The Hebrew University of Jerusalem

Syllabus

INTRODUCTION TO VLSI - 83413

Last update 10-09-2023

HU Credits: *4*

Degree/Cycle: *1st degree (Bachelor)*

Responsible Department: *Applied Physics*

Academic year: *0*

Semester: *1st Semester*

Teaching Languages: *Hebrew*

Campus: *E. Safra*

Course/Module Coordinator: *Mr. Daniel Adar*

Coordinator Email: *daniel.adar@mail.huji.ac.il*

Coordinator Office Hours: *Coordinate in advance*

Teaching Staff:

Mr. Adar Daniel,
Mr. Eran Maday

Course/Module description:

Basics in solid state physics, the CMOS IC Design Process, Analog Signal Processing, Semiconductor and Silicon overview

The MOSFET Transistor, Cases: Accumulation, Depletion and Strong Inversion, The Threshold voltage, IV Characteristic of MOSFET, MOSFET Operation in triode region, The Saturation region, CMOS Technology

SPICE Modeling of the MOSFET, Simple MOS Large-Signal Model, Small-Signal Model for the MOS transistor, CMOS Passive Components, Examples of MOS modeling using SPICE: IV, DC, AC and Transient Analysis

Inverter, CMOS Statics Circuits, Reading Logic Gates, Designing Logic Gates, Interconnects, Steering Logic, Flip Flop Design

MOS Switch, Active Resistor/Load, Currents Sinks and Sources, The Current Mirrors and Current Amplifiers, Current and Voltage References, Geometrical Consideration in CMOS Design
Layout of Simple Current Mirror

Basic CMOS Operational Amplifier, Characterizing the Op Amp, Operational Transconductance Amplifiers

Neurons-transistors interfacing, Biosensors based transistors

Course/Module aims:

See learning outcomes

Learning outcomes - On successful completion of this module, students should be able to:

Theoretical knowledge required for integrated circuit designer CMOS technology with practical application of knowledge with useful circuit design. Integral part of the course will be devoted to the purchase of practical experience in various circles planning processes (behavioral, schematic electrical and physical) working with a variety of design tools, simulation and verification of the design. Students recognize the properties considerations integrated circuit design and chip building blocks analogs and digital sub-systems used to construct useful as an operational amplifier analog.

Attendance requirements(%):
0

Teaching arrangement and method of instruction: Frontal lecture + Exercise

Course/Module Content:
Chapter 1. Introduction to Integrated Circuits
Chapter 2. MOS transistor and their layout
Chapter 3. MOS transistor models and advanced physical affects
Chapter 4. Interconnects and passive devices
Chapter 5. Memories elements, implantation, timing analysis and metastability
Chapter 6.
Building blocks for analog integrated circuits and their implementation
Chapter 7. Operational Amplifiers
Chapter 8. Using op-amp in LDO circuit

Required Reading:
NA

Additional Reading Material:
1. CMOS Analog Circuit Design by Phillip E. Allen , Douglas R. Holberg , Allen ,
2. Introduction to CMOS OP-AMPs and Comparators Roubik Gregorian
3. Design of Analog CMOS Integrated Circuits Behzad Razavi
4. CMOS Circuit Design, Layout, and Simulation, Second Edition by R. Jacob Baker
5. Phase-Locked Loops: Design, Simulation, and Applications by Roland E. Best
6. CMOS Mixed-Signal Circuit Design by R. Jacob Baker.
7. CMOS VLSI Design: A Circuits and Systems Perspective (3rd Edition) by Neil H.E. Weste , David Harris
8. IC Mask Design: Essential Layout Techniques by Christopher Saint, Judy Saint

Grading Scheme:
Written / Oral / Practical Exam 50 %
Essay / Project / Final Assignment / Home Exam / Referat 25 %
Submission assignments during the semester: Exercises / Essays / Audits / Reports / Forum / Simulation / others 25 %

Additional information:

NA