



EJ2312 Modulation of Power Electronic Converters 6.0 credits

Effektelektronisk modulation

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

Establishment

The official course syllabus is valid from the spring semester 2027 as decided by the faculty board: registration number HS-2026-0799. Decision date: 2026-04-21.

Grading scale

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

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Knowledge in power electronics, 6 credits, equivalent to completed course EJ2301.

At least one of the following:

- Knowledge in continuous-time signals and systems, 6 credits, equivalent to completed course EQ1110/HF1011/II1303/CM2013/SD2125.

- Knowledge in differential equations and transform methods, 6 credits, equivalent to completed course SF1523/SF1633/SF1682/SF1683.

Intended learning outcomes

After passing the course, the student shall be able to

- compute the harmonics resulting from different modulation schemes and its impact on different connected loads and sources
- solve problems related to the selection and adaptation of pulse-width modulation schemes to meet common performance criteria
- analyze modulation schemes using modern numeric computer tools and EMT simulators and explain their solutions.

Course contents

- Fourier series expansions to analyze arbitrary periodic signals in the frequency domain. Waveform symmetries to identify and characterize spectral components in periodic signals.
- Analysis of three-phase systems by symmetric components.
- Figures of merit to quantify the harmonic distortion of periodic signals.
- Carrier-based pulse width modulators (PWM) for single and polyphase voltage source converters.
- Fourier analysis of carrier PWM by double fourier series expansion.
- Simple space vector modulators.
- Selective harmonic elimination methods.
- Direct torque control systems (DTC).
- Multi-level power converter topologies.
- Multilevel modulation methods.

Examination

- LAB1 - Laboratory Work, 1.0 credits, grading scale: P, F
- PROA - Project, 1.0 credits, grading scale: P, F
- PROB - Project, 1.0 credits, grading scale: P, F
- TENA - Written Exam, 3.0 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.