PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2413 ELECTRONICS

Credits and contact hours: 5 UC credits / 5 hours (5h. Laboratory experiences)

Instructor's name: Enrique Álvarez

Course coordinator's name: To be defined

Textbook: Microelectronics Circuits, 4th Edition – A. Sedra y K. Smith
Electrical Circuits, Malik. Prentice Hall.
Microelectronic Circuit Analysis and Design, Mc Graw Hill, tercera edición, 2006. Donal Neamen.

Course Catalog Description: The course is structured so that the student understands the fundamentals of Electronics, including basic devices and circuits. At the end of the course, the student will be able to analyze a wide variety of basic and medium complexity electronic circuits.

Prerequisite Courses: IEE2123 Electrical Circuits

Co-requisite Courses: To be defined

Status in the Curriculum: Elective

Course Learning Outcomes:

1. Distinguish and explain the operation of an electronic circuit at a high level, in terms of its blocks functional and their signals.
2. Distinguish and explain the basic operation of semiconductor devices.
3. Distinguish simple mathematical models of electronic components such as diode, bipolar transistor, field effect transistor, and use them to analyze the behavior of a circuit.
4. Analyze the polarization of an electronic circuit, and from it, extract a small signal model of the circuit.
5. Analyze the operation and response in the time and frequency domains of simple electronic circuits with transistors, op-amps, and passive components, using hand-made calculations.
6. Analyze the operation and response in the time and frequency domains of electronic circuits with transistors, operational amplifiers and passive components, through simulations.
7. Design simple linear circuits using op amps and passive components.
8. Analyze the operation of electronic harmonic oscillators using the oscillation condition of Barkhausen, and determine its oscillation frequency.
9. Effectively use circuit simulation programs.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering.
b. Design and carry out experiments: analyze and interpret data.
c. Design systems, components or processes.
e. Identify, formulate and solve engineering problems.
j. Knowledge of contemporary issues.
k. Modern techniques, skills and tools for engineering practice

Topics covered:

1. Foundations and definitions
1.1. Introduction
1.1.1. Analog and digital signals; analog, digital and mixed signal circuits
1.1.2. Integrated circuits and discrete component circuits; embedded systems
1.1.3. Moore's law
1.1.4. Manufacturing Technologies
1.1.5. Companies
1.2. Electronic design
1.2.1. Specifications
1.2.2. 1.2.2. System level design: Block diagram. Amplifiers, data converters, filters, PLLs, Voltage regulators
1.2.3. Transistor level design
1.2.4. Fixed layer level design
1.3. Models
1.3.1. Great signal models
1.3.2. Linearization and small signal
1.4. Electronic Circuit Specifications
1.4.1. Gain
1.4.2. Bandwidth
1.4.3. Input and output impedances
1.4.4. Excursion excursion
1.4.5. Common mode and differential mode
1.4.6. PSRR
1.4.7. CMRR
1.4.8. Slew rate
1.4.9. Noise
1.4.10. Temperature
1.5. Two-port networks
1.6. The voltage amplifier
1.6.1. Linear model
1.6.2. Gain-bandwidth product
1.6.3. Differential applicator
1.6.4. Impedances; Miller's theorem
1.7. Frequency response
1.7.1. Bode diagrams
1.7.2. Time constants

1.7.3. Dominant pole concept
1.7.4. First-order systems
1.7.5. Second order systems
1.8. Response in time
1.8.1. Concepts (overshoot, ringig, etc)
1.8.2. First-order systems
1.8.3. Second order systems
1.8.4. Link with frequency response
2. The op amp
2.1. Introduction
2.2. Feedback
2.2.1. Stability
2.2.2. Virtual Short Circuit Concept
2.2.3. Effects on gain, bandwidth, linearity, sensitivity
2.3. Applications
2.3.1. Adder, subtractor, integrator, differentiator
2.3.2. Filters
2.3.3. Data converters
2.3.4. Nonlinear applications
2.4. Practical aspects
2.4.1. Polarization
2.4.2. Component values
2.4.3. Commercial Operational Amplifiers
2.4.4. Transconductance op amps
3. The junction diode
3.1. Introduction
3.2. Physical model
3.2.1. Instrinsic and extrinsic semiconductors
3.2.2. Displacement and diffusion currents
3.2.3. Union P-N
3.2.4. Capacitance
3.3. Diode circuit
3.3.1. Rectifiers
3.3.2. Other apps
3.4. Practical aspects
3.4.1. LEDs, Zener, photodiodes, solar cells; polarization and amplification
3.4.2. SCR, triacs and other elements of industrial electronics
3.4.3. Commercial diodes
4. MOSFET
4.1. Introduction
4.2. Physical model
4.2.1. Structure
4.2.2. Capacitor Mos
4.2.3. Modes of operation and MOSFET equations