

Course Code	Course Title	L	T	P	C
1152EC104	ANALOG VLSI DESIGN	3	0	0	3

**a) Course Category**

Program elective

**b) Preamble**

The goal of this course is to understand the fundamentals of CMOS analog VLSI design, single-stage, CMOS operational amplifiers, Data Converters and switched Capacitor Circuits

**c) Prerequisite**

Analog Circuits and VLSI design

**d) Related Courses**

Low power VLSI

**e) Course educational objectives**

1. To study the concepts of MOS large signal model and small signal model
2. To understand the characteristics of Data conversion methods and their Performances.
3. To design the CMOS amplifiers.
4. To study about the switched capacitor circuits.

**f) Course Outcomes**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on Revised Bloom's Taxonomy)
CO1	Identify the mathematical models in CMOS analog electronics circuits	K2
CO2	Discuss the Analog CMOS Sub circuits like reference Current Source and current mirrors.	K2
CO3	Apply the Two Stage and cascade Op Amps in CMOS Circuits	K3
CO4	Explain the Data converters in CMOS Circuits	K2
CO5	Describe the effects of Switched capacitance Amplifier and its characteristics.	K2

**g) Correlation of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO1</b>	L	L	L	-	-	-	-	-	-	-	-	-	-	-
<b>CO2</b>	L	L	L	-	-	-	-	-	L	-	-	-	-	-
<b>CO3</b>	M	H	H	H	-	-	L	-	-	-	-	L	-	-
<b>CO4</b>	M	L	L	-	L	-	-	L	-	-	L	L	L	-
<b>CO5</b>	M	L	L	-	-	-	-	-	-	L	-	L	-	-

**h) Course Content**

**UNIT I INTRODUCTION AND CMOS DEVICE MODELING 9**

Introduction of MOS Devices - Challenges in analog design- characteristics large signal model – small signal model- single stage Amplifier-Source follower-Sub threshold MOS model.

**UNIT II ANALOG CMOS SUBCIRCUITS 11**

MOS Diode active resistor, Capacitors and resistors, current sinks and sources, Current mirrors, Current and voltage References, Bandgap Reference

**UNIT III CMOS OPERATIONAL AMPLIFIER 8**

Design of CMOS Op Amps, Compensation of Op Amps, Design Of two stage Op Amps, Power-supply Rejection Ratio of Two stage Op Amps, Cascode Op Amps.

**UNIT IV DATA CONVERTERS 8**

Characterization of Digital to Analog Converters-static Characteristics of DAC-Differential NonLinearity-Integral Non linearity, Characterization of Analog to Digital Converters- static Characteristics of ADC

**UNIT V SWITCHED CAPACITOR CIRCUITS 9**

Resistors Emulation, Analysis Method for switched capacitor circuits using two phase non overlapping clocks, Switched capacitor Amplifier-Summing Amplifier, Switched Capacitor Integrator-Continuous time integrator.

**Total 45 Hrs**

**i) Learning Resources**

**Text Books**

1. Philip E. Allen, Douglas R. Halberg, "CMOS Analog Circuit Design", Oxford University Press, 2<sup>nd</sup> Edition, 2003
2. YannisTsividis,"Mixed Analog-Digital VLSI Devices and Technology",McGraw-Hill Publication, 2<sup>nd</sup> Edition, 1999

**Reference Books**

1. VineethaP.Geji Analog and Mixed Mode Design - Prentice Hall, 1st Edition , 2011
- 2.JeyaGowri Analog and Mixed Mode Design- Sapna publishing House 2011

#### **Online Resources**

1. <https://www.google.co.in/search?hl=en-IN&source=hp&biw=&bih=&q=ANALOG+VLSI+DESIGN+.PPT&btnG=Google+Search&gbv=1>