile Development 1, 3713MBDV1A*			
Other details	None			
Examination criteria	After successfully completing this module, the student is able to: Research the market and come up with an idea for a new mobile application Take an idea for a mobile application and translate this into a high-level design Develop the architecture of an Android application Implement the mobile application using a variety of tools Search and find resources to improve the application beyond the already known			
Details on examination formats	This module will be examined by a practical exam. During the first term of the course, each student designs an Android application at a very high level (wireframes etc.) This design is evaluated by the teacher. After approval, the exam consists of creating this application during the second term, using the techniques learned during the first term. The application should use at least some of the specialized hardware available in a mobile device, such as GPS, gyroscope or camera.			

	The deadline for the assignment is the Friday of the second exam week of the second term during which the course was taught. The deadline for the resit is the Friday of the second exam week of the exam Term after this. Handing in after the deadline is an automatic fail of the assignment, with no feedback given.	
Instructional formats and education activities	This course is split over two terms, with the examination being in the second term. During the first term, class will start with a presentation on the subjects of that day. After that, the teacher will write a short demonstration application, using the ideas and input from the students attending. The main idea here is to explore the possibilities of the technology, so this part of the lesson will have little preparation from the teacher. When this explorative phase is finished, students will work on assignments given, finishing them between classes. Also during the first term, students have to come up with an idea for a mobile application they would like to build themselves. They set up the rough idea by drawing some wireframes and describing the functionality envisioned in a few paragraphs. The final idea has to be approved by the teacher. During the second term, classes only consist of working on the application with the teacher being available for consultancy. The final result is a mobile app using the hardware of the mobile device.	
Contact hours for instructional formats and education activities	31	31 (first term), 31 (second term)
Compulsory attendance		No
Aids permitted	N/A	

Year 4

Term 1

Advanced Data Disclosure - 3712IT411Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 1	Data		No	5
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Advanced Data Disclosure, 3712IT411A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	As discussed in the courses on relational databases, these databases form an effective solution for storing and retrieving structured data. Unfortunately, a large part of the data that is nowadays available is not structured, but comes in the form of text (unstructured data) or XML-documents (semi-structured data). For these types of data different solutions are necessary. The first part of this course treats so called NoSQL databases. These advanced databases can be used to disclose semi-structured data. The second part of the course focusses on information retrieval (IR) as a means for retrieving text documents. The course builds upon the databases courses and the courses on algorithms and data structures. Programming skills are needed for the assignments.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, Design				
Condition(s) for Participation	Non, but students are expected to have a good knowledge of SQL and databases and programming.				
Other details	None				
Examination criteria	choose a suitable data storage and retrieval method for a real-world problem; explain the various ways to distribute databases; write queries for NoSQL databases; explain the working of various components of an information retrieval system; implement a small-scale information search engine; explain algorithms for link analysis;				
Details on examination formats	The assignment must be sufficient to pass the course. The grade is determined by the exam consisting of open question.				
Instructional formats and education activities	Instructions and hands-on exercises				
Contact hours for instructional formats and education activities	24				
Compulsory attendance	No				
Aids permitted	None				

Distributed Systems and Parallel Computing - 3712IT412Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 1	Data		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Distributed Systems and Parallel Computing, 3712IT412A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	As our machines get more and more cores, understanding concurrency is more important than ever before. Amdahl's law is gaining importance over Moore's law, and the focus is shifting from object-oriented programming towards concurrency-oriented programming. Every working programmer must learn to think about concurrency, parallelism and distributed systems. This course taps in the vast field out there and covers a wide range of concurrency models. Some classics like Threads and Locks, functional programming, agent/actor based frameworks will be discussed. Also some new paradigms like Data Parallelism and Lambda architecture will get attention.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyse, Design, Realise				
Condition(s) for Participation	None, but students are expected to the knowledge and skills of *Object Oriented Programming 2, 3713IT213A*				
Other details	None				
Examination criteria	(technology) portfolio on parallel computing				
Details on examination formats	A student will create a (technology) portfolio that documents case studies on parallel computing they worked on.				
Instructional formats and education activities	Class will be a mix of theory and practice. In the theoretical part, students learn the ideas behind important concurrency models. In the practical component students learn to design and solve concurrency problems				
Contact hours for instructional formats and education activities	24				
Compulsory attendance	No				
Aids permitted	Laptop recommended				

Advanced Java Programming - 3711IT425Z

Study Year	Education Term	Name of Examination Component	Graduation product designation	Study Load in Credits
4	Term 1	Software Engineering	No	5

Examination Name and Code	Examination Format	Examination session	Examination Scale	Weighting Factor
Advanced Java Programming, 3711IT425A	Other Method	No	Grade (10-100)	100%

Content of Unit of Study		
Stage in the Bachelor programme		
Competencies		
Condition(s) for Participation		
Other details		
Examination criteria		
Details on examination formats		
Instructional formats and education activities		
Contact hours for instructional formats and education activities		
Compulsory attendance		
Aids permitted		

Research 4 - 3711IT422Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 1	Research		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Research 4, 3711IT422A		Other Method	No	Grade (10-100)	100%

Content of Unit of Study	In the research courses the student develops the soft skills needed for successfully conducting applied research projects during their studies and in their professional life. The focus of this course is literature study. Students learn how to find land apply literature in a structured way during the various phases of the research cycle.	
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation	
Competencies	Research	
Condition(s) for Participation	None	
Other details	None	
Examination criteria	The student can: find high quality literature on a research topic; assess the quality of literature; independently conduct a literature study; write a short thesis about a literature study.	
Details on examination formats	The grade will be based on the quality of the research paper and presentation.	
Instructional formats and education activities	Instructions and working on individual assignment.	
Contact hours for instructional formats and education activities	17	
Compulsory attendance	No	
Aids permitted	All	

Term 2

Project Big Data - 3711IT421Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 2	Data		No	5
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Project Big Data, 3711IT421A		Other Method	No	Grade (10-100)	100%
Content of Unit of Study	Huge amounts of data are being collected by companies, governments, and individuals alike. Within these data a wealth of information is hidden, that has the potential to improve both business and quality of life. However, uncovering this information is like finding the proverbial needle in the data haystack. In this projects students are faced with a real-life data set and are challenged to store, transform, mine, and interpret it until it reveals its true potential.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, design, research, and professionalize				
Condition(s) for Participation	None , but students are expected to have a good programming and big data knowledge.				
Other details	None				
Examination criteria	The student can: manage and store large amounts of data in a such a way that it becomes ready for analysis; model a real-world problem as a big data task; handle software needed to analyze data; determine relevant data preprocessing techniques; apply data preprocessing techniques; integrate multiple data sources; determine relevant data mining techniques; apply data mining techniques; draw conclusions from results of data analysis; find relevant literature and use the literature during a project; professionally report on a big data project; integrate multiple techniques into a solution for a big data problem; identify ethical aspects of a big data project; work according to a project plan; perform managing tasks within a project group; communicate effectively and efficiently with all parties involved; divide work within a project team; effectively collaborate in a project team; write a well-structured report about a project; critically reflect on the effectively of the chosen methods.				
Details on examination formats	The grade will be based on the quality of the research and the report, and the individual performance of the student.				

Instructional formats and education activities	Instructions and group work.	
Contact hours for instructional formats and education activities	32	
Compulsory attendance	Yes	Assessment is partly based on active participation in the project and during the project meetings. In case of insufficient participation the project can be resit in the next academic year.
Aids permitted	All	

Data Warehousing and Business Intelligence - 3712IT422Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 2	Data		No	2
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Data Warehousing and Business Intelligence, 3712IT422A		Written	No	Grade (10-100)	100%
Content of Unit of Study	A data warehouse is a collection of technologies aimed at enabling executives, managers or business analysts to make better and faster decisions. The right information in the right place at the right time with the right cost in order to support the right decision. This course will not only focus on this classical after-the fact business intelligence, but also on new models of business intelligence. Being the conceptual backbone of business intelligence, the analysis and design of data warehouses will be discussed. Different architectural solutions and connected components and modelling techniques will be discussed. Furthermore industry examples will be demonstrated and the applicability of dimensional modelling in industry best practices.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze, design, realize and research				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Fundamental Concepts of BI Data quality and visualisation Market Basket Analysis and Datamining Data warehouse architecture Relational & Multidimensional design ETL techniques Data visualisation Industry focus				
Details on examination formats	In a group you will work on a industry-topic of interest, perform additional research, build cube(s) for a business area and share your findings.				
Instructional formats and education activities	Class will be a mix of theory and practice. In the theoretical part, students learn the ideas behind important concepts. In the practical component students learn to solve problems.				
Contact hours for instructional formats and education activities	24				
Compulsory attendance	No				
Aids permitted	All available relevant sources				

Data Mining & Analysis - 3711IT411Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 2	Data		No	4
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Data Mining & Analysis, 3711IT411A		Written	Yes	Grade (10-100)	100%

Content of Unit of Study	Companies use data about their customers to predict how changes in prices will affect what customers buy. Meteorologists use data collected by weather stations and satellites to forecast tomorrow's weather. Police officers need to determine whether signatures are genuine. Network Administrators must recognize malicious actions between all the traffic on a network. In all these examples the key is Data Analysis and Mining. Data mining is defined as the process of discovering patterns in data, lots of data. This course treats a wide variety of data analysis and data mining techniques, such as regression, dimension reduction methods, decision trees, clustering methods, Bayesian models, and instance-based learning. We treat the practical application of the techniques as well as the theories behind them. Especially the interpretation and evaluation of discovered structural patterns require theoretical analysis and qualification. To be applicable in any realistic setting data analysis and mining must be done automatically. In the course students get acquainted with two software packages: SPSS for statistical data analysis and Weka for data mining. When gigabytes become petabytes, data becomes Big Data. Big Data cannot be analyzed in reasonable time on a single machine. To deal with Big Data parallelization is needed. This course touches upon the fundamental parallelization techniques needed for handling Big Data. To understand data mining algorithms and evaluation techniques, it is necessary to master the concepts treated in the course statistics. Furthermore the course builds upon techniques from the database courses and the course on data warehousing and business intelligence. This course prepares for Project Big Data in the next Term.
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation
Competencies	Analyze and design
Condition(s) for Participation	None
Other details	None
Examination criteria	The student can: explain the goals of data mining; explain the different data mining tasks; explain the main five steps of the data mining process; convert a real-world problem into a data analysis or mining task; choose an appropriate data mining method for a real-world problem; independently explore a data set; by means of statistical or data mining software preprocess a real-world data set to prepare it for data analysis and mining;

	explain the working, advantages, and disadvantages of a number of prediction, classification, and clustering algorithms; manually apply a number of prediction, classification, and clustering algorithms to a small example data set; apply a number of prediction, classification, and clustering algorithms to a realistic data set by means of data mining software; set-up and conduct a data mining experiment; interpret the results of a data mining experiment;	
Details on examination formats	The exam consists of open questions.	
Instructional formats and education activities	Instructions and lab sessions.	
Contact hours for instructional formats and education activities	31	
Compulsory attendance	No	
Aids permitted	Calculator	

Cryptography - 3711IT423Z

Study Year	Education Term	Name of Examination Component		Graduation product designation	Study Load in Credits
4	Term 2	Mathematics		No	3
Examination Name and Code		**Examination Format**	**Examination session**	**Examination Scale**	**Weighting Factor**
Cryptography, 3711IT423A		Written	Yes	Grade (10-100)	100%
Content of Unit of Study	Cryptography can be considered as part of Information Security. Cryptography can be found everywhere: Web browsers, on-line banking, wireless lan's, e-mail programs, cell phones, bank cards, RFID tags etc. Individual users, businesses and organizations worldwide can only communicate in a secure way over open (= unsafe) networks if cryptographic tools are used. Encryption, digital signatures, password-based authentication, are some of the basic cryptographic techniques to achieve secure communication and to prevent hackers and attackers to break into computer systems, steal information, change data etc. Cryptography plays an important role in the defense against such attacks, and that's why this course deals almost exclusively with studying cryptography and the underlying mathematics.				
Stage in the Bachelor programme	In possession of the skills necessary for professionalisation				
Competencies	Analyze and Design				
Condition(s) for Participation	None				
Other details	None				
Examination criteria	Ciphers, Mathematical theory for Cryptography				
Details on examination formats	Written Exam				
Instructional formats and education activities	Lectures				
Contact hours for instructional formats and education activities	31				
Compulsory attendance	No				
Aids permitted	None				