

Microwave Engineering and Antennas.

Subject area: Electrical Engineering

University:	TU/e
Level:	MA all years
Teaching mode:	hybrid: some students participate online, other students attend real-life
Instructor(s):	Dr. U. Johanssen, Prof. dr.ir. A.B. Smolders, Prof. dr. Ir. D. Leenaerts, Dr. Elmine Meyer, G. Federico, G. Theis

Short description

Within the domain of electrical engineering there is a growing interest in microwave engineering and antenna systems. One of the key application domains is 5G wireless communications, which will operate at much higher frequencies (30 GHz) as compared to existing 3G/4G networks. In depth know-how of microwave engineering and antennas is required for future specialists in this application domain.

Full description

Together with industry we work on the following contents:

General introduction to the world of microwave and antennas

Transmission line theory and passive and active microwave circuits

- Review of transmission line theory (short summary of Bachelor course CWT)
- Lossy transmission lines and Field analysis
- Microwave networks
- Wilkinson Power Combiners
- Impedance matching and tuning
- Microwave filters
- Low-noise amplifiers
- Power amplifiers

Antenna theory

- Radio and radar equations and related antenna parameters
- General solution Maxwell's equation in free space
- Thin-wire antennas
- Folded-dipole antenna
- Loop antenna
- Magnetic sources
- Lorentz-Lamor theorem (reciprocity)
- Horn antennas

- Reflector antennas (only uniform circular aperture)
- Numerical EM analysis of microwave circuits and antennas
- Method of Moments including use of ADS Momentum
 - FDTD/FIT including use of CST

Labs

- Hands-on introduction into ADS/QUCS (microwave/RF design tool)
- Hands-on introduction into CST (antenna design tool)

Design Challenge: Design of a 5G phased-array system.

Learning outcomes

Introduction in Microwave engineering, including passive components and active circuits (amplifiers).

Introduction into antenna systems

Hands-on labs in design tools (ADS/QUCS)

Design Challenge

General information

Contact hours per week: 4

Total workload: 140 (in student hours for the whole course)

ECTS credits: 5

Language: English

Course start date: 14 November 2022

Course end date: 19 January 2023

Add. info about start date:

Weekly teaching day/time: Tuesday 15.30-17.15 hours and Thursday 10.45-12.30 hours

Time zone: CET (Denmark, Germany, France, Netherlands, Switzerland, Czech Republic)

Further information: "We will use the Coursera platform for web lectures and on-line quizzes.
Course material:

"Modern Antennas and Microwave Engineering" by Bart Smolders, Huib Visser and Ulf Johannsen: <https://arxiv.org/abs/1911.08484>"

Prerequisites: Bachelor courses in Circuits/Electromagnetics

Activities and methods: Lectures, Online Lectures, online quizzes, assignments,

Presence on campus:

Final examination

Form: oral

Date:

Location/format:

Re-sit possibility: yes

Transcript available:

Add. info/requirements: The final grade is based on the weighted average of the results of a written final test (50%), assignments (30%) and quizzes (20%). To pass the exam, the written final test must be graded with at least a 5,0 and the weighted average must be at least 6,0.

Registration

To register for this course, follow the registration requirements of your **home university** as specified here: www.euroteq.eu/courses-registration.

Administration

Number of places: unlimited

Minimum participants:

Internal course code: 5SPB0

Contact: Dr. U. Johanssen and Prof. dr.ir. A.B. Smolders (a.b.smolders@tue.nl)

This course is part of the EuroTeQ Engineering University joint course catalogue 2022/2023. This is a collaborative activity of the partner universities DTU, L'X, TU/e, TalTech, CTU, TUM as well as Technion. Students from these universities can participate in the offered courses. It is the responsibility of the student to check if you fulfil the requirements to participate in a specific course. Students are also advised to check with their home institution how to get recognition of the ECTS credits gained in courses of the EuroTeQ course catalogue. For further information about EuroTeQ Engineering University, visit www.euroteq.eu or get in touch with the above-mentioned point of contact.