

**17VL002 MIXED SIGNAL DESIGN**

Hours Per Week :

L	T	P	C
3	-	3	5

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	-	45	15	30	-	5	5	-

**Course Objectives:**

- To understand the types of filters.
- To understand the different techniques of ADC and DAC.

**Course Outcomes:**

Upon successful completion of this course student should be able to:

- The ability to use DAC and ADC techniques for data conversions.
- The ability to program, Mixed Signal VLSI Circuits.

**SKILLS:**

- Understand What SoC is and what the differences between SoC and Embedded System.
- Learn to employ specialized knowledge of subsystems like processor cores and other SoC components to design.
- Improve student's capabilities of using the technical knowledge of processor architecture, peripherals, programming, and CAD tools.

**UNIT – I**

**PLL & Switched Capacitors** : Characterization of a comparator, Basic CMOS comparator design, analog multiplier, PLL – simple PLL, charge-pump PLL, applications of PLL, Switched Capacitor circuits – basic principles, switched capacitor sensitive integrator and insensitive integrator, switched capacitor filter, switched capacitor amplifier.

**UNIT – II**

**Sampling Circuits** : Basic sampling circuits for analog signal sampling, performance metrics of sampling circuits, different types of sampling switches.

**Sample-and-Hold Architectures**: Open-loop & closed-loop architectures, open-loop architecture with miller capacitance, multiplexed-input architectures, recycling architecture.

**UNIT – III**

**Digital - to Analog Conversion** : Input/output characteristics of an ideal D/A converter, performance metrics of D/A converter, Resistor string 3 bit DAC , Binary scale DACs, Cyclic DAC.

**D/A Converter architectures**: Resistor-Ladder architectures, current-steering, Pipeline DAC

**UNIT – IV**

**Analog-To-Digital Conversion** Input/output characteristics and quantization error of an A/D converter, performance metrics of A/D converter.

**A/D converter architectures**: Flash architectures, interpolate and folding architectures, pipelined architectures, Integrating (Dual slope) ADC Successive approximation architectures.

**UNIT – V**

**Analog CMOS Filters** : Low Pass filters, active–RC fully differential integrator, Two transistor MOSFET–C integrator,  $g_m$ -C Integrator, Active RC integrators

**Mixed Signal Design Lab**

List of Experiments:

1. Design of Common mode feed-back circuits
2. Design of switched capacitor circuits
3. Design of High Speed Comparator
4. Design of High Gain comparator
5. Design of first order filters
6. Design of full wave rectifier
7. Design of sinusoidal oscillator
8. Design of Ring oscillator
9. Design of PLL
10. Design of ADC
11. Design of DACs
12. Mini project.

Note : All the experiments are to be carried out independently by each student with different specifications.

**ACTIVITIES:**

- Students can conceptualize multi resolution techniques using CAD.
- Ability of extract the MOS amplification parameters.
- Design improved CMOS amplifiers and Operational Amplifiers.

**TEXT BOOKS:**

1. Razavi, "Design of analog CMOS integrated circuits", McGraw Hill, 2001.
2. Razavi, "Principles of data conversion system design", S.Chand and company ltd, 2000.
3. Jacob Baker et. all, "CMOS Mixed-Signal circuit design", IEEE Press, 2002

**REFERENCE BOOKS:**

1. Gregorian, Temes, "Analog MOS Integrated Circuit for signal processing", John Wiley & Sons.