VIGNAN'S UNIVERSITY

DEPARTMENT OF ELECTRONICS AND COMMUNCATION ENGINEERING

10th July, 2017

Minutes of the BoS meeting held on 10/07/2017

The following External members attended the BoS meeting on 10/07/2017

1. Dr. N. V.S.N. Sharma Professor, NIT Warangal.
2. Mr. P. Haribabu, Scientist, CDAC, Bangalore

The following Internal members attended the BoS meeting

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. Babburi Seetha Ramanjaneyulu. Professor, ECE
3. Dr. M.S.S. Rukmini, Professor, ECE
4. Dr. Jakeer Hussain Shaik, Professor, ECE

The Members of Board of Studies (BoS) reviewed the courses recommended by the Doctoral Review Committee for Pre-PhD course work for PhD in Electronics and Communication Engineering. The members have approved the following list of courses after through discussion and these will be offered in addition to existing courses in M.Tech programes offered by the ECE department.

1. Biomedical signal processing
2. Fundamentals of massive MIMO
3. Compressive sensing
4. Speech processing
5. Convex optimization
6. Physically unclonable functions constructions, properties & applications
7. Antenna theory

8. Biomechanics
9. Microwave & Millimeter wave circuits
10. Broadband wireless technologies
11. Channel coding
12. Wireless & cellular communications
13. Micro strip antenna
14. Microwave measurements
15. Meta materials
16. Advanced digital communications

Annexure –I -Letter from DRC Members.

Chairman, BoS

Annexure –I

Syllabus Copy

BIOMEDICAL SIGNAL PROCESSING

Unit-I : Biomedical signal origin
Preliminaries; Biomedical signal origin & dynamics (ECG) : the EEG Signal and its characteristics; Biomedical signal origin & dynamics (EEG, EMG etc.);
Filtering for Removal of artifacts Statistical Preliminaries – random noise, structured noise, stationary vs non stationary processes; Time domain filtering (Synchronized Averaging, Moving Average, Derivative-based operator to remove low frequency)

Unit-II : Frequency Domain Filtering
Removal of High-Frequency noise: butterworthlowpass filters; Removal of Low-Frequency noise: butterworthhighpass filters; Removal of periodic artifacts: Notch and Comb Filters.
Optimal Filtering: The Weiner Filter, Adaptive Filters for Removal of interference : the adaptive noise canceller, the least mean squares adaptive filter, the recursive least square adaptive filter.

Unit-III : Event Detection
P, QRS and T wave in ECG, Derivative based Approaches for QRS Detection, Pan Tompkins Algorithm for QRS Detection, Detection of Dicrotic Notch, Correlation Analysis of EEG Signal.

Unit-IV : Waveform Analysis
Illustrations of problem with case studies: The QRS complex in the case of bundle-branch block, The effect of myocardial ischemia and infarction on QRS waveshape, ectopic beats, EMG interference pattern complexity, PCG intensity patterns.
Morphological Analysis of ECG: Correlation coefficient, The Minimum phase correspondent and Signal Length
Envelop Extraction & analysis: Amplitude demodulation, The Envelogram Analysis of activity Root Mean Square value, Zero-crossing, rate Turns Count, Form factor.

Unit-V : Frequency-domain Analysis
Averaged Periodogram Blackman-Tukey Spectral Estimator Daniellâ€™s Spectral Estimator, Measures derived from PSDs: moments of PSD functions, Spectral power ratios.

Text Book:

1. RANGARAJ M.RANGAYYAN, "Biomedical Signal Analysis: A case-study approach" , wiley interscience-2002.

Reference books:

1. D.C. Reddy, "Biomedical Signal Processing: principles and techniques", Tata McGraw Hill, New Delhi, 2005
2. MetinAkay, "Biomedical Signal Processing", Academic press, Inc.
3. Bruce, "Biomedical Signal Processing & signal modeling," wiley, 2001.

FUNDAMENTALS OF MASSIVE MIMO

UNIT-I

Introduction: Point-to- point MIMO, Multi-user MIMO, Massive MIMO, Time Division verses Frequency Division Duplexing

Models and Preliminaries: Single-Antenna Transmitter and Single-Antenna Receiver, Coherence Time, Coherence Bandwidth, Coherence Interval, Interpretation of T_c and B_c in Terms of Nyquist Sampling Rate, TDD Coherence Interval Structure

UNIT-II

Single Cell Systems: Uplink Pilots and Channel Estimation: Orthogonal Pilots, De-Spreading of the Received Pilot Signal, MMSE Channel Estimation

Uplink Data Transmission: Zero-Forcing, Maximum-Ratio

Downlink Data Transmission: Linear Precoding, Zero-Forcing, Maximum-Ratio

UNIT-III

Multi Cell Systems: Uplink Pilots and Channel Estimation, Uplink Data Transmission, Zero-Forcing, Maximum-Ratio, Downlink Data Transmission, Zero-Forcing, Maximum-Ratio

UNIT- IV

Massive MIMO Propagation Channel: Favorable Propagation and Deterministic channels, Favorable Propagation and Random Channels, Finite-Dimensional Channels

UNIT- V

Capacity and Capacity Bounding Tools: Jensen's Inequality, Point-to-Point Scalar Channel Point-to-Point MIMO Channel, Multiuser MIMO Channel

Test Books

1. Thomas L. Marzetta, Erik G. Larsson, Hong Yang and HienQuoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016.

2. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press 2005.

Reference Books:

1. EzioBiglieri , Robert Calderbank et al "MIMO Wireless Communications" Cambridge University Press 2007.

2. Daniel W. Bliss and Siddhartan Govindasamy, "Adaptive Wireless Communications: MIMO Channels and Networks", Cambridge University Press, 2013.

COMPRESSIVE SENSING

UNIT I: Introduction to Compressive Sensing, Sparse and Compressible Signal Models.

UNIT II: Uniqueness and Uncertainty, General Sparse Signal Representations using Dictionaries. Dictionary Analysis.

UNIT III: Compressive Sensing and Sensing Matrices, Sensing Matrices for Exact Recovery, Recovery in the Presence of Noise,

UNIT IV: Sub-Gaussian Distributions and Sensing Matrices.

UNIT V: Recovery via l1 Minimization, Algorithms for Sparse Recovery, Applications.

Text Books: There is no required text but the following titles may prove useful

1. Probability and Random Processes by G. Grimmett and D. Stirzaker, 3rd. ed., Oxford University Press
2. Random Matrices by M. Mehta, 3rd ed., New York: Academic Press
3. Function Estimation and Gaussian Sequence Models by I. Johnstone.

Reference Books:

1. All of Statistics by L. Wasserman, Springer
2. Numerical Linear Algebra by LLoyd N. Trefethen and David Bau, III, SIAM
3. Convex Optimization by S. Boyd and L. Vandenberghe, Cambridge University Press
4. Introductory Lectures on Convex Optimization: A Basic Course by Y. Nesterov, Kluwer Academic Publisher
5. A Wavelet Tour of Signal Processing by S. Mallat, 3rd ed., Academic Press
6. Discrete Time Signal Processing by A. Oppenheim and R. Schafer, Prentice Hall.

SPEECH PROCESSING

Unit-I Introduction to speech processing, Digitization and Recording of speech signal, Review of Digital Signal Processing Concepts

Unit-II Human Speech production, Acoustic Phonetics and Articulatory Phonetics, Different categories speech, sounds and Location of sounds in the acoustic waveform and spectrograms, Uniform Tube Modeling of Speech Production, Speech Perception

Unit-III Time Domain Methods in Speech Processing, Analysis and Synthesis of Pole-Zero Speech Models, Short-Time Fourier Transform, Analysis:- FT view and Filtering view, Synthesis:-Filter bank summation (FBS) Method and OLA Method.

Unit-IV Features Extraction, Extraction of Fundamental frequency, Speech Prosody, Speech Prosody Modeling (Fujisaki Model). Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status. Speech based Applications (TTS, ASR and spoken language acquisition).

Unit-V Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Text Books:

1. Discrete-Time Speech Signal Processing: Principles and Practice by Thomas F. Quatieri
2. Theory and Applications of Digital Speech Processing, by L. R. Rabiner and R. W. Schafer.

CONVEX OPTIMIZATION

UNIT 1: Introduction to optimization: Role of optimization, convexity, Examples of application (communications, signal processing). Review of linear algebra and mathematics background.

UNIT 2: Convex set and convex function, Convex set, convex functions, Operations that preserve convexity (both sets and functions), Conjugate function, conjugate sets, and separating hyper-plane theorem. Convex optimization problems. Optimization problem definition and examples, linear programming, Quadratic programming, Geometric programming, Semi-definite programming

UNIT 3: Duality: Lagrangian dual function (conjugate function), Lagrange dual problem i. Properties, weak and strong duality ii. Interpretation of dual variables, duality (geometric, saddle point, economics) Optimality conditions i. KKT, necessity and sufficiency ii. Sub-gradients for non-smooth functions

UNIT 4: Methods and algorithms: Unconstrained i. Gradient descent, steepest descent ii. Newton method with equality constraints i. Newton methods with equality constraints ii. ADMM method iii. Sub-gradient method. With inequality constraints i. Barrier interior point method ii. Primal-dual interior point methods.

UNIT 5: Advanced topics: First-order methods for large-scale optimization, i. First-order gradient descent ii. Application in machine learning, Schur convexity.

Text Book:

1. Boyd and Vandenberghe, Convex Optimization, Cambridge University Press, 2004.

Reference Books:

1. Ben-Tal and Nemirovski, Lectures on Modern Convex Optimization: Analysis, Algorithms, and Engineering Applications, MPS-SIAM Series on Optimization, 2001.
2. Nesterov, Introductory Lectures on Convex Optimization: A Basic Course, Springer, 2003.
3. David G. Luenberger, Optimization by Vector Space Methods, Wiley, 1997.
4. R. Tyrell Rockafellar, Convex Analysis, Princeton University Press., 1996.

PHYSICALLY UNCLONABLE FUNCTIONS CONSTRUCTIONS, PROPERTIES AND APPLICATIONS

UNIT-1: Introduction to Physical Unclonable Functions (PUFs): Introduction, Trust and Security in a Modern World, Information Security and Cryptology, Physical Security and Roots of Trust, The PUF Concept, On PUFs and Fingerprints, PUF Class, PUF Instance, PUF Evaluation, Shorthand Notation, Details of a PUF Experiment, PUF Response Intra-distance, Inter-distance Statistics.

UNIT-2: Classification Non-electronic, Electronic and Silicon PUFs, Intrinsic and Non-intrinsic PUFs, Weak and Strong PUFs, Intrinsic PUF Constructions: SRAM PUF, Latch, Flip-Flop, Butterfly, Buskeeper PUFs, Bistable Ring PUF.

UNIT-3: Physically Unclonable Functions: Properties Introduction, Constructability and Evaluability, Reproducibility, Uniqueness and Identifiability, Unpredictability, Mathematics and True Unclonability, One-Wayness, Tamper Evidence, Unpredictability of a Physical Function System.

UNIT-4: Implementation and Experimental Analysis of Intrinsic PUFs Introduction, Test Chip Design, Top-Level Architecture, PUF Block: Arbiter PUF, Power Domains, Implementation Details, Experimental

UNIT-5: Modeling Attacks and Applications Modeling Attacks on Arbiter PUFs, Modeling with Machine Learning Techniques, Modeling Entropy Bound, Assessing Entropy Adversary Models and Basic Entropy Bounds, Completely Ignorant Adversary, Adversary Knows Global Bias, Adversary Knows Inter-Bit Dependencies

Text book:

1. Physically Unclonable Functions Construction, Properties and Applications: Role Maes, springer, DOI 10.1007/978-3-642-41395-7

Reference Books:

1. O. Kommerling and M. G. Kuhn, —Design principles for tamper-resistant smartcard processors,‖ in Proc. USENIX Workshop Smartcard Technology,1999, pp. 9–20.
2. R. Anderson and M. Kuhn, —Tamper resistance—A cautionary note,‖in Proc. 2nd USENIX Workshop Electronic Commerce, Nov. 1996, pp. 1–11.
3. O. Goldreich, S. Goldwasser, and S. Micali, —On the cryptographic applications of random functions,‖ Proc. Crypto Advanceds in Cryptology, pp. 276–288, 1985.
4. P. S. Ravikanth, —Physical one-way functions,‖ Ph.D. dissertation, Dept.

ANTENNA THEORY AND TECHNIQUES

UNIT I - FUNDAMENTAL CONCEPTS

Physical concept of radiation- Radiation pattern-near-and far-field regions,-antenna theorem formulation of fundamental antenna properties -Friis transmission equation-radiation integrals and auxiliary potential functions

UNIT II – RADIATION FROM WIREANTENNAS

Infinitesimal dipole-finite-length dipole-linear elements near, conductors- dipoles for mobile communication-small circular loop.

UNIT III - APERTURE AND REFLECTOR ANTENNAS

Huygens' principle- radiation from rectangular and circular apertures- design considerations - Babinet's principle -Radiation from sectoral and pyramidal horns-design concepts prime-focus parabolic reflector and cassegrain antennas.

UNIT IV - BROADBAND AND MICROSTRIP ANTENNAS

Log-periodic and Yagi antennas- frequency independent antennas- helical antennas -Basic characteristics of microstrip antennas -feeding methods- methods of analysis -design of rectangular and circular patch antennas-microstrip arrays.

UNIT V – ANTENNAARRAYS AND BASIC CONCEPTS OF SMART ANTENNAS

Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays. Concept and benefits of smart antennas- Fixed weight beam forming basics- Adaptive beam forming.

Text Books:

1. C. A. Balanis, *"Antenna Theory Analysis and Design"*, 3rd Ed., John Wiley & Sons, 2008.
2. W. L. Stutzman, and G. A. Thiele, *"Antenna Theory and Design"*, 2nd Ed., John Wiley & Sons, 2010.

Reference Books:

1. R. S. Elliot, *"Antenna Theory and Design"*, Revised edition, Wiley-IEEE Press, 2005.
2. R. E. Collin, *"Antennas and Radio Wave Propagation"*, McGraw-Hill., 1985.
3. F. B. Gross, *"Smart Antennas for Wireless Communications"*, McGraw-Hill, 2005.
4. John.D.Kraus and R.J.Marhetka, *"Antennas for all Applications"*3rd edition.Tata McGraw Hill, 2008.

BIOMECHANICS

UNIT-1 Introduction to biomechanics: what is biomechanics, Fundamentals of biomechanics and qualitative analysis, Anatomical description and its limitations.

UNIT-2 Multiaxial deformations and stress analyses: Poisson's ratio, biaxial and triaxial stresses, stress transformation, principal stresses, Mohr's circle, failure theories, allowable stress and factor of safety, factors affecting strength of materials, fatigue and endurance, stress concentrations, torsion , bending and combined loading-problems.

UNIT-3 Applications of statics to biomechanics: skeletal joints and muscles, basics considerations, basic assumptions and limitations, mechanics of the elbow, shoulder, spinal column, hip, knee and ankle.

UNIT-4 Mechanical properties of biological tissues: viscoelasticity, analogies based on springs and dashpots, empirical models of viscoelasticity, time-dependent material response, comparison of elasticity and viscoelasticity, common characteristics of biological tissues, biomechanics of bone, tendons and ligaments, skeletal muscles and articular cartilage.

UNIT-5 Biomechanics of human movement: linear and angular kinematics of human movement, linear kinetics of human movement, equilibrium and human movement, and angular kinetics of human movement

Text books:

1. Duane Knudson, "*Fundamentals of Biomechanics*", 2ndedition Springer Science and Business Media, 2007.
2. Nihat ozkaya and Margareta Nordin, " *Fundamentals of biomechanics-equilibrium, motion and deformation*" Springer, Second edition
3. Susan .J. Hall, "*Basic biomechanics*", Tata McGraw Hill, Sixth edition, 2011

Reference Books:

1. Y.C. Fung, "*Bio-Mechanics- Mechanical Properties of Tissues*", Springer-Verlag, 1998.
2. D. J. Schneck and J. D. Bronzino, "*Biomechanics- Principles and Applications*", CRC Press, Second Edition, 2000.
3. *Jay D. Humphrey and Sherry De Lange, "An Introduction to Biomechanics: Solids and Fluids, Analysis and Design", Springer Science and Business Media, 2004.*

MICROWAVE AND MILLIMETER WAVE CIRCUITS

UNIT-1 Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, H-plane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.

UNIT-2 Transformers &Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.

UNIT- 3 Filters And Periodic Structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures,

UNIT-4 Obstacles in Wave Guides: Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures

UNIT-5 Millimeter Wave Circuits: Wave Propagation in microstriplines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits.

Text Books:

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mcgraw-hill.
2. Robert E Collin, "Foundation For Microwave Engineering", McGraw-Hill.

Reference Book:

1. Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission LineStructures by Cam Nguyun

BROADBAND WIRELESS TECHNOLOGIES

UNIT 1 Introduction to Wireless Communication. The Cellular concept, System design, Capacity improvement in cellular systems, Co channel interference reduction. Intelligent cell concept and applications.TechnicalChallenges.

UNIT2

Mobile radio propagation: Reflection, Diffraction. Fading. Multipath Propagation. Channel mo deling, Diversity Schemes and Combining Techniques.

UNIT 3 Design parameters at the base station, Practical link budget design using path loss models. Smart antenna systems, Beam forming. MIMO Systems. RAKE receiver.

UNIT 4 Multiuser Systems: CDMA- Principle, Network design, Link capacity, Power control, WCDMA-Network planning, MC-CDMA, OFDM, Cellular mobile communication beyond 3G.

UNIT 5 GSM, IS-95, GPRS, UMTS, WLAN, WPAN, WMAN, Ultra Wideband communications, 4G and beyond 4G.

Text Books:

1. A.F.Molisch, Wireless Communications, Wiley, 2005.
2. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

Reference Books:

1. P.MuthuChidambara Nathan, "Wireless Communication"s, PHI, 2008.
2. Ke-Lin Du, M.N.S.Swamy, "Wireless Communication Systems", Cambridge University Press, 2010.
3. K.Fazel& S. Kaiser," Multi-carrier and Spread Spectrum Systems", Wiley, 2003
4. S.G. Glisic, "Advanced Wireless Communications", 4G Technologies, Wiley, 2004.
5. W.C.Y.Lee, "Mobile Communication Engineering", (2/e), McGraw- Hill, 1998.
6. S.G. Glisic, "Adaptive CDMA", Wiley, 2003

MICRO STRIP ANTENNA

UNIT-1 BASICS OF MICROSTRIP ANTENNAS Origin of Microstrip radiators, microstrip antenna analysis methods, microstrip antenna advantages, disadvantages and applications; materials used for microstrip antennas, feed, ground and substrates and their properties, Common Feed methods, Characteristics of Resonance Frequency, Bandwidth, % BW, Return loss, VSWR, 50 Ohms Characteristic impedance, Axial ratio, Efficiency, Gain, Directivity, Rectangular & Polar Radiation Patterns, Experiment on the design of simple feeds.

UNIT-2 RECANGULAR, CIRCULAR MICROSTRIP ANTENNA MODELS AND CHARACTERISTICS Rectangular microstrip antennas- common feed methods, TM10 and TM01 modes, return loss, radiation pattern, quarterwave rectangular microstrip antenna, single feed and dual fed circular polarized rectangular microwave antenna design, impedance and axial ratio bandwidth, efficiency. Circular micro strip antenna properties, directivity, input impedance bandwidth, gain, radiation pattern and efficiency, radiation modesTM11 bipolar mode, TM21 Quadra polar mode, TM02 unipolar mode, cross polarization.

UNIT-3 DESIGN GUIDELINES OF MICROSTRIP Design guidelines for a linearly polarized rectangular microstrip antenna, Design guidelines for a circularly polarized rectangular microstrip antenna, electromagnetically coupled rectangular microstrip antenna, ultra-wideband rectangular microstrip antenna, design of SMSA, RMSA, UWB.

UNIT-4 Broadband microstrip antennas, broadbanding, microstrip antenna matching with capacitive slot, microstrip arrays- planar array theory, array feeding methods – corporate fed and series fed; overview of printed antennas –omnidirectional microstrip antenna, stripline fed tapered slot antenna.

UNIT-5 DESIGN STRUCTURES AND APPLICATIONS OF DIFFERENT ANTENNAS Basic concepts of CPW-Coplanar Waveguide antennas, metamaterials, DRA-Dielectric Resonator Antennas, Micro strip antenna with DGS, MIMO antennas, reconfigurable antennas, Design structures of different antennasand applications of different antennas.

Text Books:

1. Randy Bancraft, "Microstrip and Printed Antenna Design",2nd Edition, Prentice-Hall of India, 2009
2. Ramesh Garg, PrakashBhartia, InderBaul and ApisakIttipiboon, "Microstrip Antenna Design Handbook", Artech House, 2001
3. Time Domain Finite Element Methods for Maxwell's equations in Metamaterials by Jichun Li, Yunqinghuang, 2013

Reference Books:

1. MIMO System Techonology for Wireless Communications by George tsoulos, 1st Edition
2. A CPW fed monopole antenna with uni planar EBG & Rhombic SRR by Madhav B.T.P &MeenaKumari
3. Rectangular Dielectric Resonator Antennas by Rajveer S. Yadhuvanshi& Harish Parthasarathy Reconfigurable antennas by Jennifer T. Bernhard, 2007

4. Broadband microstrip antenna by Girish Kumar & KP Ray, 2003
5. Microstrip patch antennas by Redney B.Waterhouse, 2003
6. Microstrip antennas by David M.Pozar & Daniel by H.Schaubert,1995
7. Electromagnetic band gap structure antenna by Fan Yang, Yahya Rahmat-sail

MICROWAVE MEASUREMENTS

UNIT I Introduction to Microwaves and Mathematical model of Microwave Transmission History of Microwaves, Microwave Frequency bands, General Applications of Microwaves, Advantages of Microwaves. Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission, S-Parameters.

UNIT II Analysis of Microwave Transmission Lines and Waveguides Analysis of Microwave Transmission Lines and Waveguides Transmission line equations & solutions, reflection and transmission coefficient, standing wave and standing wave ratio, line impedance and admittance, impedance matching, using stub line, application of Smith Chart in solving transmission line, transients in transmission lines.

UNIT III Microwave Measurements Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of spectrum of a microwave signal.

UNIT IV Antenna Pattern Measurements Basic Considerations, Pattern Formats, Fresnel Region Measurements, Modeling Techniques, Antenna Range Design and Evaluation: Introduction, Electromagnetic Design Consideration, Antenna Range Evaluation. Antenna Testing: Introduction, Types of of Ranges: Elevated Ranges, Ground Ranges, Near Field Ranges, Radar Cross Section Ranges.

UNIT V Modern Trends in Microwaves Engineering Effect of Microwaves on human body, Medical and Civil applications of microwaves, Wireless Communications system, Radar Systems, Radiometer Systems, Satellite Communication, Remote sensing,

Text Books:

1. Samuel Liao - Microwave devices and circuits, PHI , Third Edition
2. Dennis Roddy - Microwave Technology, PHI
3. G. Kennedy - Electronic Communication systems, McGraw-Hill Book Company , Fourth Edition

Reference Books:

1. Annapurna Das, Sisir K.Das- Microwave engineering, (TMG), Second Edition
2. Siteshkumar Roy & Manojit Mitra - Microwave semiconductor devices, PHI , Third Printing
3. A. K. Gautam - Microwave engineering, (S. K. Kataria pub) , 2nd Edition
4. Sanjeev Gupta, Microwave Engineering, Khanna Pub., Third Edition
5. Evans, Gray E," Antenna measurements techniques", Artech House, Inc
6. J S Hollis, T J Lyon, L Clayton," Microwave Antenna Measurements" , Scientific Atlants, Inc Third Edition
7. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.

8. S. Ramo, J.R.Whinnery and T.V.Duzer, "Fields and Waves in Communication Electronics", Third Edition, Wiley India.

ADVANCED DIGITAL COMMUNICATION

UNIT 1 Digital modulation techniques: Digital modulation formats, Coherent binary modulation techniques, Coherent quadrature - modulation techniques, No-coherent binary modulation techniques, Comparison of binary and quaternary modulation techniques, M-ray modulation techniques, Power spectra, Bandwidth efficiency, M-array modulation formats viewed in the light of the channel capacity theorem, Effect of inter symbol interference, Bit verses symbol error probabilities, Synchronization, Applications.

UNIT 2 Coding techniques: Convolutional encoding, Convolutional encoder representation, Formulation of the convolutional decoding problem, Properties of convolutional codes: Distance property of convolutional codes, Systematic and nonsystematic convolutional codes, Performance Bounds for Convolutional codes, Coding gain, Other convolutional decoding algorithms, Sequential decoding, Feedback decoding, Turbo codes. Communication through band limited linear filter channels: Optimum receiver for channel with ISI and AWGN, Linear equalization, Decision - feedback equalization, reduced complexity ML detectors, Iterative equalization and decoding - Turbo equalization.

UNIT 3 Adaptive equalization: Adaptive linear equalizer, adaptive decision feedback equalizer, Adaptive equalization of Trellis - coded signals, Recursive least square algorithms for adaptive equalization, Self recovering (blind) equalization.

UNIT 4 Spread spectrum signals for digital communication: Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.

UNIT 5 Digital communication through fading multipath channels: Characterization of fading multipath channels, The effect of signal characteristics on the choice of a channel model, Frequency nonselective, Slowly fading channel, Diversity techniques for fading multipath channels, Digital signals over a frequency selective, Slowly fading channel, Coded wave forms for fading channels, Multiple antenna systems.

Text books:

1. John G. Proakis, **"Digital Communication"**, McGraw Hill, 4th edition, 2001.
2. Bernard Sklar, **"Digital Communication - Fundamental and applications",** Pearson education (Asia), Pvt. Ltd., 2nd edition, 2001.
3. Simon Haykin, **"Digital communications",** John Wiley and Sons.
4. Andrew J. Viterbi, **"CDMA: Principles of spread spectrum communications",** Prentice Hall, USA, 1995.

METAMATERIALS

UNIT-I: Introduction to Metamaterials (MTMs): The concept of Metamaterials: Basic Electromagnetic and Optical properties, Basic structures, potential applications, Governing equations for Metamaterials, Brief overview of computational electromagnetics. Definition of Metamaterials and Left-Handed(LH) MTMs.

UNIT-II: Fundamentals of LH MTMs: Conventional Backward waves and Novelty of LH MTMs, Terminology, Transmission line approach, Composite Left/Right Handed MTMs, MTMs and photonic Band-Gap structures. Left-Handedness from Maxwell's equations, Entropy conditions in Dispersive media, Boundary conditions, Reversal of Doppler effect, Reversal of Snell's law, Focusing by a "Flat LH Lens".

UNIT-III: Simulations of Wave propagation in Metamaterials I: Interesting phenomena of wave propagation in MTMs: Demonstration of a PML model, Multiscale phenomena for Metamaterials, Demonstration of Backward Wave Propagation, Metamaterial electro magnetic cloak: Form Invariant property of Maxwell's equations, Design of Cylindrical and square cloaks, cloak simulation in Frequency domain.

UNIT-IV: Simulations of Wave propagation in Metamaterials II:

Solar cell design with Metamaterials: Brief Introduction, Mathematical formulation, Numerical Simulations, Problems needing special attention: Unit cell design and Homogenization, A posteriori error estimator.

UNIT-V: Future of MTMs: "Real-Artificial" Materials: the challenge of Homogenization, Three-Dimensional isotropic LH MTMs, "Magnet less" Magnetic MTMs, Terahertz Magnetic MTMs, Antenna Radomes and Frequency selective surfaces, Nonlinear MTMs, Active MTMs.

Textbooks:

1. "Time Domain Finite Element Methods for Maxwell's equations in Metamaterials" by Jichun Li, Yunqing huang.
2. "Electromagnetic Metamaterials: Transmission Line Theory and Microwave Applications" The Engineering Approach by Christophe Caloz, Tatsuo Itoh

CHANNEL CODING

UNIT – I INTRODUCTION TO ERROR CONTROL CODING: Introduction to error control coding, Introduction to block codes, linear block codes, Generator matrix and parity check matrix, Properties of linear block codes: Syndrome, error detection, Decoding of linear block codes.

UNIT – II LOW DENSITY PARITY CHECK CODES: Introduction to low density parity check codes, LDPC code properties, Construction of parity check matrix H, Representation using tanner graphs, Encoding of low density parity check codes, Efficient encoding of LDPC codes , Decoding of low density parity check codes.

UNIT – III CONVOLUTIONAL CODES: Introduction to convolutional codes, Encoding of convolutional codes, Structural properties of convolutional codes - state diagram, catastrophic convolutional codes, Transfer function of convolutional encoder, Distance properties of convolutional codes, Trellis diagram, Decoding of convolutional codes- Viterbi algorithm- hard decision decoding, soft decision decoding.

UNIT – IV TURBO CODES: Introduction to turbo codes, Encoding of turbo codes, Turbo decoding – the BCJR algorithm, Performance analysis of the turbo codes.

UNIT – V SPACE-TIME CODING: Introduction to space-time coded MIMO system, Space-time block code, Decoding STBCs, Alamouti code - 2-transmit, 1-receive alamouti STBC coding, 2-transmit, 2-receive alamouti STBC coding, Higher order STBC's, Space-time trellis coding.

TEXT BOOKS:

1. K. Deergha Rao, "Channel Coding Techniques for Wireless Communications", Springer India, 2015.
2. Richardson T, "Modern Coding Theory", Cambridge University Press, 2008.

WIRELESS AND CELLULAR COMMUNICATION

UNIT – I OVERVIEW OF CELLULAR EVOLUTION AND WIRELESS TECHNOLOGIES: Introduction, 2G/3G Cellular Systems and their features, Cellular evolution to 4G, Motivation and scope for 5G Cellular systems, Non-Cellular technologies for Internet of Things (IoT) and Smart grids, Basic Cellular Terminology, Introduction to Antennas and Propagation Models, Link budget, Fading margin, Outage, Cellular concept, Cellular system design and analysis, Cellular Geometry and System Design, Cellular System Capacity, Trunking, Handoff and Mobility, Classification of signal variation, Shadowing, Outage, Multipath.

UNIT – II MULTIPATH FADING ENVIRONMENT AND BER PERFORMANCE IN FADING CHANNELS: Rayleigh Fading and Statistical Characterization, Properties of Rayleigh Distribution, BER in Fading, Narrowband vs Wideband Channels, Characterization of Multipath Fading Channels, Choice of Modulation, Coherent versus Differential Detection, BER in Fading, Ricean Fading, Ricean and Nakagami Fading, Moment Generating Function.

UNIT – III TRANSCEIVERS AND SIGNAL PROCESSING: Structure of a wireless communication link, Modulation formats, Demodulation, Diversity, Channel coding and information theory, Equalizers, BER in fading, Equal Gain Combining, Array Gain, Diversity Gain, Alamouti Scheme, Channel capacity, Capacity of fading Channels, Capacity with Outage, Channel State Information, Optimum Power Allocation.

UNIT – IV CDMA and OFDM: Optimum Power Allocation – Water filling, Introduction to Direct Sequence Spread Spectrum Communications, Properties of Spreading Sequences, Introduction to CDMA, Features of cdma2000 and WCDMA, Rake Receiver for multipath channels, Multiuser environment, CDMA system capacity, CDMA Multiuser Detectors, Orthogonal Frequency Division Multiplexing, Multiantenna systems.

UNIT – V MIMO: Multi User Introduction: Point-to- point MIMO, Multi-user MIMO, Massive MIMO, Time Division verses Frequency Division Duplexing, Models and Preliminaries: Single-Antenna Transmitter and Single-Antenna Receiver, Coherence Time, Coherence Bandwidth, Coherence Interval, Interpretation of Tc and Bc in Terms of Nyquist Sampling Rate, TDD Coherence Interval Structure Detection, MIMO, Space time codes.

TEXT BOOKS:

1. T. S. Rappaport, "Wireless Communications – Principles and Practice" (2nd edition) Pearson, 2010, ISBN 9788131731864.

2. A. Molisch, "Wireless Communications," Wiley, 2005Haykin & Moher, "Modern Wireless Communications" Pearson 2011 (Indian Edition).

3. J. G. Proakis, "Digital Communications," McGraw Hill.

4. A. Goldsmith, "Wireless Communications," Cambridge Univ Press, 2005.

5. D. Tse and P. Viswanath, "Fundamentals of Wireless Communications," Cambridge Univ Press, 2005.

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Chairman, BoS

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Department of Electronics and Communication Engineering

Recommendations of DRC member for Pre-PhD courses

The member(s) of Doctoral Review committee met on 01/07/2017 to analyse the Pre-PhD courses suitable for course work pertaining to PhD Programme in Electronics and communication Engineering (ECE). The members have recommended the following courses for pre-PhD Course work in the Image processing and signal processing area of research.

Names and signatures of DRC Members

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. Babburi Seetha Ramanjaneyulu. Professor, ECE
3. Dr. M.S.S. Rukmini, Professor, ECE
4. Dr. A. Srinivasulu. Professor, ECE
5. Dr. Jakeer Hussain Shaik, Professor, ECE

The members are identified the following courses are useful to do research in ECE.

1. Biomedical signal processing
2. Fundamentals of massive MIMO
3. Compressive sensing
4. Speech processing
5. Convex optimization
6. Physically unclonable functions constructions, properties & applications
7. Antenna theory
8. Microwave & Millimeter wave circuits

9. Broadband wireless technologies
10. Channel coding
11. Wireless & cellular communications
12. Micro strip antenna
13. Microwave measurements
14. Meta materials
15. Advanced digital communications

The Recommendations of DRC meeting is being forwarded to the Board of Studies (BoS) committee for approval.

Chairman, BoS

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DEPARTMENT OF ELECTRONICS AND COMMUNCATION ENGINEERING

16th April, 2016

Minutes of the BoS meeting held on 16/04/2016

The following External members attended the BoS meeting on 16/04/2016

1. Dr. N. V.S.N. Sharma Professor, NIT Warangal.
2. Mr. P. Haribabu, Scientist, CDAC, Bangalore

The following Internal members attended the BoS meeting

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. B. Seetaramanjaneyulu. Professor, ECE
3. Dr. A. Srinivasulu. Professor, ECE

The Members of Board of Studies (BoS) reviewed the courses recommended by the Doctoral Review Committee for Pre-PhD course work in addition to existing M.Tech courses Electronics and Communication Engineering (ECE) for PhD in ECE. The course name is given below.

1. Cognitive Radio Technology

Note: - Enclosed Letter from DRC Members.

Chairman, BoS

Annexure –I

Syllabus Copy

COGNITIVE RADIO TECHNOLOGY

UNIT I - Introduction Aware, Adaptive and Cognitive Radios. Cognitive Radio Technology, Cognitive Radio Network Architectures, Cognitive Radio Networks Applications.

UNIT II - Cognitive Radio Networks Network Coding for Cognitive Radio Relay Networks. Cognitive Radio Networks Architecture. Terminal Architecture for CRN. Mathematical Models toward Networking Cognitive Radios. Scaling Laws of CRN.

UNIT III - Spectrum Sensing and Spectrum Management Spectrum Sensing to detect specific Primary System. Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks. Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards.

UNIT IV - Trusted Cognitive Radio Networks Framework of Trust in CRN; Trusted Association and Routing; Trust with Learning; Security in CRN.

UNIT V - Software Defined Radio Introduction to SDR. Evolution of SDR Baseband Requirements. SDR Architectures – Ideal SDR Architectures, Realistic SDR Architecture. SDR and Cognitive Radio Relationship.

Text Books:

1. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & sons, 2009.
2. Ahmed Khattab, Dmitri Perkins, MagdyBayoumi, "Cognitive Radio Networks: From Theory to Practice", Springer, 2013.
3. Walter Tuttlebee, "Software Defined Radio- Baseband Technology for 3G Handsets and Base stations", John Wiley @ Sons, 2004.

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Chairman, BoS

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Department of Electronics and Communication Engineering

Recommendations of DRC member for Pre-PhD courses

The member(s) of Doctoral Review committee met on 09/04/2016 to analyse the Pre-PhD courses suitable for course work pertaining to PhD Programme in Electronics and communication Engineering (ECE). The members have recommended the following course for pre-PhD Course work in the Image processing and signal processing area of research.

Names and signatures of DRC Members

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. B. Seetaramanjaneyulu. Professor, ECE
3. Dr. A. Srinivasulu. Professor, ECE

The members identified the following courses that are useful to do research Software Defined Radio (SDR)

1. Cognitive Radio Technology

The Recommendations of DRC meeting is being forwarded to the Board of Studies (BoS) committee for approval.

Chairman, BoS

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DEPARTMENT OF ELECTRONICS AND COMMUNCATION ENGINEERING

4th March, 2015

Minutes of the BoS meeting held on 04/03/2015

The following External members attended the BoS meeting on 04/03/2015

1. Er. D. Ramakrishna. Managing Director, Efftronics, Vijayawada.
2. Dr. N. V.S.N. Sharma Professor, NIT Warangal.

The following Internal members attended the BoS meeting

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. B. Seetaramanjaneyulu. Professor, ECE
3. Dr. A. Srinivasulu. Professor, ECE

The Members of Board of Studies (BoS) reviewed the courses recommended by the Doctoral Review Committee for Pre-PhD course work in addition to existing M.Tech courses in Electronics and Communication Engineering (ECE) for PhD in ECE . The list of courses are given below.

1. Digital Image Processing
2. Transforms Techniques

Note: - Enclosed Letter from DRC Members.

Chairman, BoS

Annexure –I

Syllabus Copy

DIGITAL IMAGE PROCESSING

UNIT-I Digital Image Fundamentals: Digital Image Representation, Fundamental Steps in Digital Image Processing, Elements of Digital Image Processing Systems. Elements of Visual Perception, A Simple image model, Image sensing and acquisition, Image Sampling and Quantization, Neighborhood of Pixels, Pixel Connectivity, Labeling of Connected Components, Distance Measures, Arithmetic and Logic Operations. **Image Transforms:** Introduction to Fourier transform - Discrete Fourier transform - Properties of DFT– Separability, Translation, Periodicity, Rotation, Average Value – Discrete Cosine Transform – Properties - Haar Transform.

UNIT- II Image Enhancement: Spatial Domain Methods, Point processing, Intensity Transformations, Histogram Processing, Spatial filtering, Smoothing Filters, Sharpening Filters, Image Enhancement in the Frequency Domain, smoothing filters, Low Pass Filtering, sharpening filters, High Pass Filtering, Homomorphic filtering, Pseudo-Color Image Enhancement.

UNIT- III Image Restoration: Model of image degradation/ restoration process, noise models, restoration in presence of noise only- spatial filtering, periodic noise reduction by frequency domain filters, Inverse filtering.

UNIT- IV Image Compression: Fundamentals of Compression, Image Compression Model, Error free Compression, Huffman and LZW coding, Lossy Predictive Coding, Transform Coding.

UNIT- V Image Segmentation: Detection of Discontinuities, Line Detection, Edge Detection, Edge Linking and Boundary Detection, Thresholding, Threshold Selection on Boundary Characteristics, Region Growing, Region Splitting and Merging, Use of motion in Segmentation.

Textbooks:

1. Digital Image Processing, Rafael C Gonzalez and Richard E Woods, 2nd editionPearson Education Asia, New Delhi, 2010.
2. Digital Image Processing and Analysis: B. Chanda, D. DuttaMajumder, PHI, New Delhi, 2006.
3. Fundamentals of Digital Image Processing: A.K. Jain, PHI, New Delhi, 2006.

REFERENCE Books:

1. Kenneth R Castleman, "Digital Image Processing", Prentice Hall, New Delhi, 2008.
2. William K Pratt, "Digital Image Processing", John Wiley, India, 2007.
3. Sid Ahmed M A, "Image Processing Theory, Algorithm and Architectures", McGraw-Hill,New Delhi, 1995.
4. Rafael C Gonzalez, Richard E.woods and Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill,New Delhi, 2010.
5. Milan Sonka, Vaclav Hlavac and Roger Boyle, "Image Procesing, Analysis, and Machine Vision", Brooks/Cole, Singapore, 2008.
6. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt Ltd, New Delhi, 1995.
7. Jayaraman S, Esakkirajan S and Veerakumar T, "Digital Image Processing", Tata McGraw Hill, New Delhi, 2009.

TRANSFORM TECHNIQUES

UNIT -I : Fourier Analysis: Vector space, Hilbert spaces, Fourier basis, FT- Limitations of Fourier Analysis, Need for time-frequency analysis, DFT, 2D-DFT: Definition, Properties and Applications, IDFT, Hilbert Transform, STFT.

UNIT -II : Transforms: Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT,– definition, properties and applications

UNIT -III : Continuous Wavelet Transform (CWT):Short comings of STFT, Need for wavelets, Wavelet Basis Concept of Scale and its relation with frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT -IV : Multi Rate Analysis and DWT:Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT -V : Special Topics: Wavelet Packet Transform, Multidimensional Wavelets, Bi-orthogonal basis- BSplines, Lifting Scheme of Wavelet Generation, Multi Wavelets

TEXT BOOKS:

1. Raghuveer M.Rao and Ajit S. Bopardikar, "Wavelet Transforms-Introduction theory and applications" Pearson Edu, Asia, New Delhi, 2003.
2. Soman. K. P, Ramachandran. K.I, "Insight into Wavelets from Theory to Practice" Printice Hall India, 1st Edition, 2004.

REFERENCE BOOKS:

1. Jaideva C Goswami, Andrew K Chan, "Fundamentals of Wavelets- Theory, Algorithms and Applications" John Wiley & Sons, Inc, Singapore, 1999.
2. Vetterli M. Kovacevic, "Wavelets and Sub-band Coding", PJI, 1995.
3. C. Sydney Burrus, "Introduction to Wavelets and Wavelet Transforms", PHI, 1st Edition, 1997.
4. Stephen G. Mallat,v, "A Wavelet Tour of Signal Processing" , Academic Press, 2nd Edition
5. S.Jayaraman, S.Esakkirajan, T.Veera Kumar, "Digital Image Processing" , TMH, 2009

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Department of Electronics and Communication Engineering

Recommendations of DRC member for Pre-PhD courses

The members of Doctoral Review committee met on 26/02/2015 to analyse the Pre-PhD courses suitable for course work pertaining to PhD Programme in Electronics and communication Engineering (ECE). The members have recommended the following courses for pre-PhD Course work in the Image processing and signal processing area of research.

Names and signatures of DRC Members

1. Dr. N. Usha Rani. BoS Chairman, HoD, ECE
2. Dr. B. Seetaramanjaneyulu. Professor, ECE
3. Dr. A. Srinivasulu. Professor, ECE

The members identified the following courses that are useful to do research in image and signal processing.

1. Digital Signal Processing.
2. Transform Techniques.

The Recommendations of DRC meeting is being forwarded to the Board of Studies (BoS) committee for approval.

Chairman, BoS