

EC8003 CMOS ANALOG IC DESIGN

DETAILED SYLLABUS

OBJECTIVES:

- To study the fundamentals of analog circuits and MOS device models
- To gain knowledge on various configurations of MOS transistors and feedback concepts
- To study the characteristics of noise and frequency response of the amplifier
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs

UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors- Cascode current mirrors Active current mirrors- Large and Small signal analysis- Common mode properties.

UNIT II AMPLIFIERS AND FEEDBACK

Basic Concepts – Common source stage- Source follower- Common gate stage- Cascode stage. Single ended and differential operation- Basic Differential pair- Common mode response Differential pair with MOS loads- Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading- Effect of feedback on Noise.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps General consideration of stability and frequency compensation- Multipole system- Phase margin Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

UNIT V SWITCHED CAPACITOR CIRCUITS AND PLLS

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops- Simple PLL Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

TEXT BOOK:

1. Behzad Razavi, —Design of Analog CMOS Integrated CircuitsII, Tata McGraw Hill, 2001, 33rd re-print, 2016.

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REFERENCES:

1. Phillip Allen and Douglas Holmberg —CMOS Analog Circuit Design|| Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009
3. Grebene, —Bipolar and MOS Analog Integrated circuit design||, John Wiley & sons, Inc., 2003