Microwave Engineering

Programme course

6 credits

Mikrovågsteknik

TNE071

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Electronics Design Engineering, M Sc in Engineering
- Communication Systems, Master's programme
- Electronics Engineering, Master's programme
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Electromagnetism, RF Electronics, RF System Design

Intended learning outcomes

The aim of the course is to provide a through coverage of fundamental principles of microwave engineering with focus on wireless communication system and high-speed data transmission. Besides enhancing general radio frequency circuit theory covered in previous courses, it introduces the fundamental of microwave circuit analysis and design, from electromagnetic theory to radar systems. Starting with a concise presentation of the electromagnetic theory, the course leads to passive and active microwave circuit design supported by complex Electronic Design Automation (EDA) software for high-frequency systems. After passing the course the student should know:

- Maxwell's and Helmholtz's equations, wave solutions, TEM, TE and TM wave propagation modes, and account for the relevant propagation modes for transmission lines
- Describe the concept of plane waves in different transmission media, polarized plane waves and plane wave reflection in mathematical form
- Compare the electromagnetic theory with transmission line theory in order to describe transmission lines from the point of view of either field theory or the circuit model
- Calculate the characteristic parameters of a rectangular waveguide
- Use Smith Chart to design matching networks
- Understand different concepts of impedance matching, i.e., narrow- and broadband impedance matching
- Describe, analyse and design basic passive and active microwave circuits such as couplers, amplifiers, mixers, oscillators
- Describe, analyse on system level different radarsystem, e.g., Doppler radar.
- Use radar equation, understand radar parameters and describe different modern radar applications.
- Carry out the design of microwave circuits using advanced simulation tools, including electromagnetic simulations

Course content

Electromagnetic theory, transmission line theory, transmission lines and waveguides, impedance matching and tuning, microwave resonators, power dividers and couplers, microwave oscillators and frequency multipliers, radar and radiometer systems.

Teaching and working methods

Lectures, classes and laboratory exercises. Laboratory sessions are compulsory. Written laboratory work in form of an unitary project report.

Examination

LAB1	Laboratory work with oral and written presentation	1.5 credits	U, G
TEN1	Written examination	4.5 credits	U, 3, 4, 5

Grades
Four-grade scale, LiU, U, 3, 4, 5

Department
Institutionen för teknik och naturvetenskap

Director of Studies or equivalent
Adriana Serban

Examiner
Adriana Serban

Course website and other links
http://www2.itn.liu.se/utbildning/kurs/

Education components
Preliminary scheduled hours: 50 h
Recommended self-study hours: 110 h

Course literature
David M. Pozar, Microwave Engineering, Wiley & Sons 2005, ISBN 0-471-44878-8.
Vetenskapliga artiklar används också som kurslitteratur för att aktualisera kursensinnehåll och sprida forskningsresultst.

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.