Basics of Electronics B

Finalità
Providing the students with basic knowledge of the most important semiconductor devices and of analog circuits, with specific focus on linear amplifiers.

Programma
Basics of semiconductor devices
Metals, insulators, semiconductors. Band structure of semiconductors. Intrinsic semiconductors. n and p doping. Drift and diffusion currents. p-n junction diodes: equilibrium, reverse and forward bias; static I-V characteristics; breakdown; capacitive effects; application: half-wave rectifier. Bipolar Junction Transistor (BJT): I-V static characteristics; forward-active region and saturation; Safe Operating Area (SOA); capacitive effects; Ebers-Moll model. MOSFET: n-channel enhancement MOSFET; static I-V characteristics; linear region and saturation; dynamic effects; SOA; depletion MOSFET; p-channel MOSFET.
Linear analog circuits
Analog and digital signals. Linearity and linearization. Small-signal equivalent circuits: p-n diode, common-emitter npn BJT, saturated n-channel MOSFET. Linear amplifiers: voltage and current gain, imput and output impedance. Common emitter amplifier: polarization; small-signal analysis; maximum efficiency under class A operation; hints to class AB, B, and C operations. Common-collector amplifier. Common-base amplifier. Hints to multi-stage amplifiers. High-frequency operation of the common-emitter amplifier. Common-source amplifier. BJT differential amplifier. Feedback: effects of negative feedback on first-order systems; Common emitter amplifier with feedback. Stability of systems with a feedback loop. Ideal operational amplifiers and their applications. Hints to the non-idealities of operational amplifiers.

Modalità d'esame
The test is made of a written test and an oral test. Students must pass the written test to be admitted to the oral test.

Propedeuticità
Analisi matematica (ABC). Fisica generale (ABC). Elettrotecnica AB. Fondamenti di Elettronica A.

Testi consigliati
R. Menozzi, “Appunti di elettronica: dispositivi ed elettronica analogica lineare,” Pitagora (Part B)
P. R. Gray, R. G. Meyer , “Analog Integrated Circuits,” Mc Graw Hill