



EI2400 Applied Antenna Theory

7.5 credits

Tillämpad antennteknik

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

Establishment

Course syllabus for EI2400 valid from Spring 2018

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

150 university credits (hp) in engineering or natural sciences including 10 hp electromagnetic theory and documented proficiency in English corresponding to English B.

Language of instruction

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

Intended learning outcomes

Applied Antenna Theory is a course where theory is implemented to practice. As a student, you will learn how to classify, design, build, and measure antennas.

Students should, at the end of the course, be able to:

- Explain the operation of a given antenna based on its geometry; and describe its expected performance in terms of radiation pattern, efficiency, bandwidth, and polarization.
- Define the required specifications of an antenna for a given application.
- Judge, by using physical constraints, if an antenna can fulfil some given specifications.
- Design an antenna for some given feasible and realistic specifications.
- Simulate, evaluate the performance and design antennas using commercial software: CST Microwave Studio or HFSS.
- Measure the performance of an antenna by using standard microwave equipment. The equipment includes a vector network analyser, a spectrum analyser, a near-field scanner, a signal generator and an anechoic chamber.
- To find, understand and use relevant technical literature to solve antenna problems.

Course contents

The course includes a review of the main parameters that describe antennas. It continues with the mathematical description and experimental demonstration of the operation of the most commercially employed antennas. The list of antennas studied in the course includes classical and modern antennas:

- Dipole antennas.
- Loop antennas.
- Aperture antennas.
- Horn antennas.
- Arrays.
- Reflector antennas.
- Lens antennas.
- Leaky wave antennas.
- Frequency independent antennas.
- Periodic structures.
- Antennas based on gap waveguide technology.

This course includes a modern view of the physical operation of antennas.

Disposition

The course includes:

- 12 theory lectures of 2 hours each.
- 4 computers lab sessions of 2 hours each. These labs are carried out in pairs.
- 4 measurement lab sessions of 2 hours each. These labs are carried out in groups of 3-4 people each.
- A number of visits industrial facilities. Typically a visit to SAAB facilities of 3 hours, and a visit to Ericsson of 2 hours.

Finally, the students have free access to the ETK lab for the elaboration of the final project which consists of a design of antenna, manufacturing, and experimental validation.

Course literature

- John Daniel Kraus, Ronald J. Marhefka, “Antennas for all applications”, McGraw-Hill, 2002.
- Constantine A. Balanis, “Antenna Theory: Analysis and Design”, 4th Edition, Wiley, 2016.
- Robert E. Collin, “Antennas and radiowave propagation”, McGraw-Hill Higher Education, 1985.
- Per-Simon Kildal “Foundations of Antenna Engineering”, 2015.
- John Daniel Kraus, Ronald J. Marhefka, “Antennas for all applications”, McGraw-Hill, 2002.
- Constantine A. Balanis, “Antenna Theory: Analysis and Design”, 4th Edition, Wiley, 2016.
- Robert E. Collin, “Antennas and radiowave propagation”, McGraw-Hill Higher Education, 1985.
- Per-Simon Kildal “Foundations of Antenna Engineering”, 2015.

Equipment

During the course, the students will be able to use commercial full wave simulation software.

Additionally, the students will have access to the measurement equipment, including vector network analysers, a spectrum analyser, a near-field scanner, a signal generator and an anechoic chamber.

Examination

- PRO1 - Project, 4.0 credits, grading scale: A, B, C, D, E, FX, F
- LAB1 - Laboratory Work, 3.5 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.

The students will be evaluated with:

- The attendance and participation in the labs.
- The attendance and participation in the lectures.
- Delivered reports of the results obtained in the labs.
- Delivered reports of the homework specified during the lectures.
- Final oral exam.

Other requirements for final grade

To achieve a grade, the student must fulfil ALL of the requirements for each ILO for that grade.

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.