RF Integrated Circuits - Video course

COURSE OUTLINE

This course will develop electronic circuits for radio frequency applications, specific to CMOS integrated circuits. As the course title suggests, the course will be specific to CMOS integrated circuits, and specific to radio frequencies.

In particular, the course will focus on circuits for radio front-ends for mobile phone handsets. The course will cover low noise amplifiers, mixers, power amplifiers, frequency synthesizers (and phase locked loops). The course will also cover several modern radio architectures.

COURSE DETAIL

Modules	Lectures
Module 1: Introduction	• Lecture 1: RF systems – basic architectures • Lecture 2: Transmission media and reflections • Lecture 3: Maximum power transfer
Module 2: Passive RLC Networks	• Lecture 4: Parallel RLC tank, Q • Lecture 5: Series RLC networks, matching • Lecture 6: Pi match, T match
Module 3: Passive IC Components	• Lecture 7: Interconnects and skin effect • Lecture 8: Resistors, capacitors • Lecture 9: Inductors
Module 4: Review of MOS Device Physics	• Lecture 10: MOS device review

NP-TEL

NPTEL

http://nptel.iitm.ac.in

Electronics & Communication Engineering

Pre-requisites:

- Analog integrated circuits.

Coordinators:

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Module 5: Distributed Systems	• Lecture 11: Transmission lines, reflection coefficient • Lecture 12: The wave equation, examples • Lecture 13: Lossy transmission lines • Lecture 14: Smith charts – plotting gamma
Module 6: High Frequency Amplifier Design	• Lecture 15: Bandwidth estimation using open-circuit time constants • Lecture 16: Bandwidth estimation using short-circuit time constants • Lecture 17: Risetime, delay and bandwidth • Lecture 18: Zeros to enhance bandwidth • Lecture 19: Shunt-series amplifiers, tuned amplifiers • Lecture 20: Cascaded amplifiers
Module 7: Noise	• Lecture 21: Thermal noise, flicker noise review • Lecture 22: Noise figure
Module 8: LNA Design	• Lecture 23: Intrinsic MOS noise parametes • Lecture 24: Power match versus noise match • Lecture 25: Large signal performance, design examples & Multiplier based mixers
Module 9: Mixer Design	• Lecture 26: Subsampling mixers
Module 10: RF Power Amplifiers	• Lecture 27: Class A, AB, B, C amplifiers • Lecture 28: Class D, E, F amplifiers • Lecture 29: RF Power amplifier design examples
Module 11: Voltage controlled oscillators	• Lecture 30: Resonators • Lecture 31: Negative resistance oscillators

Module 12: Phase locked loops	• Lecture 32: Linearized PLL models • Lecture 33: Phase detectors, charge pumps • Lecture 34: Loop filters, PLL design examples
Module 13: Frequency synthesis and oscillators	• Lecture 35: Frequency division, integer-N synthesis • Lecture 36: Fractional frequency synthesis
Module 14: Phase noise	• Lecture 37: General considerations • Lecture 38: Circuit examples
Module 15: Radio architectures	• Lecture 39: GSM radio architectures • Lecture 40: CDMA, UMTS radio architectures

References:

1. The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge University Press, 2004.

2. RF Microelectronics by Behzad Razavi. Prentice Hall, 1997.