Code: ING-INF/01 **Credits:** 6
Matter: Fundamentals of Analog and Digital Electronics
Main language of instruction: Italian
Other language of instruction: English

Teaching Staff

Head instructor
Prof. Stefano Salvatori - stefano.salvatori@unicusano.it

Introduction

1. Objective of the course :

The The course aims to provide basic knowledge in the field of analogue and digital electronics. After a brief review of passive network analysis, basic of operational amplifiers and their application are presented.
The main properties of semiconductor devices (diodes, BJTs and MOSFETs) will be described. Then, simple electronic circuits based on this devices will be analyzed.
Finally, fundamentals of digital electronics are presented, from the Boolean algebra to the implementation of combinational and sequential circuits.

Objectives

2. Course Structure:

The course is focused on the following goals:

- To illustrate concepts related to some circuit topologies
- To provide the tools for the correct acquisition and conditioning of the electronic signals
- To illustrate the basic ideas related to fundamentals circuit topologies and solutions
- To present competencies about circuit analysis.

Competencies:

As prerequisites, to attend the course the student must have passed the courses of **Electric Systems** (Elettrotecnica).
Notions and concepts of a Signal Theory course are extremely important, too.

At the end of the course the student will have the following competencies:

Knowledge and Understanding
to know and understand the terminology, properties and physical quantities involved in particular circuit solutions;
remember the peculiar characteristics of some circuit solutions;
recognize elementary circuit solutions, based on standard analog devices and analyze them to understand their peculiar characteristics;
remember some fundamental models of components and circuits;
memorize the analytical techniques necessary to understand an electronic system function.

Applying knowledge and understanding
use an appropriate terminology when describing an electronic system;
describe the principle of operation of some integrated components;
interpreting the scheme of a circuit with a practical but rigorous approach.

Making judgments
identify the circuit blocks needed to perform a desired function ;
interpret the results both in terms of physical consistency and feasibility.

Communication skills
develop a correct and comprehensible technical-scientific language.

Syllabus

3. Programme of the course:

Introduction

Brief history of electronics, classification of electronic signals (analog signals, digital signals and conversion between the two domains), basics of circuit theory (voltage and current dividers, Thevenin and Norton equivalent).

Operational Amplifier

Ideal operational amplifier, circuits with ideal operational amplifier, real operational amplifier, some applications.

Solid state diode

PN junction diode, Schottky diode, analysis of diode circuits.

Field effect transistor

Structures, operation principle and characteristics of MOSFET, polarization.

Analog systems

Amplification concept, parameters of analog amplifiers, two-port model of the amplifiers, transfer function and frequency response.

Digital systems

Logic gates, multiplexers, Flip Flops, Boolean algebra and reduction techniques, implementation of combinational and sequential circuits.

Evaluation system and criteria

The assessments of course is based on the following criteria:

4. Final exam (84 %)
5. Homework (16 %)

The final exam generally consists of four parts: numerical exercises. The homework consists in the writing of a technical report related to a circuit design or analysis.

Bibliography and resources

6. Materials to consult:

- Lecture notes
- Recorded and live lectures

7. Recommended bibliography:

- Richard C. Jaeger, *Elettronica analogica*, McGraw-Hill.
- Ron Mancini, *Op amp for everyone*, Texas Instruments Inc. (on-line).
- M. Thompson, *Intuitive Analog Circuit Design*, Newnes-Elsevier, 2006.
- Thomas Floyd, Digital Fundamentals, Pearson.