Anno Accademico 2021/2022

RF MICROELECTRONICS	
Anno immatricolazione	2021/2022
Anno offerta	2021/2022
Normativa	DM270
SSD	ING-INF/01 (ELETTRONICA)
Dipartimento	DIPARTIMENTO DI INGEGNERIA INDUSTRIALE E DELL'INFORMAZIONE
Corso di studio	ELECTRONIC ENGINEERING
Curriculum	Microelectronics
Anno di corso	1°
Periodo didattico	Secondo Semestre (07/03/2022 - 17/06/2022)
Crediti	9
Ore	82 ore di attività frontale
Lingua insegnamento	English
Tipo esame	SCRITTO E ORALE CONGIUNTI
Docente	MAZZANTI ANDREA (titolare) - 9 CFU
Prerequisiti	Basic knowledge of Analog Electronics and Electrical Communications
Obiettivi formativi	This course is aimed at introducing students to the design of integrated transceivers for wireless communications. At the end, attendees will have gained knowledge of fundamental parameters describing system performances, insights into alternative processing architectures and ability to design the following building blocks: low noise amplifiers, up and down converters, power amplifier, phase locked loop, phase detector, filter, voltage controlled oscillator, frequency synthesizer. As an example, the design of a complete transceiver will be described starting from the specifications of a telecommunication application, such as GSM, W-CDMA, WLAN. Based on computer aided design experience carried out in the Laboratory, the student will be able to finalize the design of single blocks integrated in most advanced CMOS nodes and will be ready for the design of complete transceivers.

Programma e contenuti	Modulation and Demodulation Amplitude Modulation, Quadrature Amplitude modulation and demodulation. Digital constellation and M-QAM. Constant envelope modulations (FSK, PSK). Multiple Access techniques. RF Transceiver impairments I-Q mismatch, compression, phase noise. Noise and noise figure. Non-linear distortion, compression desensitization and intermodulation. Examples of specifications for popular wireless standards Receiver architectures. Direct conversion and double conversion architectures. The problem of the image. Image-reject downconverters. Low Noise Amplifier Common-source LNA. Inductively degenerated amplifier. Common-gate amplifier. Noise-cancelling amplifiers Mixers Introduction. Switching mixer: conversion gain and noise figure. Single-balanced and double balanced mixers. Passive mixers. Oscillators. Oscillators principles. Large signal operation. Phase noise analysis. Voltage-controlled oscillators Phase Locked Loop and Frequency synthesizer. Type-I and Type-II PLL. Phase and frequency detectors. Issues of spurs and phase noise in PLL. Building blocks: charge-pump, crystal oscillator, high-speed dividers. Integer and fractional frequency synthesis Power amplifiers. Specifications. Class A,B,C,D,E,F amplifiers. Transmitter architectures for switch-mode amplifiers.
Metodi didattici	Lectures (hours/year in lecture theatre):50 Exercises (hours/year in lecture theatre):15 Practical class (hours/year in lecture theatre): 12
Testi di riferimento	B. Razavi. RF Microelectronic circuits. Prentice Hall PTR, Upper Saddle River, NJ 07458.
Modalità verifica apprendimento	The examination includes questions with multiple answers and excercises to be solved by the student. Further oral discussion is possible upon student request. No inter-mediate examination is foreseen.
Altre informazioni	
Obiettivi Agenda 2030 per lo sviluppo sostenibile	$lbl_legenda_sviluppo_sostenibile