

Subject Code: 1RI3000102	Subject Title: CMOS Analog Circuit Design
Pre-requisite Subject	The subject required the basic fundamental knowledge of VLSI

Objectives of course: The objective of the course is to understand basics of CMOS Technology, Analog CMOS Subcircuits, CMOS Amplifier, High Performance CMOS Op Amps and Comparators, Switched-Capacitor Circuits

Learning outcomes: After learning this subject students are able to design and simulate basic CMOS analog circuit like Inverters, Differential and Current Amplifier, Switched- Capacitor Circuits

Teaching Scheme (Credit Distribution)				Assessment Scheme (Weightage)	
Lecture	Tutorial	Practical	Credit	Hall Exam	Continuous Evaluation
4	--	--	4	60%	40%

Continuous evaluation is based on assignments/quiz/presentation/small projects as per the supervisor instructions.

Subject Contents				
Sr. No.	Topic	Total Hours	Weight (%)	
1	Introduction Analog Integrated Circuit Design, Notation Symbol and Terminology, Analog Signal Processing, Example of Analog VLSI Mixed- Signal Processing	05	10%	
2	Analog CMOS Subcircuits MOS Switch, Current Sinks and Sources, Current Mirror, Current and Voltage References	05	10%	
3	CMOS Amplifier Inverters, Differential Amplifier, Cascode Amplifier, Current Amplifier	05	10%	
4	CMOS Operational Amplifier Design of CMOS Op Amps, Compensation of Op Amps, Design of Two Stage Op Amp, Power Supply Rejection Ratio of Two Stage Op Amps, Cascode Op Amps, Simulation and Measurements of Op Amps	10	20%	
5	Comparators Characteristics of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, High-Speed Comparators	08	20%	
6	Introduction to Switch Capacitor Circuits General Consideration, Sampling Switches, Switched – Capacitor Amplifiers, Switched- Capacitor Integrator, Switched- Capacitor Common Mode Feedback	07	20%	

List of References:

1. CMOS Analog Circuit Design, By- Phillip E. Allen and Douglas R. Holberg, OXFORD University Press
2. Design of Analog CMOS Integrated Circuits, By Behzad Razavi, Mc Graw Hill Publication

***Continuous Assessment (Practical) Bifurcation**

Sr. No.	Title	Units	Marks
1	Assignment	3	10
2	Term Paper	1	10
3	Presentation	1	10
4	Minor project	1	10

Subject Code: 1RI3000103	Subject Title: VLSI Technology
Pre-requisite Subject	The subject required the basic fundamental knowledge of VLSI

Objectives of course: The objective of the course is to make the students aware with the SPICE simulation tool.

Learning outcomes: After learning this subject students are able to design and simulate basic CMOS analog circuits.

Teaching Scheme (Credit Distribution)				Assessment Scheme (Weightage)	
Lecture	Tutorial	Practical	Credit	Hall Exam	Continuous Evaluation
2	--	--	2	60%	40%

Continuous evaluation is based on assignments/quiz/presentation/small projects as per the supervisor instructions.

Subject Contents				
Sr. No	Topic	Total Hours	Weightage (%)	
1	Introduction: Overview of VLSI design methodology, VLSI design flow, Design hierarchy, Concept of regularity, Modularity, and Locality, VLSI design style, Design quality, package technology, introduction to FPGA and CPLD, computer aided design technology.	4	20%	
2	Fabrication of MOSFET : Introduction, Fabrication Process flow: Basic steps, C-MOS n-Well Process, Layout Design rules, full custom mask layout design	4	20%	
3	MOS Transistor: Metal Oxide Semiconductor (MOS) structure, MOS System under external bias, Structure and Operation of MOS transistor, MOSFET Current-Voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances	8	25%	
4	Chip I/P and O/P Circuits : On chip Clock Generation and Distribution, Latch –Up and its Prevention	2	10%	
5	Design for testability : Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques, built-in Self Test (BIST) techniques, current monitoring IDDQ test	3	25%	
		21	100%	

List of Text Books:

1. CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, Yusuf

Leblebici, Tata McGraw-Hill Publication

At the End of Semester, students has to submit following list of practical with simulations Results

Subject Contents	
Sr. No.	Topic
1	To understand BSIM3V3 level49 and Level52 parameters.
2	To understand analog low frequency and high frequency MOSFET modal.
3	To desing and analysis CMOS inverter.
4	Design four current sinks with values 20, 30, 50 and 70uA. What is the minimum voltage across each current sink?.
5	Design four current sinks using a double cascode current mirror.
6	Design four current sinks with values 20, 30, 50 and 70uA. What is the minimum voltage across each current sink? Estimate the variation in I_o , for VDD changing. Simulate the sensitivity using SPICE.
7	Design a 3 V reference using voltage divider.
8	Design a 10uA current source using the thermal voltage self-biased reference. Simulate the temperature characteristics of the design.
9	Design and analysis the differential amplifier using SPICE.
10	Design and analysis two stage CMOS Op Amp and measure various performance parameter.
11	Design and simulate 1- bit Flash ADC.
12	To study and understand VLSI layout.

List of References:

1. CMOS Circuit Design, Layout and Simulation, By R. Jacob Baker, Harry W. Li and David E. Boyce.
2. Design of Analog CMOS Integrated Circuits, By Behzad Razavi, Mc Graw Hill Publication