IL2243 Design of radio frequency integrated circuits 7.5 credits

Design av radiofrekvensintegrerade kretsar

This is a translation of the Swedish, legally binding, course syllabus.

Establishment

The official course syllabus is valid from the autumn semester 2025 according to the decision by the Faculty Board: J-2024-2268. Date of decision: 2024-11-12

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge of Introduction to Integrated Circuits covering 7.5 higher education credits, equivalent to the completed course IL2241.

Knowledge of analog integrated circuits covering 3 higher education credits, corresponding to the completed course IL2242 or the completed module LAB1 in IL2242.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After passing the course, the student should be able to:

- describe how transceiver architectures are built and explain their advantages and limitations
- describe the modelling of active and passive integrated components at radio frequencies (RF) and the influence of parasitic electrical components
- describe performance measures of RF blocks, such as noise figure, third order intercept (IP3), gain, bandwidth and phase noise
- given a set of specifications, compare different circuit topologies for RF blocks and select a suitable topology for implementation
- analyse basic RF blocks, dimension active and passive components, and design bias point setting circuits
- discuss modern trends in RF design such as MIMO and beamforming, direct RF sampling, envelope tracking and digitally assisted RF circuits
- use Electronic Design Automation (EDA) tools to design and verify RF blocks.

Course contents

This course is an introduction to radio frequency integrated circuits and systems. Firstly, basic concepts of RF design and wireless communication are covered. Then, the course introduces transceiver architectures and their building blocks: low noise amplifier, mixer, oscillator, phase locked loops and power amplifier. The implementation of each building block in modern CMOS processes is studied in detail. Finally, current trends in RF design are described including MIMO and beamforming, direct RF sampling, envelope tracking and digitally assisted RF circuits. The course includes practical design of RF blocks from specification to physical verification using the latest EDA tools.

Examination

- LAB1 - Laboratory Work, 3.0 credits, grading scale: P, F
- TENS - Written Exam, 4.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

If the course is discontinued, students may request to be examined during the following two academic years.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.