ANALOG IC DESIGN

Course Code: 13EC2210 **L P C**
4 0 3

Pre requisites: Electronic devices and circuits, Linear IC Applications.

Course Educational Objectives:

1. To design and analyze CMOS Analog IC building blocks.

Course Outcomes:

1. Students able to understand the concepts of small signal and large signal modeling of MOSFET.
2. Students will be able to design and analyze CMOS Analog IC building blocks like operational transconductance amplifiers (OTA), current mirrors, comparators, sample & hold circuits and switched capacitor circuits.
3. Students will be able to analyze, design and characterize basic CMOS data converters of different type, including flash, successive approximation, pipeline, and oversampling types.

UNIT-I
MOS MODELING AND CURRENT MIRRORS:
Large Signal and Small Signal Modeling of MOSFET, Advanced MOS Modeling, Simple CMOS Current Mirror, Common Source, Common Drain, Common Gate amplifiers, Source degenerated current mirrors, High Output Impedance Current Mirrors, cascade gain stage, MOS Differential pair and gain stage, frequency response.

UNIT-II
BASIC OPERATIONAL AMPLIFIER DESIGN AND COMPENSATION:
Two Stage CMOS Operational Amplifier, opamp gain, frequency response, slew rate, systematic offset voltage, Feedback and Operational Amplifier Compensation-linear settling time, opamp compensation, compensating the two stage opamp, lead compensation, compensation independent of process and temperature.

UNIT-III

ADVANCED CURRENT MIRRORS & COMPARATORS:

Advanced Current Mirrors, Folded-Cascode Operational Amplifier, Current Mirror Operational Amplifier, Linear settling time revisited, Fully Differential Operational Amplifier. Common Mode Feedback Circuits, Current Feedback Operational Amplifier. Comparators: using an opamp for a comparator, Charge Injection Error, Latched Comparators, CMOS and Bi CMOS Comparators.

UNIT-IV

SAMPLE AND HOLD &SWITCHED CAPACITOR CIRCUITS:

Sample & Hold Circuits: Performance of Sample & Hold Circuit, MOS Sample and Hold Circuits, CMOS, BiCMOS Sample and Hold Circuits. Switched Capacitor Circuits: Basic Operation and Analysis, First Order and Biquard Filters, Charge Injection, Switched Capacitor Gain Circuit, Correlated Double Sampling Techniques. Other Switched Capacitor Circuits.

UNIT-V

NYQUIST RATE D/A &A/D CONVERTERS:

Introduction to ideal data converters, Quantization Noise, Performance Limitations, Nyquist rate D/A converters: Decoders Based Converters, Binary Scaled Converters, Thermometer-code converters, Hybrid Converters. Nyquist rate A/D converters: Integrating, Successive Approximation, Cyclic, Flash Type, Two Step, Interpolating, Folding, Pipelined A/D Converters.

TEXT BOOKS:

[1] D.A.John& Ken Martin, "*Analog Integrated Circuit Design*", John Wiley, 1997.

REFERENCE BOOKS:

[1] Paul R Gray &Robert G Meyer," *Analysis and Design of Analog Integrated Circuits*", second edition John Wiley & Sons, 4th edition, 2009.

[2] BehzadRazavi, "*Design of Analog CMOS Integrated Circuits*", The McGraw Hill, reprint 2008.

[3] Gregolian&Temes, "*Analog MOS Integrated Circuits*", John Wiley, 1986.