Department of Electrical Engineering,
School of Engineering,
University of Management and Technology

Course Outline
Course code……EE 628….; Course title…… Advanced Circuit Design …;
Semester: Fall 2014

Program	MSEE
Credit Hours	3
Duration	One semester
Prerequisites	Analog Electronics, or at least knowledge of semiconductor devices and circuits.
Resource Person (s)	Jameel Ahmad
Counseling Timing (3S-33 Room#3)	Thursday 6:30pm-9pm,
Contacts	Jameel Ahmad Jameel.ahmad@umt.edu.pk (0333-558-3815)

Chairman/Director signature…….
Dean's signature……
Date…….

Learning Objectives:

World is analog. In this course students will learn analog circuit design leading to a CMOS analog IC design. The aim of this course is to give the student fundamental knowledge on Radio Frequency (RF) integrated circuits design. Both circuit and systems perspective is presented in a context of today's wireless personal and data communication (such as GSM, CDMA or Bluetooth). The particular objective of the course is that the student should learn methods and techniques for RF front-end design oriented to CMOS technology. Detailed specifications and limitations for RF blocks are discussed throughout the course. Throughout the course the emphasis will be on implementing analog circuits using CMOS transistors.

Content:

Introduction to IC Design, MOS Transistor modeling, Small signal equivalent models, 1-stage, 2-stage and fully-differential CMOS OP-Amps circuit analysis and design, Current Mirrors, Frequency response of amplifiers and Frequency compensation, Band-gap references, Introduction to RF design. Introduction to Noise & Distortion in RF Systems, Design of RF system building blocks at the CMOS circuit level: Receiver and Transmitter Architectures, low noise amplifier (LNA), mixer, oscillator, PLL, data converter fundamentals and power amplifier design. Practical RF circuit design with professional software.

Student Learning Outcomes:

After the course the students should be able to:

1. Analyze Common amplifiers such as Common Source, Common Gate and Common Drain Amplifiers, Gilbert Cells,
2. analyze various architectures of today's digital radio transmitters and receivers
3. analyze and design basic RF building-blocks in CMOS technology
4. verify and optimize RF blocks (circuits) using a professional software (MATLAB/ADS/or Cadence Design System)
5. Understand basic RF measurement concepts through S-parameters, sensitivity, noise figure, IP3.

Learning Methodology:

Lecture, interactive, participative, Software tools and Analysis

Grade Evaluation Criteria

Following is the criteria for the distribution of marks to evaluate final grade in a semester

Marks Evaluation	Marks in percentage
Quizzes	15
Assignments	10
Mid Term	30
Final exam	45
Total	100

Textbooks:

Course book:

[1] Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw-Hill Science/Engineering/Math; 1 edition (August 15, 2000)

[2] RF Microelectronics - 2nd ed., Behzad. Razavi, Pearson, ISBN 0132839415, 2012

Reference books:

[3] Analog Integrated Circuit Design, 2nd Edition, by Tony Chan Carusone, David A. Johns and Kenneth W. Martin, Wiley, 2012. ISBN: 978-0-470-77010-8

[4] T. H. Lee, The Design of CMOS Radio-Frequency (RF) Integrated Circuits, Cambridge Univ. Press,2006, ISBN 0-521-83539-9,2004 (Supplementary book)

[5] VLSI for Wireless Communication by Bosco Leung (Publisher: Prentice Hall - Electronics and VLSI Series)

[6] CMOS Circuit Design, Layout and Simulation – R. J. Baker, 3nd Edition, Wiley-IEEE, 2010.

Tentative Course Schedule

WEEK	Topics	Book references
1	Introduction to Analog Design, Basic MOS Transistor physics and device characteristics/modeling	[1]-Chapter-1-2
2	small signal modeling	[1]-Chapter-3
3	Single stage CMOS Amplifiers	[1]-Chapter-3
4	Differential Amplifiers	[1]-Chapter-4
5	Cascode stages and Current Mirrors	[1]-Chapter-5
6	Frequency response of amplifiers	[1]-Chapter-6
7	Operational Amplifiers (OP-Amp) circuit design	[1]-Chapter-9
8	**MIDTERM**	
9	Basic Concepts in RF design, Noise , sensitivity and dynamic range	[2]-Chapter-1-2
10	Design of RF system building blocks at the CMOS circuit level, Receiver and Transmitter Architectures	[2]-Chapter-5
11	Low Noise Amplifier (LNA) circuit design	[2]-Chapter-6
12	Mixer and Oscillator circuit design	[2]-Chapter-6-7
13	Phase Lock Loops(PLL) circuit design	[2]-Chapter-8
14	Power amplifier types and circuit design	[2]-Chapter-9
15	Data Converters circuit design and architectures [an overview only]	[3]-Chapter-15-18
16	**FINAL**	