

Mata Kuliah Course	Nama MK <i>Name</i>	Divais Semikonduktor & R.Terintegrasi : <i>Semiconductor Devices and Integrated Circuits</i>
	Kode MK <i>Code</i>	: EE184541
	Kredit <i>Credit</i>	: 4 sks
	Semester <i>Semester</i>	V (Wajib) : <i>V (Compulsory)</i>
	Beban Belajar <i>Workload</i>	Kuliah : 4 x 50 = 200 menit/minggu Latihan/tugas : 4 x 60 = 240 menit/minggu Belajar mandiri : 4 x 60 = 240 menit/minggu : <i>Lectures : 4 x 50 = 200 min/week</i> <i>Exercises/Assignments : 4 x 60 = 200 min/week</i> <i>Self learning : 4 x 60 = 240 min/week</i>
	Tingkatan <i>Module Level</i>	Sarjana (S1) : <i>Undergraduate</i>
	Penanggung Jawab <i>PIC</i>	: Astria Nur Irfansyah, ST, M.Eng
	Pengajar <i>Lecturer</i>	Ir. Gatot Kusrahardjo, MT : Dr. Ir. Suwadi, MT
	Bahasa <i>Language</i>	Bahasa Indonesia dan Bahasa Inggris : <i>Bahasa Indonesia and English</i>
	Persyaratan dan Peraturan <i>Requirement and Regulation</i>	Setiap mahasiswa harus menghadiri setidaknya 75% dari jumlah perkuliahan untuk dapat mengikuti ujian : <i>A student must have attended at least 75% of the lectures to sit in the exams</i>

Deskripsi Mata Kuliah

Description of Course

Mata kuliah ini membahas tentang teori bahan semikonduktor, prinsip kerja berbagai kelompok divais semikonduktor, fabrikasi divais semikonduktor, serta perancangan rangkaian terintegrasi analog, digital, dan mixed-signal dengan teknologi mikroelektronika CMOS (*complementary metal-oxide semiconductor*). Bagian pertama mata kuliah ini memperkenalkan teori dan prinsip kerja berbagai divais semikonduktor untuk berbagai jenis aplikasi, serta proses fabrikasinya. Bagian kedua mata kuliah ini menekankan pada aspek perancangan integrated circuit (IC), meliputi tahap rancangan skematik, simulasi, hingga layout untuk IC menggunakan CAD (*computer aided design*) tools untuk perancangan IC.

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.

CPL Prodi yang Dibebankan

Course Learning Outcomes

(CPL-03) Mampu mendesain komponen, sistem, dan proses yang logis dan realistis sesuai dengan spesifikasi yang ditentukan dengan mempertimbangkan aspek keselamatan, sosial, budaya, lingkungan, dan ekonomi

(PLO-03) Capable to design logical and realistic components, systems and processes in accordance with specified specifications by considering safety, social, cultural, environmental and economic aspects

(CPL-10) Mampu mengetahui dan menyikapi perkembangan terkini dibidang ilmu pengetahuan dan teknologi dengan mengedepankan nilai-nilai universal

(PLO-10) Capable to know and respond to the latest developments in science and technology by promoting universal values

(CPL-11) Mampu menerapkan metode, ICT, dan perangkat modern dalam penyelesaian permasalahan dibidang teknik elektro

(PLO-11) Capable to apply methods, ICT, and modern devices in solving problems in the field of electrical engineering

Capaian Pembelajaran Mata Kuliah

Course Learning Outcomes

(CPMK-01) Menguasai teori bahan semikonduktor, berbagai kelompok divais semikonduktor beserta prinsip kerjanya, proses fabrikasi divais semikonduktor dan fabrikasi rangkaian terintegrasi. Menguasai teknik perancangan rangkaian terintegrasi analog dan digital untuk teknologi CMOS hingga tahap simulasi dan layout.

(CLO-01) 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.

(CPMK-02) Mampu melakukan simulasi karakteristik divais semikonduktor dengan software bantu, melakukan perancangan dan simulasi rangkaian analog dan digital CMOS dengan SPICE dan mampu melakukan perancangan gambar layout rangkaian terintegrasi CMOS dengan IC design tool yang tersedia.

(CLO-02) 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.

(CPMK-03) Memahami teori bahan semikonduktor, berbagai kelompok divais semikonduktor beserta prinsip kerjanya, proses fabrikasi divais semikonduktor dan fabrikasi rangkaian terintegrasi.

(CLO-03) Understanding the theory of semiconductor materials, semiconductor devices and their operating principles, and semiconductor and IC fabrication technology.

(CPMK-04) Menunjukkan sikap bertanggung jawab atas pekerjaan di bidang keahliannya secara mandiri.

(CLO-04) *Showing responsibility in the field of expertise. Working together to be able to take full advantage of their potential.*

Topik/Pokok Bahasan

Main Subjects

1. Teori atom, teori bahan semikonduktor, pita energi, doping.
Model of atom, semiconductor materials, energy band, doping.
2. Sambungan PN, dioda.
PN junction, diodes.
3. Transistor bipolar.
Bipolar transistors.
4. Transistor MOSFET, FinFET, SOI.
MOSFET, FinFET, silicon-on-insulator.
5. Piranti optoelektronik, semikonduktor organik, piranti frekuensi tinggi, piranti dengan quantum effect, dan piranti daya tinggi.
Optoelectronic devices, organic semiconductor, high-frequency devices, quantum effect devices, power electronic devices.
6. Proses fabrikasi teknologi VLSI, alur perancangan IC.
VLSI technology fabrication, IC design flow.
7. Prinsip layout IC, dan tool untuk IC design dan verifikasi.
Principles of integrated circuit layout, IC design tools & verification.
8. Rancangan rangkaian terintegrasi CMOS logika statis, sekuensial, standard-cell layout.
Design of CMOS static logic circuits, sequential circuits, and standard-cell layout.
9. Rancangan rangkaian terintegrasi CMOS analog, teknik layout.
Design of analogue CMOS circuits, layout techniques.
10. Rancangan rangkaian terintegrasi mixed-signal seperti ADC dan DAC sederhana dengan teknologi CMOS.
Design of simple mixed signal CMOS circuit, including ADC and DAC.

Pustaka

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.

Prasyarat

Prerequisite(s)

EE184306 Rangkaian Elektronika

EE184306 Electronic Circuits