

FACULTY OF **ENGINEERING**

DEGREE COURSE: **COMPUTER AND CONTROL ENGINEERING
BS**

SUBJECT: ELECTRONIC SYSTEMS AND MEASUREMENTS

LECTURER: MAURO BALLICCHIA

E-mail: mauro.ballicchia@uniecampus.it

OBJECTIVES

The course is aimed at providing:

- 1) a basic knowledge of semiconductor devices: the physical structures, the operation modes and the equivalent circuit models
- 2) a basic knowledge about the fundamentals analog electronic circuits: single transistor amplifiers, differential amplifiers and operational amplifiers, oscillators and signal conditioning circuits.
- 3) a basic knowledge about analog to digital conversion and analog mixed-signal design.
- 4) a basic knowledge about analog and digital measurements of electrical quantities and the functioning of the fundamentals electronic test instruments.
- 5) an introduction to electronic systems, data acquisition systems, and electronic systems for measurements

CONTENTS

Introduction

- Introduction to Electronics, Microelectronics and Electronic Systems
- Linearization and basics of linear circuit theory

Semiconductor Devices

- Semiconductors and fundamentals of semiconductor physics
- PN Junction
- Diode circuits
- BJT: physical structures, operation modes and equivalent circuit models
- MOSFET: physical structures, operation modes and equivalent circuit models

Analog Electronics

- Amplifiers: circuit models
- Nonlinearity and frequency response of amplifiers
- Single Transistor Amplifiers
- Differential Amplifiers
- Operational Amplifiers
- Feedback and Stability
- Oscillators
- Circuits for analog signal processing

Electronic Measurements and Instruments

- Fundamentals of metrology and uncertainty theory
- Analog to digital conversion
- Analog meters
- AC measurements: RMS to DC conversion and True-RMS to DC conversion
- Digital meters: multimeters
- Methods and circuits for electronic measurements
- High-frequency measurements
- Oscilloscopes: analog and digital storage oscilloscopes
- Spectrum Analyzer
- Time and frequency measurements
- Semiconductor device characterization

Electronic systems and measurements

- Electronic systems: analog, digital and mixed signal components
- Signal conditioning
- Sensors and Transducers

LEARNING OUTCOMES

At the end of the course the students will be able to:

- understand the behavior of semiconductor devices in electronic circuits and to properly use their equivalent circuit models
- analyze and synthesize basic analog circuits using fundamental semiconductor devices and operational amplifiers
- perform measurement of electrical quantities and signals using electronic test instruments and analyze the results taking into account errors and uncertainties
- analyze electronic systems, recognizing fundamentals blocks and their functions, and synthesize simple electronic system for data acquisition and measurements

ASSESSMENT

Written exam: multiple choice and open questions

RECOMMENDED TEXTBOOKS

A. Sedra, K. Smith, *Microelectronic Circuits*, Oxford University Press

R. Jager, T. Blalock, *Microelectronic Circuit Design*, McGraw-Hill

R. A. Witte, *Electronic Test Instruments: analog and digital measurements*, Prentice Hall

M. Collier, J. Zheng, *Electronic Instrumentation and Measurements*, Collier Creation
