Course syllabus

Digital IC-konstruktion
Digital IC-design

ETIN20, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED E
Date of Decision: 2023-04-11

General Information

Main field: Electronic Design.
Main field: Nanoscience.
Compulsory for: MSOC1
Elective for: D4, E4-fh, E4-is, F4, F4-fel, N4-hn
Language of instruction: The course will be given in English

Aim

Digital IC Design is one, out of 5, courses in digital VLSI design. The course aims to give a thorough understanding for digital integrated circuit design. Increasing complexity and high requirements on performance in form of throughput and low power consumption will increase the expectations from the hardware designer. To understand both the possibilities and the limitations is important for both full custom designers and high level designers. The course will focus on CMOS design.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe the parameters that affect the physical characteristics in the transistor or a digital circuit regarding area, power consumption and delays,
- be able to analyze digital circuits in CMOS technologies based on a given topology, a given function, a layout or a net of interconnecting wires,
- be able to describe how arithmetic and combinational blocks are designed, based on elementary functions as well as apply these blocs in sequential nets,
- be able to use basic tools for layout, schematics and simulation for digital ASIC-design.

Competences and skills
For a passing grade the student must

- from a given problem, be able to apply his or her knowledge to analyze, simulate and design digital circuits in a computer based environment.

Judgement and approach
For a passing grade the student must

- be able to communicate results from laboratory experiments orally,
- have acquired knowledge enough to be able to discuss ideas, problems and solutions with competent digital designers, and
- be able to sort out important information independently, from an extensive material, such as a textbook and a manual.

Contents

The course content includes the MOS transistor and its physical characteristics. Models for the function are derived. Special attention is paid on those parameters that we can modify as a circuit designer. A survey over different families for logical functions founded on MOS transistors is given. Sizing of those are an important part. Wire characteristics are taken into consideration. Both combinational and sequential design is important in the course. Performances such as power consumption, silicon area and speed, are analyzed in all parts of the course.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Laboratory work and written examination. A small project needs to be carried out an presented orally to get e better grade than "4"

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0118. **Name:** Examination.
Credits: 6. **Grading scale:** TH. **Assessment:** Approved on written examination. **Contents:** The whole course **Further information:** Grade 5 requires a project with oral presentation.
Code: 0218. **Name:** Laboratory Works.
Credits: 1,5. **Grading scale:** UG. **Assessment:** Approved on three laboratory works. **Contents:** The whole course

Admission

Assumed prior knowledge: EIT020/EITF65 Design of Digital Circuits and ESS010/EITA35/ETIA01 Electronics or ETE115/EITF90 Electromagnetics and Electronics.
The number of participants is limited to: No
The course overlaps following course/s: ETI130

Reading list

- Rabaey J M, Chandrakasan A, Nicolic B: Digital Integrated Circuits, A Design Perspective. Prentice Hall , ISBN: 9780130909961.
- Additional material will be found at the course home page http://bwrc.eecs.berkeley.edu/icbook/.

Contact and other information

Course coordinator: Joachim Rodrigues, joachim.rodrigues@eit.lth.se
Course homepage: http://www.eit.lth.se/course/etin20
Further information: The laboratory work is done in CADENCE / Linux environment. During the laboratory works students are expected to master the basic UNIX commands.