NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	MTech Semiconductor Technology
Course Code:	6EC361CC24
Course Title:	Analog CMOS Design and Circuits
Course Type:	Departmental Elective
Year of Introduction:	2024-25

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Course Learning Outcomes (CLOs)

At the end of the course, students will be able to

1. analyse the given analog circuit using a large signal, small signal and high-frequency models (BL3)
2. develop an analog signal conditioning circuit using the operational amplifier for the given specific application (BL4)
3. evaluate input signal noise and output signal noise for analog circuit (BL4)
4. design an amplifier using switching capacitors circuits for the given specifications. (BL5)

	Contents	Teaching hours (Total 45)
Unit I	**Introduction to Analog CMOS** Analog Integrated circuit design, Analog signal processing, examples of Analog VLSI mixed-signal circuit design.	**03**
Unit II	**CMOS Device Modelling** Simple MOS large-signal model, a small-signal model for the MOS transistor, sub-threshold MOS model.	**04**
Unit III	**Noise Analysis** Noise in single-stage amplifiers, Noise in Differential amplifiers.	**06**
Unit IV	**Analog CMOS Sub-Circuits** MOS switch, MOS diode/Active resistor, current sinks and sources, Voltage references, current mirrors.	**08**
Unit V	**CMOS Amplifiers** Inverters, differential amplifiers, cascade amplifiers, current amplifiers.	**08**
Unit VI	**CMOS Operational Amplifiers** Design of CMOS OPAMPs, compensation of OPAMPs, Design of a two-stage opamp, measurement parameters of an OPAMP.	**06**
Unit VII	**Comparators and Switched Capacitor Circuits** Characterization of a comparator, Two-stage open-loop comparator. Basic concept, switched capacitor amplifiers, switched-capacitor integrators, Phase Lock Loop.	**10**

Self Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/References:

1. Philip E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design, Oxford University Press.
2. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill.
3. David and Martin, Analog Integrated Circuit Design, Wiley Publication.
4. R. Jacob Baker, CMOS Circuit Design, Layout, and Simulation, Wiley Publication.