EQ2860 Theoretical Foundations of Wireless Communications 7.5 credits

Teoretiska grunder för trådlös kommunikation

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

Establishment

The official course syllabus is valid from the spring semester 2026 as decided by the director of first and second cycle education: HS-2025-1825. Date of decision: 2025-10.14

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge in digital communication, 9 credits, equivalent to completed course EQ2310.

Knowledge in advanced digital communication, 4.5 credits, equivalent to completed course EQ2411 or completed parts HEM1 and HEM3 in EQ2411.

Intended learning outcomes

After the course, the student should be able to

- identify and describe fundamental limits for wireless communication in terms of objective analytical measures such as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency
- identify and describe physical phenomena that limit the performance of wireless communications
- identify and describe modern methods for high-speed wireless communication such as MIMO, resource allocation and coordination of users, power allocation and speed allocation
- apply mathematical methods to analyze and synthesize wireless communication links with one and multiple users
- solve mathematical problems that arise when analyzing fundamental limits for wireless communication.

To achieve higher grades, the student must also be able to

- apply objective analytical measures such as channel capacity, outage probability, error probability, degrees of freedom, diversity, power efficiency and bandwidth efficiency to compare different methods and analyze their performance for different applications
- derive, formulate and apply advanced mathematical methods to analyze and synthesize wireless communication links with one and multiple users
- solve advanced mathematical problems that arise when analyzing fundamental limits for wireless communication.

Course contents

The course covers the theoretical foundations of wireless communication, which are based on fundamental principles from information theory, communication theory, detection and estimation, and signal processing. The course covers, among other things,

- capacity of wireless channels
- multiuser capacity and opportunistic communication
- MIMO I: spatial multiplexing and channel modeling
- MIMO II: capacity and multiplexing architectures
- MIMO III: diversity-multiplexing tradeoff and universal space-time codes
- MIMO IV: multiuser communication

The three main topics are: 1) channel capacity and information theory for wireless channels; 2) multi-antenna transmissions; 3) multi-user communications.

Examination

- INLA - Home Assignment, 7.5 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.