JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure Electronics and Communication Engineering

B. Tech Course
(2013-14)

IV B. Tech – II Sem

S.No.	Course Code	Subject	Theory	Tu	Lab	Credits
1	13A04801 13A04802	MOOC-I* a. Adaptive Signal Processing b. Advanced 3G & 4G wireless Communications	3	1	-	3
2	13A04803 13A04804	MOOC-II* a. Advanced Digital Signal Processing-Multirate & Wavelet b. RF integrated Circuits	3	1	-	3
3	13A04805 13A04806	MOOC-III* a. Pattern Recognition & Application b. Linux Programming & Scripting	3	1	-	3
4	13A04807	Technical Seminar	-	-	4	2
5	13A04808	Project Work	-	-	24	12
		Total	**09**	**03**	**28**	**23**

3 Theory + 1 Technical Seminar + 1 Project work

*Either by MOOCS manner or Self study or Conventional manner

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B.Tech IV-I Sem (E.C.E)	**T**	**Tu**	**C**
	3	**1**	**3**

(13A04801) ADAPTIVE SIGNAL PROCESSING

Course Objective:

- To study in detail about adaptive Systems.
- To study about various Linear optimum filtering techniques.
- To study about various techniques related Linear and Non Linear adaptive filtering.

Course outcome:

After the course students is expected to be able to:

- Get complete knowledge regarding adaptive systems
- Design various Linear optimum filters by employing different techniques associated withthem
- Understand various techniques related to with Linear and Non linear adaptive filtering and their design considerations

UNIT I:

Introduction to Adaptive Systems: Eigen Analysis - Eigen Value problem, Properties of eigen values and eigen vectors, Eigen filters, Eigen value computations, Adaptive Systems - Definitions, Characteristics, Applications and Examples of Adaptive systems, The adaptive linear combiner – Description, weight vectors, Desired response performance function, Gradient and Mean square error(MSE).

UNIT II:

Linear Optimum Filtering: Wiener Filters – Linear optimum filtering, Principle of Orthogonality, Wiener-Hopf equations, Error performance surface, Channel Equalization, Linearly constrained minimum variance filter, Linear Prediction – Forward and Backward linear prediction, Levinson-Durbin Algorithm, Properties of prediction error filters, AR modeling of stationary stochastic process, Lattice predictors, Joint process estimation, Kalman Filters - Recursive mean square estimation for scalar random variables, Kalman filtering problem, The innovations process, Estimation of the state using innovations process, Filtering, Initial conditions, Variants of the Kalman filter, Extended Kalman filter, Problem Solving.

UNIT III:

Linear Adaptive Filtering-I: Method of Steepest descent algorithm and its stability, Least Means Square (LMS) algorithm – Structure & operation of LMS algorithm, Examples, Stability & performance analysis of the LMS algorithm, Simulations of Adaptive equalization using LMS algorithm, Convergence aspects, Method of Least Squares (LS) - Statement, Data

windowing, Minimum sum of error squares, Normal equations and linear least squares filters, Properties.

UNIT IV:

Linear Adaptive Filtering-II Recursive Least Squares (RLS) Algorithm – Matrix inversion lemma, The exponentially weighted RLS algorithm, Update recursion for the sum of weighted error squares, Example, Convergence Analysis, Simulation of adaptive equalization using RLS algorithm, Order Recursive Adaptive Filters – Adaptive forward and backward linear prediction, Least squares Lattice predictor, QR-Decomposition based Least squares Lattice filters & their properties, Simulation of Adaptive equalization using Lattice Filter.

UNIT V:

Non linear Adaptive Filtering: Blind deconvolution – Theoretical and practical considerations, Bussgang algorithm for blind equalization for real base band channels, Special cases of Bussgang algorithm, Simulation studies of Bussgang algorithms, SVD, Problem solving.

Text Books:

1. Simon Haykin, "Adaptive Filter Theory," Prentice Hall, 4th Edition, 2002.
2. Bernard Widrow, Samuel D. Strearns, "Adaptive Signal Processing," Prentice Hall, 2005.

References:

1. Paulo S.R. Diniz, Adaptive Filtering Algorithms and Practical Implementation, Third Edition,Springer, Kluwer Academic Publishers.
2. Alexander D Poularikas, Zayed M Ramadan, Adaptive Filtering Primer with MATLAB, CRC Press Taylor & Francis Group, 2008 Indian Edition.
3. Ali H. Sayed, Adaptive filters, IEEE Press, Wiley-Interscience, A john Wiley & Sons, INC.,Publication. 4. S. Thomas Alexander, "Adaptive Signal Processing-Theory & Applications," Springer –Verlag, 1986

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(13A04802) ADVANCED 3G & 4G WIRELESS COMMUNICATIONS

UNIT-I

Wireless Communications and Diversity:

Introduction to 3G/4G Standards, Wireless Channel and Fading, Rayleigh Fading and BER of Wired Communication, BER for Wireless Communication, Introduction to Diversity, Multi-antenna Maximal Ratio Combiner, BER with Diversity, Spatial Diversity and Diversity Order,

UNIT-II

Broadband Wireless Channel Modelling: Wireless Channel and Delay Spread, Coherence Bandwidth of the Wireless Channel, ISI and Doppler in Wireless Communications, Doppler Spectrum and Jakes Model,

Cellular Communication:Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Teletraffic Theory.

UNIT-III

CDMA: Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization.

OFDM: Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues – PAPR, Frequency and Timing Offset Issues.

UNIT-IV

MIMO: Introduction to MIMO, MIMO Channel Capacity, SVD and Eigenmodes of the, MIMO Channel , MIMO Spatial Multiplexing – BLAST, MIMO Diversity – Alamouti, OSTBC, MRT, MIMO - OFDM.

UWB (Ultra wide Band): UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit-Error Rate Performance of UWB.

UNIT-V

3G and 4G Wireless Standards-GSM, GPRS, WCDMA, LTE, WiMAX

Text Books:

1. Principles of Modern Wireless Communication Systems-Aditya K. Jagannatham, Publisher-McGraw Hill..

2. Fundamentals of Wireless Communications – David Tse and PramodViswanath, Publisher - Cambridge University Press.

3. Wireless Communications: Andrea Goldsmith, Cambridge University Press.

References:

1. Wireless Communications: Principles and Practice –Theodore Rappaport - Prentice Hall.

2. MIMO Wireless Communications – EzioBiglieri – Cambridge University Press.

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(13A04803) ADVANCED DIGITAL SIGNAL PROCESSING- MULTIRATE & WAVELET

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.The importance 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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(13A04804) RF INTEGRATED CIRCUITS

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.

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(13A04805) PATTERN RECOGNITION & APPLICATION

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 Technique Iterative 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 ImageAnalysis", Prentice Hall, 1999.

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(13A04806) LINUX PROGRAMMING & SCRIPTING

Course Objectives:

- The goal of the course is the study of scripting languages such as PERL, TCL/TK , Python and BASH
- Creation of programs in the Linux environment
- The study of the principles of scripting languages
- The study of usage of scripting languages in IC design flow

Learning Outcomes:

- Ability to create and run scripts using Perl / TCL / Python in IC design flow • Ability to use Linux environment and write programs for automation of scripts in VLSI tool design flow

UNIT 1

LINUX BASICS: Introduction to Linux , File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group , Permissions for file , directory and users, Searching a file & directory, zipping and unzipping concepts

UNIT 2

LINUX NETWORKING: Introduction to Networking in Linux, Network basics & tools, File transfer protocol in Linux, Network file system , Domain Naming Services, Dynamic hosting configuration Protocol & Network information Services.

UNIT 3

PERL SCRIPTING: Introduction to Perl Scripting ,Working with Simple Values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting ,References &Subroutines , Running and Debugging Perl, Modules, Object-Oriented Perl.

UNIT 4

TCL/ TK SCRIPTING: Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures ,Control Flow Commands, Procedures and Scope , Evel, Working With UNIX, Reflection and Debugging, Script Libraries, Tk Fundamentals ,Tk by Examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and Listbox Widgets Focus, Grabs and Dialogs

UNIT 5

PYTHON SCRIPTING : Introduction to Python, Using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

References:

1. Instructor reference material

2. Python Tutorial by Guido van Rossum, and Fred L. Drake, Jr., editor, Release 2.6.4

3. Practical Programming in Tcl and Tk by Brent Welch , Updated for Tcl 7.4 and Tk 4.0

4. Teach Yourself Perl 5 in 21 days by David Till.