Title: Digital Logic Design

Prerequisites: None

Specific learning goals: The course aims to provide students with the basic techniques on the analysis and design of digital systems combinational and sequential. These techniques are the basis of modern automatic synthesis tools for digital circuits design. The topics are addressed both in theoretical form and by means of examples and exercises.

Course Description:
ENUMERATION AND CODES: Introduction to number representation on an arbitrary basis. Binary coding in fixed point and operations. Introduction to the most common encodings: efficient codes, redundant and error correction codes.
BOOLEAN ALGEBRA: Introduction, boolean functions and simplification techniques, definition and application of symmetric functions.
COMBINATIONAL CIRCUITS: introduction, simplification of the circuits through decomposition techniques, multi-terminal circuits, analysis and synthesis of circuits with logic gates.
SEQUENTIAL CIRCUITS: Introduction to sequential machines and simplifications, The flip-flop. A general model for sequential circuits representation. Synchronous and asynchronous operation of the fundamental model. Timing problems and master-slave flip-flop.
ASYNCHRONOUS SEQUENTIAL CIRCUITS: Recognition of asynchronous circuits. The analysis. Multiple transitions, instability and race conditions. Synthesis of asynchronous sequential circuits. Determination of the primitive matrix of the sequences. Matrix of the minimum machine sequences. Code of the states. Analysis of the fundamental model flow table.Realization of the final circuit. Glitches in asynchronous sequential circuits. Hazards: static, dynamic, essential.
SYNCHRONOUS SEQUENTIAL CIRCUITS: Analysis of synchronous sequential circuits. Design procedure. Synthesis of the states. Circuits based of a finite memory. State optimization. Encoding and estimation of the excitation equations.