

## Discrete Mathematics II (E001470)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

<b>Course size</b>	<i>(nominal values; actual values may depend on programme)</i>		
<b>Credits</b> 6.0	<b>Study time</b> 180 h	<b>Contact hrs</b>	60.0 h

### Course offerings and teaching methods in academic year 2020-2021

A (semester 2)	Dutch	Gent	lecture	30.0 h
			seminar: coached exercises	30.0 h

### Lecturers in academic year 2020-2021

Walraevens, Joris	TW07	lecturer-in-charge
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### Offered in the following programmes in 2020-2021

	crdts	offering
<a href="#">Bachelor of Science in Engineering (main subject Computer Science Engineering)</a>	6	A
<a href="#">Bachelor of Science in Computer Science Engineering</a>	6	A
<a href="#">Bridging Programme Master of Science in Bioinformatics (main subject Engineering)</a>	6	A
<a href="#">Bridging Programme Master of Science in Computer Science Engineering</a>	6	A
<a href="#">Bridging Programme Master of Science in Computer Science Engineering</a>	6	A

### Teaching languages

Dutch

### Keywords

Algebraic structures, polynomials and rational expressions, finite fields, generating functions, matching problems

### Position of the course

This course introduces a number of advanced topics from discrete mathematics. It builds upon mathematical courses of the first three semesters in the bachelor program of engineering (predominantly on Discrete mathematics I) and serves as a useful preparation to more applied courses in the bachelor and the master of computer science engineering and the master of electrical engineering (Algorithms and data structures, Automata, Compilers, Information theory, Queueing theory)

### Contents

- Chapter 1: Introduction to algebraic structures: groups, rings, integral domains, fields, polynomial rings, congruence
- Chapter 2: Polynomials and rational expressions: polynomials with coefficients in a field, division with remainder, divisibility, greatest common divisor, factorization into irreducible polynomials, congruence modulo an irreducible polynomial, zeroes, derivatives, construction of rational expressions, partial fractions, rational expressions with real or complex coefficients
- Chapter 3: Finite fields - Galois fields: definition, basic properties, prime fields and extension fields, existence and uniqueness, construction of finite fields, properties of the multiplicative group, logarithm table
- Chapter 4: Generating functions: formal power series, derivatives, Newton's binomial, ordinary and exponential generating functions, arithmetic rules, convergence of power series, inversion, rational generating functions, tail approximation, dominant singularity, applications (Catalan numbers, Bell numbers, Stirling numbers, ...)
- Chapter 5: Discrete optimization: general aim, matching problems, scheduling problems, Hungarian algorithm

### Initial competences

This course builds on certain learning outcomes of course units 'Discrete mathematics I' and 'Geometry and linear algebra'.

### **Final competences**

- 1 To have insight in algebraic structures and their properties
- 2 To be familiar with polynomials and rational expressions with coefficients in a (finite) field and with real coefficients
- 3 To construct and connect the different representations of finite fields and to understand the specific properties of finite fields
- 4 To transform relations between sequences of numbers to generating functions and vice versa
- 5 Solve combinatorial problems
- 6 Recognize and solve simple matching problems

### **Conditions for credit contract**

Access to this course unit via a credit contract is determined after successful competences assessment

### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

### **Teaching methods**

Lecture, seminar: coached exercises

### **Learning materials and price**

Syllabus

### **References**

- J.H. van Lint, J.W. Nienhuys: 'Discrete Wiskunde', Academic Service, 1991 (ISBN: 90-6233-368-0)
- V. Shoup, A Computational Introduction to Number Theory and Algebra, Cambridge University Press, 2005
- H.S. Wilf, Generatingfunctionology, A K Peters, Ltd., 2006

### **Course content-related study coaching**

By the lecturer and the assistants: contact is possible during and after classroom lectures and classroom problem solving sessions.

### **Evaluation methods**

end-of-term evaluation

### **Examination methods in case of periodic evaluation during the first examination period**

Written examination with open questions, open book examination

### **Examination methods in case of periodic evaluation during the second examination period**

Written examination with open questions, open book examination

### **Examination methods in case of permanent evaluation**

### **Possibilities of retake in case of permanent evaluation**

not applicable

### **Calculation of the examination mark**