Digital Integrated Circuits

Programme course

6 credits

Digitala integrerade kretsar

TSTE86

Valid from: 2017 Spring semester

Determined by
Board of Studies for Electrical
Engineering, Physics and Mathematics

Date determined
2017-01-25

Main field of study
Computer Science and Engineering, Electrical Engineering

Course level
Second cycle

Advancement level
A1X

Course offered for
- Electronics Engineering, Master's Programme
- Computer Science and Engineering, M Sc in Engineering
- Industrial Engineering and Management - International, M Sc in Engineering
- Industrial Engineering and Management, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Computer Science, Master's programme

Entry requirements
Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

Prerequisites
Knowledge on basic electrical components like resistors, capacitors, inductors, and semiconductors. Ability to solve basic electrical, switching theory, and logical design problems.

Intended learning outcomes
The course aims at providing knowledge on the design of digital integrated circuits. After the course is completed the students should be able to perform the following:

- use methods and techniques for implementation and verification of circuits
- understand the possibilities and limitations of circuits in System-on-Chip design
- comprehend and apply electrical models of integrated components and interconnect
- estimate circuit performance.

Course content

The lectures, exercises, and laboratory work treat the following subjects:

- review of CMOS processes and semiconductor technology
- electrical and geometrical properties of the MOSFET
- modelling of wires and interconnect
- design of basic logic circuits, such as static and dynamic gates, latches and flip-flops
- digital circuit timing and clocking
- estimation of performance and power dissipation
- logic and arithmetic blocks, data paths, control units and memories
- I/O and chip packaging
- layout strategies and CAD tools
- overview of ASIC design flow from logic synthesis to layout
- overview of design verification including estimation, simulation and testing.

Teaching and working methods

The course consists of lectures, and in connection to those, exercises and laboratory work. The course is given in Ht1 and is completed within one study period.

Examination

LAB1	Laboratory Work	1.5 credits	U, G
TEN1	Written Examination	4.5 credits	U, 3, 4, 5

The examination problems test the student's comprehension of circuit structure and function, circuit design skill, and ability to analyse the circuit performance. Five homework problems are given during the course, which are awarded points in the written examination, if solved. Three laboratory work passes demonstrate and test CAD tools, circuit design, and physical hardware behaviour. The laboratory work is complete when all mandatory exercises are completed.

Grades

Four-grade scale, LiU, U, 3, 4, 5

Department

Institutionen för systemteknik

Director of Studies or equivalent

Tomas Svensson

Examiner

Mark Vesterbacka

Course website and other links

http://www.isy.liu.se/edu/kurs/TSTE86/

Education components

Preliminary scheduled hours: 60 h
Recommended self-study hours: 100 h

Course literature

Additional literature

Books

Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, (2003) *Digital Integrated Circuits* 2nd ed
ISBN: ISBN 0-13-120764-4

Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at http://styrdokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva.