

Course Type	Course Code	Name of Course	L	T	P	Credit
DE	NECD548	VLSI for Wireless Communication	3	0	0	3

### Course Objective

This course will introduce approaches and methodologies for VLSI design for wireless communication.

- To cover the design of VLSI circuits used in modern wireless transceivers.
- To illustrate the design trade-offs in the transceivers with practical, real life circuit examples, with low power as an important design objective.
- To discuss the architectures of wireless transceivers at the transistor level, using submicron CMOS.
- To discuss the circuits such as low noise amplifiers, mixers, power amplifiers, oscillators, phase locked loops and A/D and D/A converters.

### Learning Outcomes

Upon successful completion of this course, the students will have:

- Ability to design wireless transceivers using low noise amplifiers, mixers, power amplifiers, oscillators, phase locked loops, A/D and D/A converters and frequency synthesizers.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Wireless systems, Standards, Access methods, Modulation schemes, Classical channel, Wireless Channel Description, Path Loss, Multipath Fading, Channel Model and Envelope Fading, Frequency Selective and Fast Fading.	07	The students will be introduced to the basic concepts of communication.
2	Transmitter backend, Quadrature LO generator, Receiver Front End: Filter Design, Rest of Receiver Front End, Derivation of NF, IIP3 of Receiver Front End, Wideband LNA Design, Narrow Band LNA: Impedance Matching, Core Amplifier.	08	The students will learn the architecture of transmitters and receivers in communication systems.
3	Active Mixer: Balancing, Qualitative Description of the Gilbert Mixer, Distortion, Low Frequency Case: Analysis of Gilbert Mixer, Distortion, High Frequency Case, Noise 27 Passive Mixer: Switching Mixer, Distortion in Unbalanced Switching Mixer, Conversion Gain in Unbalanced Switching Mixer, Noise in Unbalanced Switching Mixer, practical Unbalanced Switching Mixer, Sampling Mixer, Conversion Gain in Single-Ended Sampling Mixer.	09	The students will get the exposure on active and passive mixers in communication circuits.
4	Demodulators, A/D converters Used in a Receiver, Low-Pass Sigma-Delta Modulators, Implementation of Low-Pass Sigma-Delta Modulators, Bandpass Sigma-Delta Modulators, Implementation of Bandpass Sigma-Delta Modulators.	09	The students will learn the ADC and its applications.
5	PLL based frequency synthesizer, Phase detector/Charge pump, VCO, Dividers, Ring oscillators, Loop filter, General description, Design approaches.	09	The students will learn the PLL circuits and its applications.
<b>Total</b>		<b>42</b>	

### Text Books:

1. Bosco Leung, "VLSI for Wireless Communication, Second Edition, Springer, 2011.
2. Wen-Chih Kan, "VLSI Architecture for High-capacity Wireless Communications", University of Minnesota, 2007

### Reference Books:

1. Emad N Farag, M.I Elmasry, "Mixed Signal VLSI Wireless Design Circuits and Systems", Kluwer Publications, 2013.
2. David Tsee, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge Univ Press, 2005.