DRIEI
PhD Program in Electronic and Computer Engineering
University of Cagliari, Italy

Course:	Microelectronics for Wireless Communications and Sensing
Instructor:	Corrado Carta (TU Berlin, IHP)
SSD:	09/E3, 09/F1
Credits / hours:	9h
Language:	English or Italian
Scheduling:	July 9th, 10th and 11th, 10.00-13.00, room B1, building M
Final Exam:	Written exam
Registration:	Interested students should send an email to andrea.casula@unica.it

Goal of the Course

In the early 90s the successful single-die integration of transceivers suitable to serve the GMS bands at 900MHz and 1.8GHz has reduced the cost of cellular phones to a point compatible to nearly universal availability. The fundamental aspects of this technological step are very relevant today with wireless systems of increasingly-higher performance being developed and design methods being adapted to higher frequencies and more advanced transistor technologies. This short course provides an overview of the basic techniques and methods, overlapping analog integrated-circuit design and microwave engineering, which enable the realization of silicon transceivers operating from the low-GHz range up to the deep sub-THz bands.

Prerequisites: Analog Integrated Circuits

Intersection with other courses at the University of Cagliari: Electronic systems and components; Wireless control and communication systems; Integrated circuits; Microwave systems and sensors; Design of wireless devices

Course Outline

1. Introduction
Technologies and devices for RF to THz SoCs. Methods of microwave engineering for analog integrated circuits: narrow-band linearity; noise and noise matching; matching for small-signal power versus voltage or current; large-signal matching; stability; distributed circuits: transmission lines and Kirchhoff's domain.

2. Applications and system architectures
Receiver and transmitter architectures compatible with single-chip integration: direct conversion, low-Q image rejection and low-IF receivers. Quadrature transceivers. Asynchronous wireless communication. Phased arrays and beam-steering electronics. Comparison of communication and radar/sensing frontends.

3. Realization of basic circuit blocks in Silicon RF technologies

Low-noise amplifiers. Power amplifiers: V-I conversion, load pull, efficiency, switching classes. Mixers: analog multipliers versus down- and up-conversion mixers, active and passive switching mixers, resistive mixers. Oscillators: basic topologies, injection locking, phase noise and its effect on wireless systems. Frequency multipliers. Phase shifters.