

Course Code	ECE 315/ECE515			
Course Name	Analog CMOS Circuit Design			
Credits	4			
Course Offered to	UG/PG			
Course Description	This course introduces the basic analog building blocks and quantifies their performance parameters. More advanced circuits are derived from these basic building blocks. Concepts of feedback and stability are introduced to enable analysis of complex circuits. The course also includes a self-learning lab component in which the students are expected to learn circuit simulation and design tools such as LTSpice, Eldo, Cadence Analog Suite etc. A design project is an essential component of this course.			
Pre-requisites				
Pre-requisite (Mandatory)	Pre-requisite (Desirable)			
Circuit or Network Analysis	Electronics Device			
*Please insert more rows if required				
Post Conditions				
CO1	CO2	CO3	CO4	CO5
Students are able to analyze CMOS active circuits.	Students are able to analyze circuits such as Current Mirror, Linear Amplifier, Differential Amplifier, Power Amplifier etc.	Students are able to acquire the ability to solve, analyze, design, and simulate moderately complex MOS based circuits.	Students are able to use standard commercial tools such as ELDO and Cadence Suite	
Weekly Lecture Plan				
Week Number	Lecture Topic	COs Met	Assignment/Labs/Tutorial	Project
Week 1	Introduction to the semiconductor industry, introduction to layouts and industry design flow for analog circuits (design flow for analog circuits, introduction to layout, case study)	CO1	LTSpice, Cadence Suite, and Eldo Tutorials by TAs	Starts in the first week. The project essentially helps in meeting all the COs namely CO1, CO2, CO3 and CO4.
Week 2	Single Stage MOS Amplifiers (Intro to CS, CD, CG Amplifiers, analysis of CS amplifier with resistive load, analysis of CS amplifier with diode connected load, analysis of CS amplifier with current source load)	CO1, CO2, CO4	Students to first analyze some circuits and then verify using LTSpice and Eldo (HA#1)	
Week 3 & 4	Analysis of Source Follower (CD amplifier), analysis of CG amplifier , Analysis of CS amplifier with source degeneration, analysis of cascode and folded cascode, cascode as a current source	CO1, CO2, CO3, CO4	Students to first analyze some circuits and then verify using LTSpice and Eldo (HA#2 and HA#3)	

Week 4, 5, 6, 7	Introduction to current mirror, simple CMOS current mirror, source-degenerated current mirror, small-signal analysis, large-signal analysis (PA), and common mode properties of current mirror, Differential amplifier (single ended operation, differential mode operation, common mode response, common mode rejection), Differential amplifier (differential pair with active loads, cascade differential amplifier), Gilbert Cell	C01, C02, C03, C04	Students to first analyze some circuits and then verify using LTSpice and Eldo (HA#4 and HA#5)	
Week 7, 8, 9	Frequency Response (fundamental concepts, relationship between transfer function and frequency response, Bode's Rules, Association of Poles with Nodes, Miller Effect and Miller's Theorem and its dual, General Frequency Response, Frequency Response of CS Amplifier, Frequency Response of Differential Amplifier) , Feedback, Feedback Topologies, Properties of Feedback Circuits, Stability in Feedback Systems	C02, C03, C04	Students to first analyze some circuits and then verify using LTSpice and Eldo (HA#6 and HA#7)	
Week 10, 11,12, 13	Multi-stage Op Amps (one-stage and two-stage Op Amps, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate), Noise in CMOS Circuits (Concepts, PSD, PDF, Noise in Single Stage Amplifier)	C02, C03, C04	Students to first analyze some circuits and then verify using LTSpice and Eldo (HA#8)	

Weekly Lab Plan

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Assessment Plan

Type of Evaluation	% of contribution in grades
Assignments	15
Class Tests	15
Mid-Sem	20
End-Sem	20
Project	30

Resource Material

Type	Title
Textbook	Design of Analog CMOS Circuits, Behzad Razavi, Tata McGraw Hill
Textbook	CMOS Analog Circuit Design, Allen and Holberg, 3rd Indian Edition, Oxford University Press