

COURSE	Name	: Semiconductor Devices and Integrated Circuits
	Code	: EE184541
	Credits	: 3
	Semester	: 5

Description of Course

This course develops the understanding of semiconductor devices and skills in integrated circuit (IC) design. The topics include theory of semiconductor materials, operating principles and fabrication of semiconductor devices, and the design of digital, analogue, and mixed signal IC, in CMOS (complementary metal-oxide semiconductor) technology. The first part of the course introduces fundamental theories and operating principles of semiconductor devices for various applications, as well as the fabrication process of semiconductor materials and integrated circuits. The second part of this course develops skills on IC design, covering schematic entry, simulation, and IC layout using computer aided design (CAD) tools.

Learning Outcomes

Knowledge

(P02) Mastering the concepts and principles of engineering, and implementing them in the form of procedures for analysis and design in power systems, control systems, multimedia telecommunications, or electronics.

Specific Skill

(KK04) Able to implement alternative solutions of engineering problems in power systems, control systems, multimedia telecommunications, or electronics by concerning in factors of economy, public health and safety, culture, social, and environment.

General Skill

(KU08) Able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently.

Attitude

(S09) Demonstrating attitude of responsibility on work in his/her field of expertise independently.

Course Learning Outcomes

Knowledge

Understanding the theory of semiconductor materials, various groups of semiconductor devices with their operating principles, semiconductor device and integrated circuits fabrication. Mastering analogue and digital integrated circuit design techniques in CMOS technology, from simulation stage to complete IC layout.

Specific Skill

Able to perform simulations of semiconductor device using computer software, design and simulation of analogue and digital CMOS circuits in SPICE, and able to implement CMOS IC layout using CAD tools.

General Skill

Understanding the theory of semiconductor materials, semiconductor devices and their operating principles, and semiconductor and IC fabrication technology.

Attitude

Showing responsibility in the field of expertise. Working together to be able to take full advantage of their potential.

Main Subjects

1. Model of atom, semiconductor materials, energy band, doping.
2. PN junction, diodes.
3. Bipolar transistors.
4. MOSFET, FinFET, silicon-on-insulator.
5. Optoelectronic devices, organic semiconductor, high-frequency devices, quantum effect devices, power electronic devices.
6. VLSI technology fabrication, IC design flow.
7. Principles of integrated circuit layout, IC design tools & verification.
8. Design of CMOS static logic circuits, sequential circuits, and standard-cell layout.
9. Design of analogue CMOS circuits, layout techniques.
10. Design of simple mixed signal CMOS circuit, including ADC and DAC.

Reference(s)

- [1] R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 2nd edition, IEEE Press, Wiley-Interscience, 2005, USA.
- [2] Adel Sedra, Kenneth Smith, "Microelectronic Circuits: Theory and Applications", 6th edition, Oxford University Press, 2011.
- [3] Ben Streeman, Sanjay Banerjee, "Solid State Electronic Devices", 6th edition, Pearson, 2006.

Prerequisite(s)

EE184306 Electronic Circuits
