

## **EC8006 MIXED SIGNAL IC DESIGN**

### DETAILED SYLLABUS

#### **OBJECTIVES:**

The student should be made to:

- Study the mixed signal of submicron CMOS circuits
- Understand the various integrated based filters and topologies
- Learn the data converters architecture, modeling and signal to noise ratio
- Study the integrated circuit of oscillators and PLLs

#### **UNIT I SUBMICRON CMOS CIRCUIT DESIGN**

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

#### **UNIT II INTEGRATOR BASED CMOS FILTERS**

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

#### **UNIT III DATA CONVERTER ARCHITECTURES**

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC's, Successive Approximation ADC.

#### **UNIT IV DATA CONVERTER MODELING AND SNR**

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

#### **UNIT V OSCILLATORS AND PLL**

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

#### **REFERENCES:**

1. CMOS Mixed Signal Circuit Design by R. Jacob Baker, Wiley India, IEEE Press, reprint 2008.
2. CMOS Circuit Design, Layout and Simulation by R. Jacob Baker, Wiley India, IEEE Press, Second Edition, reprint 2009.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 33rd Re-print, 2016.