20VL006 - Mixed Signal Design

COURSE OBJECTIVE

To make the students to understand the design and performance measures concept of mixed signal circuit.

COURSE OUTCOMES:

CO1: Use the techniques and skills for designing CMOS based switched capacitor circuits.
CO2: Analyze CMOS based comparator and PLL.
CO3: Able to enhance the performance of sampling circuits.
CO4: Understand and analyze the non idealities of data converters.
CO5: Apply appropriate techniques, resources and tools to engineering activities in development of Data Converters.
CO6: Design the frequency and Q tunable time domain filters.

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, Ramp type ADC, Integrating (Dual slope) ADC, Successive approximation architectures, Sigma Delta ADC , Design of Decimation filter.

UNIT – V

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

Mixed Signal Design Lab

List of Experiments:

1. Design of switched capacitor circuits
2. Design of High Speed Comparator
3. Design of High Gain comparator
4. Design of first order filters
5. Design of full wave rectifier
6. Design of sinusoidal oscillator
7. Design of Ring oscillator
8. Gm-C Integrator
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.

TEXTBOOKS:

1. B.Razavi, *"DesignofanalogCMOSintegratedcircuits"*,McGrawHill,2001.

2. B.Razavi, *"Principles of data conversion system design"*, S.Chand and company ltd,2000.

3. JacobBakeret.all,"CMOSMixed-Signalcircuitdesign",IEEEPress,2002

REFERENCE BOOKS:

1. **Gregorian,Temes,"AnalogMOSIntegratedCircuitforsignalprocessing",JohnWiley&Sons.**

2. **Schreier & Themes, Understanding Delta-Sigma Data Converters, Wiley –IEEE Press,2004.**