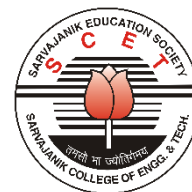




SARVAJANIK UNIVERSITY
Sarvajani College of Engineering and Technology
Bachelor of Technology



B. Tech. Semester VII

Subject Name: Mixed Signal Design

Subject Code: BTEC14702

Type of course: PEC

Prerequisite: CMOS Analog circuit design

Rationale: This course builds the advanced CMOS analog IC design. This course focuses on the concepts of mixed signal VLSI design. The course will give practical aspects of mixed signal VLSI blocks such as comparators, data converters, oscillators and phase locked loop. In summary, the course is designed for considering the needs of the VLSI design industry.

Teaching and Examination Scheme:

Teaching Scheme				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

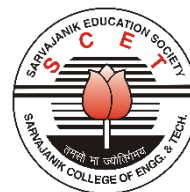
CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests) **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. no.	Topics	Teaching Hrs.	Module % Weightage
1.	Data Converter Fundamentals: Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications, Mixed-Signal Layout Issues.	6	15
2.	Data Converter Architectures: DAC Architectures, Resistor String, R-2R Ladder Networks, Cyclic DAC, Pipeline DAC, ADC Architectures, Two-Step Flash ADC, Successive Approximation ADC, Dual-Slope ADC, Pipeline ADC, Op-Amps in Data Converters.	8	20
3.	Switched capacitor circuits: Sampling switches, Switched capacitor amplifiers, Switched capacitor integrators, Switched capacitor common mode feedback.	6	15
4.	Feedback Amplifiers: Feedback Equation, Properties of Negative Feedback on Amplifier Design, Recognizing Feedback Topologies, The Voltage Amp (Series-Shunt Feedback), The Transimpedance	10	20



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	Amp (Shunt-Shunt Feedback), Transconductance Amp (Series-Series Feedback), The Current Amplifier (Shunt-Series Feedback), Stability.		
5.	CMOS filters: Integrator building blocks, Filtering topologies.	6	15
6.	Oscillators and PLL: Ring oscillators, LC oscillators, Voltage controlled oscillators, Phase locked loops, Applications of PLL.	6	15

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	25	25	10	10	10

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels (**Revised Bloom’s Taxonomy**) **Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	CMOS Mixed Signal Circuit Design	R. Jacob Baker	Wiley India IEEE Press	2008	Latest
2.	CMOS Circuit Design Layout and Simulation	R.Jacob Baker	Wiley IEEE press	2009	2nd
3.	Design of Analog CMOS Integrated Circuits	Behzad Razavi	McGraw Hill	2016	3 rd

Course Outcome:

Sr. No.	CO Statement After learning this subject students will be able to	Marks % weightage
CO-1	Explain analog to digital and digital to analog converters.	15
CO-2	Describe architectures of ADCs and DACs.	15
CO-3	Explain switched capacitor amplifiers, integrators and feedback mechanism.	20
CO-4	Discuss properties of negative feedback amplifiers, filters and oscillators	20
CO-5	Design parameters for various feedback amplifier topologies and filters.	15
CO-6	Apply oscillators and phase locked loops. for various mixed signal design based applications	15



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Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	2	2	2	2	2	-	-	2	-	-	2	2	2	2
CO-2	2	-	2	-	-	-	-	-	-	-	-	2	3	2	2
CO-3	2	2	2	2	2	2	-	-	2	-	-	2	2	2	2
CO-4	1	-	-	-	-	-	-	-	-	-	-		2	2	2
CO-5	2	2	2	2	2	2	-	-	2	2	2	2	2	2	2

List of Practical:

1. To obtain ON resistance of following devices when using a switch using simulation: 1. NMOS 2. PMOS 3. Transmission Gate .
2. To obtain the error in sampled voltage when following devices use a switch using simulation: 1. NMOS 2. PMOS 3. Transmission Gate.
3. To study and simulate dummy device based charge injection cancellation technique. Obtain the error in sampled voltage.
4. Simulate switched capacitor amplifier circuit.
5. To simulate basic clock signal based sense amplifier circuit and measure its performance parameters.
6. To simulate and analyze charge pump PLL.
7. To simulate regenerative feedback based CMOS comparator circuit and measure its performance parameters.

List of Open Source Software:

- ngspice/multisim (software)