PET6J008   ANALOG VLSI DESIGN

MODULE – I (10 HOURS)

1. **Introduction to Analog Design-** General Concepts, Levels of Abstraction, Robust Analog Design.
2. **Single-Stage Amplifiers-** Basic Concepts, Common-Source Stage, Common-Source Stage with Resistive Load, CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode.
3. **Differential Amplifiers-** Single-Ended and Differential Operation, Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell.

MODULE – II (12 HOURS)

4. **Passive and Active Current Mirrors-** Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties.
5. **Band gap References-** General Considerations, Supply-Independent Biasing, Temperature-Independent References, Negative-TC Voltage, Positive-TC Voltage, Bandgap Reference.

MODULE-III (7 HOURS)

6. **Operational Amplifiers-** General Considerations, Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection.
7. **Frequency Response of Amplifiers-** General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair.

MODULE – IV (7 HOURS)

8. **Feedback-** General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise.

ADDITIONAL MODULE (TERMINAL EXAMINATION-INTERNAL)

9. **Oscillators-** General Considerations, Ring Oscillators, LC Oscillators, Crossed-Coupled Oscillator, Colpitts Oscillator, One-Port Oscillators, Voltage-Controlled Oscillators, Tuning in Ring Oscillators, Tuning in LC Oscillators, Mathematical Model of VCOs.

TEXT BOOKS
1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, Tata McGraw-Hill Publishing Company Limited, 2002.
2. CMOS Analog Circuit Design, D. Holberg and P. Allen, Oxford University Press, 2013.

REFERENCE BOOKS
1. Analysis and Design of Analog Integrated Circuits,P. Gray, P. Hurst, S. Lewis, and R. Meyer, John Wiley, 4th Edition, 2001.
2. Fundamentals of Microelectronics, BehzadRazavi, John Wiley, 1st Edition, 2008.
3. Analog Integrated Circuit Design, D. Johns and K. Martin, John Wiley, 1997.
4. Design of Analog Integrated Circuits and Systems, K.R. Laker and W.M.C. Sansen, McGraw-Hill, Inc., 1994.
5. Microelectronic Circuits, A. Sedra and K.C. Smith, Oxford University Press,5th Edition, 2004.