

# Radio-Frequency IC Design

---

## Lecture 0: Radio Frequency Integrated Circuits

ELEC 404



©Sudip Shekhar

**Not to be copied, used, or revised without explicit written permission from the copyright owner.**

# **Course Objectives**

---

- **Understand a variety of RF architectures and system-level & circuit-level trade-offs.**
- **Design and simulate analog and RF circuits using Cadence**
- **Become familiar with different wireless standards such as WiFi, 5G, etc.**
- **Obtain an overview of the state-of-the-art in wireless transceivers.**

# Broad Contents

---

- Introduction to RF communication
- Basics of digital communication
- RLC matching networks
- On-chip component models
- S-parameters
- Noise theory
- Receiver architectures
- Low noise amplifiers
- Mixers
- Voltage-controlled oscillators
- Phase noise
- Transmitter architectures
- Power amplifiers

# Suggested Reading

---

- **RF Microelectronics: B. Razavi. 2nd Edition, Prentice Hall.**
  - **The Design of CMOS Radio-Frequency Integrated Circuits: Thomas H. Lee. 2nd Edition, Cambridge University Press.**
  - **IEEE Journals (JSSC, TCAS) and Conference Proceedings (ISSCC, VLSI Symposium, RFIC Symposium, CICC)**

# Prerequisites

---

- **Anyone of (ELEC 221, EECE359, EECE369)**
- **ELEC 401 or ELEC 402 (co-requisite ok)**
  - **If you have taken ELEC 301 but not 401/402, please consult me**
- **Other graduate courses**

# Content Delivery

---

- **Course webpage:** [https://sudip.ece.ubc.ca/teaching/elec404\\_571f\\_rfic/](https://sudip.ece.ubc.ca/teaching/elec404_571f_rfic/)
- **Cadence Tutorial:** <http://sudip.ece.ubc.ca/cad-tutorials/>
- **Course Content: Piazza**
  - **Piazza servers are based outside Canada – if you have confidentiality concerns, please talk to Sudip after the class**
- **Semi-populated handouts will be uploaded before the lecture.**
- **Annotated lectures will not be provided**
- **No Q/A through email**
- **Ask questions on Piazza**
- **Previous year exam solutions and homework solutions will be provided**
- **Students upload projects to Canvas.**

# Grading

---

## ELEC 404

Project 1 – Low Noise Amplifier 30%

Project 2 – Voltage Controlled Oscillator 30%

Final 40%

Must pass final to pass the course

# Office Hours

---

## Sudip's Office Hours:-

- Mondays: 5:30-6:20pm K4017
- By appointment [sudip@ece.ubc.ca](mailto:sudip@ece.ubc.ca)

## TA: Bahram Jafari

## TA's Office Hours:-

- TBD
- [bjafari@ece.ubc.ca](mailto:bjafari@ece.ubc.ca)