# GUJARAT TECHNOLOGICAL UNIVERSITY

M.E. Semester: I

## Signal Processing and VLSI Technology(EC)

Subject Name: **CMOS Circuit Design I**

### (A) Digital Circuit Design:

| Sr.No | Course content |
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| 1. | **Introduction to CMOS Digital Circuit Design:**<br><br>Issues in Digital Integrated Circuit Design, MOSFET Transistor Overview, Process Variations, Future Device Developments, Concept of Static and Dynamic CMOS Circuits, Power Consumption and Power-Delay Product in Static CMOS Inverter, Effects of Technology Scaling on the Performance of CMOS Inverter, Power Consumption in CMOS Gates |
| 2. | **CMOS Arithmetic Circuits:**<br><br>Introduction, Datapaths in Digital Processor Architectures, Various Adder Circuits, Multiplier, Shifter, Other Arithmetic Operators, Power Considerations in Datapath Structures, Perspective – Design as a Trade-off |

### (B) Analog Circuit Design

| Sr.No | Course content |
|---|---|
| 1. | **Introduction to CMOS Analog Circuit Design:**<br><br>Introduction to Analog Design, Basic MOS Device Physics – General Consideration, MOS I/V Characteristics, Second-Order Effects, MOS Device Models |
| 2. | **Single-Stage Amplifiers:**<br><br>Basic Concepts, Common-Source Stage, Source Followe, Common-Gate Stage, Cascode Stage – Folded Cascode |
| 3. | **Differential Amplifiers:**<br><br>Single-Ended and Differential Operation, Basic Differential Pair, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell |
| 4. | **Passive and Active Current Mirrors:**<br><br>Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors |
| 5. | **Frequency Response of Amplifiers:**<br><br>General Considerations, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair |

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| 6. | **Operational Amplifiers:**<br><br>General Considerations, One-stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection, Noise in Op Amps |
| 7. | **Stability and Frequency Compensation:**<br><br>Introduction, Multipole Systems, Phase Margin, Frequency Compensation, Compensation of Two-Stage Op amp, Other Compensation Techniques |

## Reference Books:


1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, TMH
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India
3. CMOS Circuit Design, Layout, and Simulation, R. Jacob Baker, Wiley, 2nd Edition