T-406-RAS2 **HÖNNUN RÁSA (enska: CIRCUIT DESIGN)** **6 ECTS**

Year of study: Second year.
Semester: Spring. *Kennt í fyrsta sinn á vorönn 2021.*
Level of course: 2. Undergraduate (First cycle), intermediate.
Type of course: Core HÁV, RAV.
Prerequisites (mandatory): Circuit Analysis (T-306-RAS1), Mathematics III (T-301-MATH).
Schedule: Runs for 12 weeks – 6 teaching hours a week; 3 hours of lectures + 3 hours of problem solving per week + 3 lab sessions during the semester.
Supervising teacher: Slawomir Koziel.
Lecturer: Slawomir Koziel.

Learning outcome:

Upon successful completion of the course, the students should gain the following skills:

- Knowledge of fundamental concepts pertinent to frequency analysis (phasors, impedance, etc.);
- Understanding of circuit laws in the frequency domain;
- Understanding ideal operational amplifiers, basic types of non-idealities and how they affect op-amp circuits;
- Understanding the fundamentals of the frequency response in AC circuits, including resonance conditions. Ability to analyze the transfer function and use the Bode plots;
- Understanding of the Laplace and Fourier transform methods and how to apply it for electric circuit analysis;
- Understanding of the concept of the two-port network and capability to apply the various types of two-port network parameters for circuit analysis and design;
- Ability to build, simulate and measure simple electric circuits, including phase shifters, filters (passive and active) and simple oscillators;

Content:

- Phasors, impedance and admittance;
- Circuit laws in frequency domain;
- Ideal and non-ideal operational amplifiers;
- Sinusoidal steady-state analysis (mesh currents, node voltage analysis, superposition, source transformation, Thevenin's and Norton's theorems);
- Frequency response, transfer function, Bode plots, resonant circuits, frequency/magnitude scaling;
- Passive and active (active-RC, OTA-C) filters;
- Laplace transform: definition and properties;
- Application of Laplace transform to circuit analysis and design;
- Fourier transform: definition and properties;
- Applications of Fourier transform to circuit analysis;
- Two-port networks; the relationship between input and output currents and voltages, network parameters and various combinations of networks connections.

Reading material: Textbook: *Fundamentals of Electric Circuits*, C. K. Alexander and M. N. O. Sadiku, Mc Graw Hill, 6th edition, 2016 (Chapters: 14-19); Laboratory manuals; Assignment manuals.
Teaching and learning activities: Lectures for the presentation of the fundamentals and theory; Exercises (problem solving); Computer simulations exercises (NI Multisim); Group assignments; Individual homework assignments.
Assessment methods: Quizzes (short tests); Midterm exam; Assignments; homework problems and lab exercises; Final exam. In order to pass the course, the students need 50% or higher of the final exam grade and 50% or higher of the total grade.
Language of instruction: English.