Course:

Introduction to digital circuits design in the CMOS Technology

Lecture: 20 h

Exercise: 10 h

The aim of the course is to familiarize students with MOSFET transistors and CMOS technology at a level that will allow you to the design of digital circuits and simple analog circuits.

During the classes, students will learn about the design of digital systems. They will design the digital watch with 7-segments displays.

To follow this course students should have a basic knowledge about semiconductor and Boolean algebra.

Lecture topics:

1. Transistors nMOSFET and pMOSFET, CMOS Technology: functionality, biasing and characteristics, topology. 2h
2. Basic analog MOSFET circuit: amplifier, active load, current mirror, source follower, current source, MOS as a switch element. 2h
3. Introduction to logic circuits: operators and theorems of Boolean algebra, minterms and maxterms, logic function expressions (algebraic, canonical, true table, Karnaughe matrix), gate symbols. -4h
4. Karnaugh matrix apply to digital circuit projects. 2h
5. Simple combinational circuit design: inverter, NAND, NOR, AND, OR, ExOR,Transmission gate. 2h
6. Advanced combinational circuit: multiplexer, demultiplexer, encoder, decoder, transcoder. 2h
7. Sequential circuits: latch, flip-flop, counters, registers. 4h
8. Counting circuits: adder, multiplier, comparator. 2h

Exercise topics:

1. Design of 7-segments display driver . 4 h
2. Design 4-bits counter and modulo n counters. 2h
3. Design watch with hours and minutes displays 4h
4. Extending of watch functionality: alarm clock, hour and minutes setting. 2h