B.TechIV-II Semester(ECE)

S. No.	Course Code	Subject	L	T	P	C
1.	15A04801 15A04802	**MOOCS-II*** a. Advanced Digital Signal Processing-Multirate & Wavlet b. Low Power VLSI Circuits & Systems	3	1	-	3
2.	15A04803 15A04804	**MOOCS-III *** a. Pattern Recognition & Applications b. RF Integrated Circuits	3	1	-	3
3.	15A04805	Comprehensive Viva Voce	-	-	4	2
4.	15A04806	Technical Seminar	-	-	4	2
5.	15A04807	Project Work	-	-	24	12
		Total:	**6**	**02**	**32**	**22**

2 Theory + 1 Comprehensive Viva voce + 1 Technical Seminar + 1 Project work
*Either by MOOCS manner or Self-study or Conventional manner

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3	1	0	3

15A04801 ADVANCED DIGITAL SIGNAL PROCESSING-MULTIRATE & WAVELET (MOOCS-II)

Course Objectives:

- To study about the digital signal processing algorithms and multi rate signal processing
- To study about the power spectral estimation by using Barlett, Welch &Blackmann& Tukey methods.
- The study about the effects of finite word length in fixed-point dsp systems.

Course Outcomes:

After completion of the course students will be able to

- Get complete knowledge regarding various algorithms associated with Digital signal processing and multi rate signal processing.
- Verify the power spectral estimation by using Barlett, Welch &Blackmann& Tukey methods.
- Understand the effects of finite word length in fixed-point DSP systems by using ADC and FFT algorithms

UNIT – I

A Beginning with some practical situations, which call for multi-resolution/ multi-scale analysis - and how time-frequency analysis and wavelets arise from them. Examples: Image Compression, Wideband Correlation Processing, Magnetic Resonance Imaging, Digital CommunicationPiecewise constant approximation - the Haar wavelet, Building up the concept of dyadic Multi-resolution Analysis (MRA), Relating dyadic MRA to filter banks.

UNIT – II

A review of discrete signal processing, Elements of multi-rate systems and two-band filter bank design for dyadic wavelets.Families of wavelets: Orthogonal and bi-orthogonal wavelets, Daubechies' family of wavelets in detail, Vanishing moments and regularity, Conjugate Quadrature Filter Banks (CQF) and their design, Dyadic MRA more formally, Data compression - fingerprint compression standards, JPEG-2000 standards.

UNIT – III

The Uncertainty Principle: and its implications: the fundamental issue in this subject - the problem and the challenge that Nature imposes. Theimportances of the Gaussian function: the Gabor Transform and its generalization; time, frequency and scale - their interplay, The Continuous Wavelet Transform (CWT), Condition of admissibility and its implications. Application of the CWT in wideband correlation processing.

UNIT – IV

Journey from the CWT to the DWT: Discretization in steps, Discretization of scale - generalized filter bank, Discretization of translation - generalized output sampling, Discretization of time/ space (independent variable) - sampled inputs, Going from piecewise linear to piecewise polynomial, The class of spline wavelets - a case for infinite impulse response (IIR) filter banks, Variants of the wavelet transform and its implementation structures, the wave packet transform, Computational efficiency in realizing filter banks - Polyphase components, The lattice structure, The lifting scheme.

UNIT – V

An exploration of applications (this will be a joint effort between the instructor and the class).Examples: Transient analysis; singularity detection; Biomedical signal processing applications; Geophysical signal analysis applications; Efficient signal design and realization: wavelet based modulation and demodulation; Applications in mathematical approximation; Applications to the solution of some differential equations; Applications in computer graphics and computer vision; Relation to the ideas of fractals and fractal phenomena.

Textbooks:

1. Howard L. Resnikoff, Raymond O.Wells, “Wavelet Analysis: The scalable Structure Information,” Springer, 1998 available in India edition.
2. K. P. Soman, K. I. Ramachandran, "Insight Into Wavelets - From Theory to Practice", Prentice Hall of India, Eastern Economy Edition, Prentice Hall of India Private Limited, M-97, Connaught Circus, New Delhi - 110 001, Copyright 2004, ISBN Number 81-203-2650-4.
3. Michael W. Frazier, “An Introduction to Wavelets through Linear Algebra”, Springer, ISBN 3-540-780-75-0, c 1999.

4. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson Education, Low Price Edition, ISBN 81 – 7758 – 942 – 3.

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B. Tech IV-IISem. (ECE)	**L**	**T**	**P**	**C**
	3	**1**	**0**	**3**

15A04802 LOW POWER VLSI CIRCUITS AND SYSTEMS (MOOCS-II)

Course Outcomes :

After completion of this subject, students will be able to

- Under stand the concepts of velocity saturation, Impact Ionization and Hot Electron Effect
- Implement Low power design approaches for system level and circuit level measures.
- Design low power adders, multipliers and memories for efficient design of systems.

UNIT I

Introduction, Historical background, why low power, sources of power dissipations, low-power design methodologies.

MOS Transistors: introduction, the structure of MOS Transistor, the Fluid model, Modes of operation of MOS Transistor, Electrical characteristics of MOS Transistors, MOS Transistors as a switch.

UNIT II

MOS Inverters: introduction, inverter and its characteristics, configurations, inverter ratio in different situations, switching characteristics, delay parameters, driving parameters, driving large capacitive loads.

MOS Combinational Circuits: introduction, Pass-Transistor logic, Gate logic, MOS Dynamic Circuits.

UNIT III

Sources of Power Dissipation: introduction, short-circuit power dissipation, switching power dissipation, glitching power dissipation, leakage power dissipation.

Supply voltage scaling for low power: introduction, device features size scaling, architecture-level approaches, voltage scaling, multilevel voltage scaling, challenges, dynamic voltage and frequency scaling, adaptive voltage scaling.

UNIT IV

Minimizing Switched Capacitance:introduction, system-level approaches, transmeta's Crusoe processor, bus encoding, clock gating, gated-clock FSMs, FSM state encoding, FSM Partitioning, operand isolation, precomputation, logic styles for low power.

UNIT V

Minimizing Leakage Power: introduction, fabrication of multiple threshold voltages, approaches for minimizing leakage power, Adiabatic Logic Circuits, Battery-Driven System, CAD Tools for Low Power VLSI Circuits.

TEXT BOOKS

1. Ajit. Pal, Low power VLSI Circuits and systems, springer
2. Sung Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata Mcgrag Hill.
3. Neil H. E. Weste and K. Eshraghian, Principles of CMOS VLSI Design, 2nd Edition, Addison Wesley (Indian reprint).
4. A. Bellamour, and M. I. Elmasri, Low Power VLSI CMOS Circuit Design, Kluwer Academic Press, 1995.
5. Anantha P. Chandrakasan and Robert W. Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.

REFERENCES

1. Kaushik Roy and Sharat C. Prasad, Low-Power CMOS VLSI Design, Wiley-Interscience, 2000.

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15A04803 PATTERN RECOGNITION & APPLICATIONS (MOOCS-III)

UNIT – I

Introduction: Feature extraction and Pattern Representation Concept of Supervised and Unsupervised classification Introduction to Application Areas.

UNIT – II

Statistical Pattern Recognition

Bayes Decision Theory, Minimum Error and Minimum Risk Classifiers, Discriminant Function and Decision Boundary Normal Density, Discriminant Function for Discrete Features, Parameter estimation

UNIT – III

Dimensionality Problem

Dimension and accuracy, Computational Complexity, Dimensionality Reduction, Fisher Linear Discriminant, Multiple Discriminant Analysis

Nonparametric Pattern Classification

Density Estimation, Nearest Neighbour Rule, Fuzzy Classification

UNIT – IV

Linear Discriminant Functions Separability, Two Category and Multi Category Classification, Linear Discriminators, Perceptron Criterion, Relaxation Procedure, Minimum Square Error Criterion, Widrow-Hoff Procedure, Ho-Kashyap Procedure, Kesler's Construction.

Neural Network Classifier Single and Multilayer Perceptron, Back Propagation Learning, Hopfield Network, Fuzzy Neural Network

UNIT – V

Time Varying Pattern Recognition

First Order Hidden Markov Model, Evaluation, Decoding, Learning

Unsupervised Classification

Clustering, Hierarchical Clustering, Graph Based Method, Sum of Squared Error TechniqueIterative Optimization

Textbooks:

1. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", JohnWiley& Sons, 2001.
2. Earl Gose, Richard Johsonbaugh and Steve Jost, "Pattern Recognition and Image Analysis", Prentice Hall, 1999.

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15A04804 RF INTEGRATED CIRCUITS (MOOCS-III)

UNIT – I

Introduction RF systems – basic architectures, Transmission media and reflections, Maximum power transfer , Passive RLC Networks, Parallel RLC tank, Q, Series RLC networks, matching, Pi match, T match, Passive IC Components Interconnects and skin effect, Resistors, capacitors Inductors

UNIT – II

Review of MOS Device Physics - MOS device review, Distributed Systems, Transmission lines, reflection coefficient, the wave equation, examples, Lossy transmission lines, Smith charts – plottingGamma, High Frequency Amplifier Design, Bandwidth estimation using open-circuit time constants, Bandwidth estimation, using short-circuit time constants, Rise time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers, Cascaded amplifiers

UNIT - III

Noise - Thermal noise, flicker noise review, Noise figure, LNA Design, Intrinsic MOS noise parameters, Power match versus, noise match, large signal performance, design examples & Multiplier based mixers. Mixer Design, Subsampling mixers.

UNIT – IV

RF Power Amplifiers, Class A, AB, B, C amplifiers, Class D, E, F amplifiers, RF Power amplifier design examples, Voltage controlled oscillators, Resonators, Negative resistance oscillators, Phase locked loops, Linearized PLL models, Phase detectors, charge pumps, Loop filters, and PLL design examples

UNIT - V

Frequency synthesis and oscillators, Frequency division, integer-N synthesis, Fractional frequency, synthesis, Phase noise, General considerations, and Circuit examples, Radio architectures, GSM radio architectures, CDMA, UMTS radio architectures

Textbooks:

1. The design of CMOS Radio frequency integrated circuits by Thomas H. Lee Cambridge university press, 2004.
2. RF Micro Electronics by BehzadRazavi, Prentice Hall, 1997.