

## Antennas and Propagation (E022230)

**Course size** *(nominal values; actual values may depend on programme)*

**Credits 6.0**

**Study time 180 h**

**Course offerings and teaching methods in academic year 2023-2024**

|                |         |      |                            |       |
|----------------|---------|------|----------------------------|-------|
| A (semester 1) | English | Gent | lecture                    |       |
|                |         |      | practical                  |       |
|                |         |      | seminar                    |       |
|                |         |      | independent work           | 0.0h  |
| B (semester 1) | Dutch   | Gent | seminar: coached exercises | 7.5h  |
|                |         |      | guided self-study          | 37.5h |
|                |         |      | lecture                    | 0.0h  |
|                |         |      | practicum                  | 2.5h  |
|                |         |      | project                    | 20.0h |

**Lecturers in academic year 2023-2024**

Rogier, Hendrik

TW05

lecturer-in-charge

**Offered in the following programmes in 2023-2024**

|  | <b>crdts</b> | <b>offering</b> |
|--|--------------|-----------------|
| Bridging Programme Master of Science in Electrical Engineering(main subject Communication and Information Technology ) | 6            | A               |
| Bridging Programme Master of Science in Electrical Engineering(main subject Electronic Circuits and Systems )          | 6            | A               |
| Master of Science in Electrical Engineering (main subject Communication and Information Technology )                   | 6            | A               |
| Master of Science in Electromechanical Engineering(main subject Control Engineering and Automation)                    | 6            | A               |
| Master of Science in Electromechanical Engineering(main subject Electrical Power Engineering)                          | 6            | A               |
| Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)                             | 6            | A               |
| Master of Science in Electromechanical Engineering(main subject Maritime Engineering)                                  | 6            | A               |
| Master of Science in Electromechanical Engineering(main subject Mechanical Construction)                               | 6            | A               |
| Master of Science in Electromechanical Engineering(main subject Mechanical Energy Engineering)                         | 6            | A               |
| European Master of Science in Nuclear Fusion and Engineering Physics   | 6            | A               |
| Master of Science in Electrical Engineering  | 6            | B               |
| Master of Science in Photonics Engineering   | 6            | A               |

**Teaching languages**

English, Dutch

**Keywords**

antennas, radiowave propagation, smart antenna systems

**Position of the course**

This course provides an in-depth treatment of the physics of wireless interconnections, indoor and outdoor radiowave propagation and antennas. Special attention is devoted to mobile communication channels, antenna arrays and smart antenna systems.

**Contents**

- Chapter 1: Antennas

- Chapter 2: Radiowave propagation
- Chapter 3: Antenna arrays
- Chapter 4: Multibeam and adaptive antennas

### **Initial competences**

Having successfully completed the courses on "Applied Electromagnetics" and "Probability and Statistics", or having acquired the final competences provided by these courses in any other way.

### **Final competences**

- 1 Computer-aided design antennas based on the Friis formula
- 2 Analyse full-wave problems based on the integral equation solved by the method of moments
- 3 Have insight into the radiation mechanisms of wire antennas, horn antennas, planar antennas and reflector antennas
- 4 Have insight into radiowave propagation in mobile communications systems, distinguish between path loss, shadowing, and fading, including frequency-selective fading
- 5 Have insight into the radiation mechanisms of antenna arrays, including mutual coupling and phased arrays
- 6 Mitigate fading by means of diversity, including polarisation diversity
- 7 Have insight into intelligent antenna systems, multiple input multiple output systems and beam steering

### **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**

Seminar, Lecture, Practical, Independent work

### **Extra information on the teaching methods**

Classroom lectures; Classroom problem solving sessions; Flipped classroom with online contact sessions; Project: Computer-aided design of antennas; Lab on antenna measurements

### **Learning materials and price**

course notes (10EUR in print, free electronic version on UFora), english

### **References**

C. A. Balanis, *Antenna Theory: Analysis and Design*, 3rd Edition, ISBN: 978-0-471-66782-7, John Wiley & Sons, Inc., Hoboken NJ, USA, May 2005.  
 Janaswamy, Ramakrishna, *Radiowave propagation and smart antennas for wireless communications*, Boston : Kluwer Academic Publishers, 2001. ISBN: 0-7923-7241-7  
 Location: TBBS.BESTELD

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

### **Assessment moments**

end-of-term and continuous assessment

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

Oral assessment open-book, Written assessment open-book

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

Oral assessment open-book, Written assessment open-book

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

Skills test, Assignment

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

examination during the second examination period is possible in modified form

### **Extra information on the examination methods**

During examination period: oral open-book assessment; written open-book assessment - problems  
 During semester: graded project reports; graded lab sessions. Second chance: Possible in adapted form

### Calculation of the examination mark

Evaluation throughout semester as well as during examination period. Special conditions: 1/3 theory (oral exam - use of course material allowed) + 1/3 exercises (in writing - use of course material allowed) + 1/3 project project and lab reports.

Students who eschew one or more parts of the assessment (part theory, part exercises and part project/lab) cannot obtain a pass mark for the course unit. Should the final mark be higher than 7/20, it will be reduced to the highest non-passable mark (i.e. 7/20). When the student obtains less than 8/20 for at least one of the components (part theory, part exercises and part project/lab), they can no longer pass the course unit as a whole. If the total score does turn out to be a mark of ten or more out of twenty, this is reduced to the highest fail mark (9/20).