PCCMECE101
ANALOG INTEGRATED CIRCUIT DESIGN

UNIT I

Introduction to the semiconductor industry, introduction to layouts and industry design flow for analog circuits (design flow for analog circuits, introduction to layout, case study), Single Stage MOS Amplifiers, analysis of CG amplifier, Analysis of CS amplifier with source degeneration, analysis of cascode and folded cascade, cascade as a current source.

UNIT II

Introduction to current mirror, simple CMOS current mirror, source-degenerated current mirror, small-signal analysis, large-signal analysis (PA), and common mode properties of current mirror, Differential amplifier (single ended operation, differential mode operation, common mode response, common mode rejection), Differential amplifier (differential pair with active loads, cascade differential amplifier), Gilbert Cell.

UNIT III

Frequency Response, fundamental concepts, relationship between transfer function and frequency response, Bode's Rules, Association of Poles with Nodes, Miller Effect and Miller's Theorem and its dual, General Frequency Response, Frequency Response of CS Amplifier, Frequency Response of Differential Amplifier, Feedback, Feedback Topologies, Properties of Feedback Circuits, Stability in Feedback Systems.

UNIT IV

Multi-stage Op Amps (one-stage and two- stage Op Amps, Comparison, Common-Mode Feedback, Input Range Limitations, Slew Rate), Noise in CMOS Circuits (Concepts, PSD, PDF, Noise in Single Stage Amplifier).

UNIT V

High speed and low noise amplifiers, Output stage amplifiers, Oscillators.

Recommended Books:

1. Design of Analog CMOS Circuits, Behzad Razavi, Tata McGraw Hill
2. CMOS Analog Circuit Design, Allen and Holberg, 3rd Indian Edition, Oxford University Press
3. Analysis and Design of Analog Integrated Circuits, Gray, Paul R., et al. John Wiley & Sons
4. Trade-offs in Analog Circuit Design: the designer's companion, by Toumazou, Chris, Moschytz, and Barrie Gilbert, eds. Springer Science & Business Media, 2004.
5. Analog Integrated Circuit Design by Tony Chan Carusone, David A. Johns, Kenneth W. Martin, John Wiley & Sons, Inc

PCCMECE102
ADVANCED DSP

UNIT I

Review of Discrete time signals and systems and frequency analysis of discrete time linear time invariant systems: Discrete time systems, analysis of discrete time linear invariant systems, implementation of discrete time systems, correlation of discrete time systems, z-transforms, linear time invariant systems as frequency selective filters. Sampling, The Discrete Fourier transforms its properties and applications. Frequency domain sampling, properties of DFT, linear filtering methods based on DFT, Frequency analysis of signals using the DFT, Design of Digital filters, Design of FIR filters, Design of IIR filters.

UNIT II

Multirate Digital Signal Processing: Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling Rate Conversion by a Rational Factor I/D, Filter Design and Implementation for sampling rate Conversion, Multistage Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Bandpass Signals.

UNIT III

Linear Prediction and Optimum Linear Filters: Innovations Representation of a Stationary Random Process, Forward and Backward linear prediction, Solution of the Normal Equations, Properties of linear prediction-Error Filter, AR Lattice and ARMA Lattice-Ladder Filters.

UNIT IV

Power Spectral Estimation: Estimation of Spectra from Finite Duration Observations of a signal, the Periodogram, Use DFT in power Spectral Estimation, Bartlett, Welch and Blackman, Tukey methods, Comparison of performance of Non-Parametric Power Spectrum Estimation Methods ,Parametric Methods for power spectrum estimation, Relationship between Auto-Correlation and Model Parameters, AR (Auto-Regressive) Process and Linear Prediction, Yule-Walker, Burg and Unconstrained Least Squares Methods, Sequential Estimation, Moving Average(MA) and ARMA Models Minimum Variance Method, Piscaranko's Harmonic Decomposition Methods, MUSIC Method.

Recommended Books:

1. Digital Signal Processing Principles, Algorithms, and Applications John G. Proakis, Prentice Hall International.Inc, 4th Edition, 2012.
2. Theory and Application of Digital Signal Processing by Lawrence R.Rabiner and Bernard Gold.
3. Oppenheim, Alan V. Discrete-time signal processing. Pearson Education India, 1999.
4. Mitra, Sanjit Kumar, and Yonghong Kuo. Digital signal processing: a computer-based approach. Vol. 2. New York: McGraw-Hill Higher Education, 2006.

Simulation Books:

1.Samuel D Stearns, "Digital Signal Processing with examples in Matlab. "CRC Press.
2. ES Gopi. "Algorithm collections for Digital Signal Processing Applications using Matlab, "Springer.
3.Taan S.Elali, "Discrete Systems and Digital Signal Processing with Matlab," CRC Press,2005.

PCCMECE102L
ADVANCED DSP LAB

List of Experiments:

1. Generate various fundamental discrete time signals.

2. Basic operations on signals (Multiplication, Folding, Scaling).

3. Find out the DFT & IDFT of a given sequence without using inbuilt instructions.

4. Interpolation & decimation of a given sequence.

5. Generation of DTMF (Dual Tone Multiple Frequency) signals.

6. Estimate the PSD of a noisy signal using periodogram and modified periodogram.

7. Estimation of PSD using different methods (Bartlett, Welch, Blackman-Tukey).

8. Design of Chebychev Type I,II Filters.

9. Cascade Digital IIR Filter Realization.

10. Parallel Realization of IIR filter.

11. Estimation of power spectrum using parametric methods (yule-walker & burg).

12. Design of LPC filter using Levinson-Durbin algorithm.

13. Time-Frequency Analysis with the Continuous Wavelet Transform.

14. Signal Reconstruction from Continuous Wavelet Transform Coefficients.

Tools Required: MATLAB, MATLAB supported DSP hardware.

PCCMECE103L
ADVANCED COMPUTATION AND SIMULATION TOOLS

Part-I: MATLAB

- M files: Working with script tools, Writing Script file, executing script files, The MATLAB Editor, Saving m files.
- Plots: Plotting vector and matrix data, Plot labelling, curve labelling and editing, 2D and 3D plotting, surface, mesh and grid plotting.
- GUI Design: Introduction of Graphical User Interface, GUI Function Property, GUI Component Design, GUI Container, Writing the code of GUI Callback, Dialog Box, Menu Designing, Applications.
- MATLAB Simulink: Introduction of Simulink, Simulink Environment & Interface, Study of Library, Circuit Oriented Design, Equation Oriented Design, Model, Subsystem Design, Connect Call back to subsystem, Application.
- MATLAB Programming: Automating commands with scripts, Writing programs with logic and flow control, Writing functions, Control statement Programming, Conditional Statement Programming, Examples.
- Image Processing with MATLAB: Importing and Visualizing Images, Importing and displaying images, Converting between image types, Exporting images, Interactive Exploration of Images.
- Symbolic Math in MATLAB: Calculus-Numerical Integration, Linear Algebra, Roots of Polynomials, Algebraic equations, Differential Equations (1st & 2nd order), Transforms (Fourier, Laplace, etc), Ordinary Differential equations, Examples of few ODEs.

Part–II: ORCAD

- **OrCAD Capture CIS (Electronic Schematic design software)**

- Introduction to OrCAD Capture
- Introduction to component database
- How to place the parts in the design
- Connecting the parts with wire, bus, net alias and power symbol in the design
- How to modify the properties of the parts (Property Editor)
- How to edit the physical appearance of the parts (Part Editor)
- How to create a new library
- How to create a new part
- How to work in Multi sheet projects
- How to make connectivity between schematic pages
- Design Processing (Annotate, Back Annotate, DRC, Create Netlist, Cross reference parts and BOM)

- **OrCAD PSpice (Electronic circuit simulation software)**

- Modifying Schematic for Simulation
- PSpice Netlist creation
- Error identification and rectification (DRC Markers)

- Creation and configuration of Simulation profile.
- Bias Point analysis (To display DC bias values)
- Transient analysis (Time domain Response)
- Single Window, Single window with multiple Y-axis, Split window and Multi window representation
- Parametric analysis (Design response variation with respect to Design element parameters)
- DC Sweep analysis (Design response variation with respect to DC parameters)
- AC Sweep analysis (Design response variation with respect to Frequency)

Part III: PYTHON

1. Python interpreter and interactive mode; values and types, variables, expressions, statements,
2. Tuple assignment, precedence of operators, comments; modules and functions
3. Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.
4. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elifelse);
5. Iteration: state, while, for, break, continue, pass;
6. Fruitful functions: return values, parameters, local and global scope, function composition, recursion;
7. Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.
8. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.
9. Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters.
10. Tuples: tuple assignment, tuple as return value;
11. Dictionaries: operations and methods; advanced list processing – list comprehension;
12. Illustrative programs: selection sort, insertion sort, mergesort, histogram.
13. Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

PCCMECE104
RESEARCH METHODOLOGY & LANGUAGE

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

UNIT II

Approaches of investigation of solutions for research problems, data collection, analysis, interpretation, Necessary instrumentations. Effective literature studies approach, analysis, Plagiarism, Research ethics.

UNIT III

Effective technical writing, how to write report, Paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT VI

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

UNIT VII

Writing Practices; Comprehension; Précis Writing; Essay Writing. Oral Communication (This unit involves interactive practice sessions in Language Lab); Listening Comprehension; Pronunciation, Intonation, Stress and Rhythm; Common Everyday Situations: Conversations and Dialogues; Communication at Workplace; Interviews; Formal Presentations;

Recommended Books:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
- Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
- Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd
- On Writing Well. William Zinsser. Harper Resource Book.
- Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press.
- Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press.
- Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press