Meeting of the Board of Postgraduate studies,

Department of Electronics and Communication,

Rajiv Gandhi University, Rono Hills, Doimukh

Dated 17th August 2015

Minutes of the meeting

A meeting of the postgraduate board of studies was held on 17th August 2015 in the presence of the following members:

- **Annexure –A Enclosed**

The board discussed different issues associated with the syllabus of Master of Technology program in Electronics and Communication and made necessary amendment to the syllabus and approved it for implementation from the next academic session.

Since there is no other issues to discuss, the meeting ended with vote of thanks from the chair.

The Syllabus may be placed in the ensuing Academic Council meeting of the University for its approval.

Jagdeep Rahul 25/08/2015

(Jagdeep Rahul)
Head (I/C)
Department of Electronics and Communication,
Rajiv Gandhi University, Arunachal Pradesh

DR (Acad)
M moess
25/8/15

So (Acad)
26/8/15

154 26/8/15

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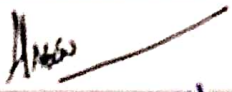
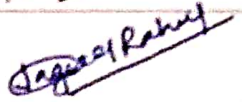
Annexure –A

S. No.	Name	Signature
1.	Prof. Utpal Bhattacharjee	
2.	Mr. Ani Taggu	
3.	Mr. Jagdeep Rahul	
4.	Mr. Maibam Sanju Meetei	
5.	Ms. Champa Tanga	

Rs. 50/-

OK.

DEPARTMENT OF ELECTRONICS & COMMUNICATION

SYLLABUS FOR M.TECH (ECE) PROGRAMME

CHOICE BASED CREDIT SYSTEM

RAJIV GANDHI UNIVERSITY,
RONO HILLS, DOIMUKH,
ARUNACHAL PRADESH

M.Tech (Electronics & Communication) Course Structure

FIRST SEMESTER

Paper Code	Title	Credit L-T-P	Mark Distribution			
			End Semester	Sessional	Practical	Total
ECC-501	Advanced Digital System Design	3-1-1	50	20	30	100
ECC-502	Communication Techniques	3-0-1	50	20	30	100
ECC-503	Advanced Microprocessors and Microcontrollers	3-1-1	50	20	30	100
	Elective I	3-1-0	80	20	-	100
	Credits	18				

SECOND SEMESTER

Paper Code	Title	Credit	Mark Distribution			
			End Semester	Sessional	Practical	Total
ECC-505	Information Theory and Coding	3-1-0	80	20	-	100
ECC-506	Advanced Digital Signal Processing	3-0-1	50	20	30	100
	Elective – II	3-0-1	50	20	30	100
	Elective –III	3-1-0	80	20	-	100
ECC-578	**Seminar**	3-0-0	100			100
	Credits	19				

THIRD SEMESTER

Paper Code	Title	Credit	Mark Distribution			
			End Semester	Sessional	Practical	Total
XXX	***Open Elective***	3-0-0	80	20		100
	Elective –IV	3-0-1	50	20	30	100
	Elective -V	3-1-0	80	20	-	100
ECC-579	***Grand Viva***	2-0-0	100	-	-	100
ECC-602	**PROJECT – I** (BASED ON SPECIALIZATION)	0-0-10	80	-	120	200
	Credits	23				

FOURTH SEMESTER

Paper Code	Title	Credit	Mark Distribution		
			External Evaluation	Internal Evaluation	Total
CEC-603	PROJECT – II	0-0-20	160	240	400
	Credits	20			

Elective – I (Any one from the Group)

Paper Code	Title	Credit	End Semester	Sessional	Practical	Specialization
ECE-541	Introduction to Bioelectronics	3-1-0	80	20	-	Bioelectronics
ECE-542	Data Communication networks	3-1-0	80	20	-	Advanced Communication System
ECE-543	MOS-VLSI Circuit Design	3-1-0	80	20	-	VLSI Design

Elective – II & Elective - III (Any Two from the Group based on specialization)

NOTE: Exactly one elective paper must have a practical component.

Paper Code	Title	Credit	End Semester	Sessional	Practical	Specialization
ECE-571	CMOS Analog IC Design	3-0-1	50	20	30	VLSI Design
ECE-572	VLSI Testing and Testability	3-1-0	50	20	30	VLSI Design
ECE-573	Low Power VLSI Design	3-1-0	80	20	-	VLSI Design & Bioelectronics
ECE-574	Biomedical Signal Processing	3-0-1	50	20	30	Bioelectronics
ECE-575	Embedded Systems	3-0-1	50	20	30	Bioelectronics & Advanced Communication System
ECE-576	Cryptography & Network Security	3-1-0	80	20	-	Advanced Communication System
ECE-577	Wireless Communication	3-0-1	50	20	30	Advanced Communication System

Elective – IV & Elective - V (Any Two from the Group based on specialization)

NOTE: Exactly one elective paper must have a practical component.

Paper Code	Title	Credit	End Semester	Sessional	Practical	Specialization
ECO-611	Advanced Computer Architecture	3-1-0	80	20	-	VLSI Design
ECE-612	FPGA Design	3-0-1	50	20	30	VLSI Design
ECE-613	Application Specific Integrated Circuits	3-0-1	50	20	30	VLSI Design
ECO-614	Wireless sensor networks	3-1-0	50	20	30	Advanced Communication System
ECE-615	Cognitive Radio	3-1-0	80	20	-	Advanced Communication System
ECE-616	Remote sensing techniques & applications	3-1-0	80	20	-	Advanced Communication System
ECE-617	Biomedical Electronics	3-1-0	80	20	-	Bioelectronics
ECE-618	Biomedical Image Processing	3-0-1	50	20	30	Bioelectronics
ECE-619	Advanced Bioelectronics Devices	3-1-0	80	20	-	Bioelectronics

Open Elective courses offered by Department Electronics and Telecommunication Engineering

Paper Code	Title	Credit	End Semester	Sessional	Practical	Specialization
ECO-620	Research Methodology	3-0-0	80	20	-	Open

ECC-501: ADVANCED DIGITAL SYSTEM DESIGN

UNIT-I: COMBINATIONAL LOGIC FUNCTIONS

Introductory concepts of Basic logic gates, Decoders, Encoders, Multiplexers, Implementing functions using Multiplexers, Demultiplexers, half adder, full adder, half subtracter, full subtractor, Parity Generators and Checkers, Signed Binary Arithmetic, rippple carry Adders , BCD Adders, carry look ahead adder.

UNIT-II: SEQUENTIAL LOGIC CIRCUITS

Introduction to sequential circuits, lathes, flip-flop, Digital counters and shift registers, Mealy machine, Moore machine, State diagrams, State table minimization, Incompletely Specified Sequential Machines- State Assignments.

UNIT-III: FINITE STATE MACHINES (FSM)

State transition table- state assignment for FPGAs, Algorithmic State Machine Charts, Derivation of ASM Charts, Realization of ASM charts, linked state machines, Implementation of Binary Multiplier, dice game controller.

UNIT-IV: PROGRAMMABLE LOGIC DEVICES

Basic concepts, Programming technologies, Programmable Logic Element (PLE), Programmable Logic Array(PLA), Programmable Array Logic (PAL), Structure of standard PLDs, complex PLDs (CPLD). Design of combinational and sequential circuits using PLD's, Introduction to Field Programmable Gate Arrays-types of FPGA- XILINX XC 3000 series and 4000 series FPGAs. Altera CPLDs- Altera FLEX 10K Series CPLDs. Design examples.

UNIT-V: DIGITAL DESIGN WITH VERILOG

Basic Concepts: Data Objects, Data Types, Operators, Concurrent and Sequential Assignment Statements, Different Styles of Modeling, Simple Examples.

REFERENCE BOOKS:

1. Digital Design – Morris Mano, M.D.Ciletti, 4th Edition, PHI.
2. Verilog HDL – Guide to Digital Design and Synthesis- Samir Palnitkar, Pearson Education, 3rd Edition, 2003.
3. Fundamentals of Logic Design – Charles H. Roth, 5th Ed., Cengage Learning.
4. Logic Design Theory – N. N. Biswas, PHI
5. Switching and Finite Automata Theory – Z. Kohavi , 2nd Ed., 2001, TMH
6. Digital Circuits and Logic Design – Samuel C. Lee , PHI
7. William Fletcher: An Engineering Approach to Digital Design, Prentice-Hall India,1980.
8. William J Dally and John W Poulton, Digital Systems Engineering, Cambridge University Press, 1998.
9. Jayaram Bhaskar A, VHDL Primer, Prentice-Hall India,1999.

ECC-502: COMMUNICATION TECHNIQUES

UNIT I: Introduction & review of signals & systems

Elements of electrical communication system, communication channels & their characteristics, Mathematical models for communication channels, frequency domain analysis of signals & systems: Fourier series & Fourier transform, power & energy, sampling of band limited signals, band pass signals.

UNIT II: Random Theory and Effect of Noise on Analog Communication.

Probability & random variables, Random processes, Random processes in frequency domain, Gaussian & White Processes, Band Limited Processes and Sampling, Band Pass Processes, Effect of Noise on Linear Modulation, Effects of Transmission Losses and Noise in Analog Communication Systems, Information Source and coding.

UNIT III: Digital Transmission through Additive White Gaussian Noise Channel

Geometric representation of signal waveforms, Optimum receiver for digitally modulated signals in AWGN. Probability of error for signal detection in AWGN, Comparison of modulation methods.

UNIT IV: Digital Transmission through Band Limited AWGN Channels

Digital PAM transmission through band limited baseband channels, Digital transmission through band limited band pass channels, Power spectrum of the baseband signal & carrier modulated signal, Signal design for band limited channels, Probability of error for detection of digital PAM.

UNIT V: Digitally Modulated Signals with Memory

Modulation codes & modulation signals with memory, System design in the presence of channel distortion, Design of transmitting & receiving filters for a known channel, channel equalization. Multicarrier Modulation and OFDM. Introduction to channel capacity and coding.

REFERENCE BOOKS:

1. John G. Proakis and Masoud Salehi, "Communication Systems Engineering", Second Edition, Pearson Education.
2. B.P. Lathi and Zhi Ding, "Modern Digital And Analog Communication Systems", International fourth edition, Oxford University Press.
3. S. Haykins, "Communication Systems", 5th ed., John wiley.
4. M. K. Simon, S. M. Hinedi and W. C. Lindsey, "Digital Communication Techniques: Signaling And Detection", Prentice Hall India, N. Delhi, 1995.
5. A.Papoulis, S.U.Pillai, Probability, "Random Variables And Stochastic Processes", Mc Graw Hill, fourth Edition

ECC-503: ADVANCE MICROPROCESSORS AND MICROCONTROLLERS

UNIT-I: Intel 8086/8088
Architecture, its register organization, Pin diagram, Minimum and Maximum Mode System and Timings, Machine language instruction formats, Addressing modes, Instruction set, Assembler directives. Architectural features of 80386, 486, RISC Vs CISC Processors

UNIT-II: Hardware description
Pin diagram, Minimum and Maximum Mode and Bus Timings, Ready and Wait states and 8086 based micro-computing system

UNIT-III: ALP Programming & special features
ALP, programming with an assembler, stack structure, Interrupts, Service subroutines and Interrupt programming and Macros.
Architectural features of 80386, 486, RISC Vs CISC Processors.

UNIT-IV: Basic Peripherals & Their Interfacing
Memory Interfacing (DRAM), PPI- Modes of operation of 8255, interfacing to ADC & DAC
Programmable timer- 8253, PIC 8259A, USART and their interfacing.

UNIT-V: Micro Controllers
Introduction to Intel 8-bit and 16-bit Micro controllers, 8051-Architecture, memory organization, Addressing modes.
Instruction formats, Instruction sets, Interrupt structure and interrupt priorities, Port structures and Different modes of operation and programming Examples.

REFERENCE BOOKS:

1. "The Intel Microprocessors", Architecture, Programming and interfacing by Barry B. Brey
2. 8086 Micro Processors by Kenrith J Ayala, Thomson Publishers.
3. Microcontrollers by K.J.Ayala - Thomson Publishers.
4. Micro Processors and Interfacing Programming and Hardware by Douglas V. Hall.
5. The 8088 and 8086 Microprocessor- W.A. Triebel & Avtar Singh- PHI, 4th Edn, 2002.

ECC-505: INFORMATION THEORY AND CODING

UNIT I: Reliable Digital Transmission
Mathematical model of Information, A logarithmic Measure of Information, Average and Mutual Information and Entropy, Shannon's theorems: source coding theorem, channel models, channel coding, information capacity theorem, Types of Errors, Error Control Strategies.

UNIT II: Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

UNIT III: Cyclic Codes
Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT IV: Convolutional Codes
Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT V: Burst –Error-Correcting Codes
Decoding of Single-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolution Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolution Codes, Phased-Burst –Error-Correcting Cyclic and Convolution codes. BCH code- Definition, Minimum distance and BCH Bounds

REFERENCE BOOKS:

1. Shu Lin, Daniel J.Costello,Jr, Error Control Coding- Fundamentals and Applications – Prentice Hall, Inc.
2. Man Young Rhee, Error Correcting Coding Theory- - 1989, McGraw-Hill Publishing.
3. Bernard Sklar, Digital Communications-Fundamental and Application -, PE.
4. John G. Proakis, Digital Communications-, 5th Ed., 2008, TMH.
5. Salvatore Gravano, Introduction to Error Control Codes- oxford
6. Ranjan Bose, Information Theory, Coding and Cryptography –2nd Ed, 2009, TMH.
7. Todd K.Moon, Error Correction Coding – Mathematical Methods and Algorithms – 2006, Wiley India.

ECC-506: ADVANCED DIGITAL SIGNAL PROCESSING

UNIT I: Introduction
Basic Concepts of signal processing, IIR & FIR Filters, Random variables, Random Processes, Filtered Random Process, Correlation, Covariance, Power spectrum, Cross Power Spectrum, Ergodicity, Time Averages and estimators.

UNIT II: Multirate Digital Signal Processing
Decimation by factor, Interpolation by Factor I, Sampling Rate Conversion by Rational Factor I/D, Filter Design and Implementation for Sampling rate conversion, Multistage implementation of Sampling rate Conversion, Sampling rate conversion of bandpass signals, Sampling rate conversion by arbitrary factor, Applications of Multirate Signal Processing.

UNIT III: Linear Prediction
Direct form linear prediction filtering, normal equations for linear prediction filtering, Levinson algorithm, Linear prediction lattice filtering ,Wiener smoothing prediction filter, Application of Weiner smoothing to noise cancelling

UNIT – IV: Power Spectrum Estimation
Estimation of spectra from finite duration observation of signals, Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, MinimiumVariance Spectral Estimation ,Eigen analysis Algorithms for Spectrum Estimation.

UNIT-V: Adaptive Filters
LMS adaptive Filters: LMS adaptive algorithm, Properties of LMS adaptive filters LS Adaptive Filters: Godard algorithm, lattice Blind Adaptive Filtering Techniques: Cost Function, Higher Order Statistics & examples

REFERENCE BOOKS:

1. John G. Proakis, Dimitris G. Manobakis, "Digital Signal Processing, Principles,
2. S. Haykin "Adaptive Filter theory", Prentice Hall, 4th Edition, 2001
3. Ali H. Sayed "Fundamentals of Adaptive Filtering", John- Willey Publication, 2003.
4. A. Papoulis, S. U. Pillai "Probability, Random Variables And Stochastic Process" TMH publication.

ECE-541: INTRODUCTION TO BIOELECTRONICS

UNIT-I: Semiconductors
Semiconductor Materials, chemical and physical bonds, Intrinsic and extrinsic semiconductors, carrier motion in semiconductors – Drift, Diffusion and Recombination – Generation process, Boltzmann Transport equation, P-N junction diode, Bipolar Junction Transistor (BJT), Field Effect Transistor (FET), Operational Amplifier (OPAMP).

UNIT-II: Digital Logic
Digital Logic: Boolean Algebra and logic gates, Combinational logic circuit, sequential logic circuit – flip flops.

UNIT-III: Biological Materials
Biological materials: analogy between semiconductor and biological materials, water and electrolyte solutions; biological molecules - Proteins, Nucleic acids, Phospholipids; cell membrane; Eucaryotic cell.

UNIT-IV: Motion in Solution and Chemical Reaction
Diffusion, Brownian motion, electrophoresis, enzyme kinetics; Solid electrolyte junctions: electrode-electrolyte interfaces, Poisson –Boltzmann equation, Membrane transport, Nernst-Plank equation and solution.

REFERENCE BOOKS:

1. Bioelectronics Handbook, MOSFETs, Biosensors & Neurons, **Author:** Massimo Grattarola, Giuseppe Massobrio, **Publisher:** Mc Graw Hill.
2. Biosensors, **Author:** E. A. Hall, **Publisher :** Wiley.
3. Biomaterial Science **Author:** Ruddy Ratner, **Publisher:** Academic Press.
4. Bioelectronics, **Author :** S. Bone, B. Zabba, **Publisher :** Wiley.
5. Commercial Biosensors: Applications to Clinical, Bioprocess and Environmental
6. Samples **Author:** G. Ramsa, **Publisher:** Wiley-Interscience.
7. Introduction to bioanalytical sensors **Author:** A .J. Cunningham, **Publisher:** Wiley Interscience.
8. Ions, Electrodes & Membrane, **Author:** J. Koryta, **Publisher:** Wiley.
9. Molecular Bioelectronics , **Author :** Claudio Nicolini, **Publisher :** World Scientific
10. Electronic Principles ; **Author:** A P Malvino ; **Publisher:** TMH
11. Digital Logic and Computer Design; **Author:** M. Mano; **Publisher:** PHI

ECC-542: DATA COMMUNICATION NETWORKS

UNIT-I: Foundations of Networking

Communication Networks – Network Elements – Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model – Data grams and Virtual Circuits – Multiplexing – Switching - Error and Flow Control –Congestion Control – Layered Architecture – Network Externalities – Service Integration – Modern Applications.

UNIT-II: Quality of Service

Traffic Characteristics and Descriptors – Quality of Service and Metrics – Best Effort model and Guaranteed Service Model – Limitations of IP networks – Scheduling and Dropping policies for BE and GS models – Traffic Shaping algorithms – End to End solutions – Laissez Faire Approach – Possible improvements in TCP –Significance of UDP in inelastic traffic

UNIT-III: High Performance Networks

Integrated Services Architecture – Components and Services – Differentiated Services Networks – Per Hop Behaviour – Admission Control – MPLS Networks – Principles and Mechanisms – Label Stacking – RSVP – RTP/RTCP, Gigabit Networks.

UNIT-V: Network Management

ICMP the Forerunner – Monitoring and Control – Network Management Systems – Abstract Syntax Notation – CMIP – SNMP Communication Model – SNMP MIB Group – Functional Model – Major changes in SNMPv2 and SNMPv3 – Remote monitoring – RMON SMI and MIB

Reference Books:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, Elsevier.
2. Behrouz A. Forouzan: Data Communications and Networking, Tata McGraw Hill.
3. William Stallings: Data and Computer Communication, Pearson Education.
4. Alberto Leon-Garcia and Indra Widjaja: Communication Networks -Fundamental Concepts and Key Architectures, Tata McGraw-Hill.

ECE-543: MOS-VLSI CIRCUIT DESIGN

UNIT-I Introduction

Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS n-well process, layout design rules.

UNIT-II MOS Transistor and Circuit Modeling

MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET currentvoltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.

UNIT-III MOS Inverter static characteristics and Interconnect Effects

Introduction, Resistive-Load Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasities, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.

UNIT-IV Combinational and Sequential MOS logic Circuits

Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bistable elements, SR latch circuit, clocked latch and flip-flop circuits, CMOS D-latch and Edge-triggered flip-flop.

UNIT-V Dynamic logic Circuits

Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, Highperformance dynamic CMOS circuits.

REFERENCE BOOKS

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH 2003
2. Neil H. E. Weste and David. Harris Ayan Banerjee,, "CMOS VLSI Design" - Pearson Education, 1999.
3. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, 2003
4. Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall,1998.
5. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, "Essentials of VLSI Circuits and Systems" – PHI, EEE, 2005 Edition.

ECE-571: CMOS ANALOG IC DESIGN

UNIT – I: MOS Devices Modeling
The MOS Transistor, Passive components: resistor and Capacitor, CMOS device modeling, Model Parameters, Large Signal Model, Small signal Model, Sub-threshold MOS Model, Computer Simulation Model.

UNIT – II: Analog Circuits
MOS Switch, MOS Diode, MOS active resistor, Current sinks and sources Current Mirror with beta Helper, Current and Voltage references.
Switched Capacitor circuits: basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators, first order filters

UNIT – III: CMOS Amplifiers
Inverters, Differential Amplifiers, Cascode Amplifiers, Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT – IV: Comparators
Two-Stage, Open-Loop Comparators, Other OpenLoop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

REFERENCE BOOKS

1. CMOS Analog Circuit Design by Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition, 2010.
2. Analysis and Design of Analog Integrated Circuits by Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.
3. Analog Integrated Circuit Design by David A. Johns, Ken Martin, Wiley Student Edition, 2013.
4. Design of Analog CMOS Integrated Circuits by Behzad Razavi, TMH Edition.

ECE-572: VLSI TESTING AND TESTABILITY

UNIT – I: Fault modeling and simulation

Physical Faults and their modeling; Stuck at Faults, Bridging Faults, Fault detection, Fault Equivalence, Fault Dominance, Fault Collapsing and Checkpoint Theorem; General fault simulation techniques serial, parallel, concurrent and deductive fault simulation, critical path tracing, statistical fault analysis.

UNIT – II: Combinational Circuit Test Pattern Generation:
Introduction to Automatic Test Pattern Generation (ATPG) and ATPG Algebras ,ATPG for single stuck-at faults and multiple stuck-at faults.
Standard ATPG Algorithms:
D algorithm. Basics of PODEM and FAN

UNIT – III: Sequential Circuit Testing and Scan Chains:
ATPG for Single-Clock Synchronous Circuits, Use of Nine-Valued Logic and Time-Frame Expansion Methods, Complexity of Sequential ATPG
Scan Chain based Sequential Circuit Testing
Scan Cell Design, Design variations of Scan Chains, Sequential Testing based on Scan Chains, Overheads of Scan Design, Partial-Scan Design

UNIT – IV: Design for testability
Ad-hoc design for testability- test points, oscillators and clocks, logical redundancy; Controllability and observability, boundary scan partial/ full scan, serial and non-serial scan; boundary scan standard; Compression techniques.

UNIT-V: Memory BIST
March Test, BIST with MISR, Neighborhood Pattern Sensitive Fault Test, Transparent Memory BIST

REFERENCE BOOKS:

1. Bushnell and Agarwal, "V. D. VLSI Testing", Kluwer.
2. Agarwal, V. D. and Seth, S. C. "Test Generation For VLSI Chips". IEEE computer society press.
3. Abramovici, M., Breuer, M. A. and Friedman, "A. D. Digital Systems Testing And Testable Design". IEEE press (Indian edition available through Jayco Publishing house), 2001.

ECE-573: LOW POWER VLSI DESIGN

UNIT – I: Fundamentals
Need for Low Power Circuit Design, Sources of Power Dissipation: Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation calibration and compensation in pressure sensors, Integrated offset, gain and nonliterary compensation

UNIT – II: Short Channel Effects
Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Switched Capacitance and minimization approaches.
Low Power Design:
Voltage scaling, VTCMOS circuits, MTCMOS circuits, Architectural Level Approach – Pipelining and Parallel Processing Approaches.

UNIT – III: Adders Design
Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low-Voltage Low-Power Design Techniques– Trends of Technology and Power Supply Voltage, LowVoltage Low-Power Logic Styles.
Multiplier Design:
Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier.

UNIT – IV: Low-Power Memories
Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, LowPower SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM,

REFERENCE BOOKS:

1. CMOS Digital Integrated Circuits by Analysis and Design by Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems by Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

ECE-574: BIOMEDICAL SIGNAL PROCESSING

UNIT-I: Biomedical signals

Genesis of bioelectric potential, ECG, EEG, EMG and their monitoring and measurement; overview of analog signal analysis: time – and frequency- domain representation of signal, Fourier series and Fourier transform, linear system, correlation, convolution and filtering; random signal – correlation and spectral representation. Digitization of signal: sampling theorem and A/D Conversion; quantizing effects; aliasing artifacts in biomedical signals.

UNIT-II: Discrete transforms

Discrete – time Fourier theorem, DFT and FFT; z-transform and properties.

UNIT-III: Digital Filters

FIR and IIR filter, biomedical applications of digital filtering- removal power line interference from ECG data, reducing ECG artifact from EMG data.

UNIT-IV: ECG & EEG

ECG Pre-processing, wave form recognition, morphological studies and rhythm analysis, automated diagnosis based on decision theory, ECG compression, evoked potential estimation. EEG: evoked responses, averaging techniques, pattern recognition of alpha, beta, theta and delta waves in EEG waves, sleep stages, epilepsy detection, EMG: wave pattern studies, biofeedback

REFERENCE BOOKS

1. Biomedical Signal Processing and Signal Modeling Author: E.N. Bruce, Publisher: John Wiley and Sons.
2. Nonlinear Biomedical Signal Processing Dynamics, Analysis and Modeling; Author: Metin Akay; Publisher: John Wiley and Sons.
3. Nonlinear Biomedical Signal Processing, Fuzzy Logic, Neural Networks and New algorithms; Author: Metin Akay: Publisher: John Wiley and Sons.
4. Biomedical Digital Signal Processing: C language examples and Laboratory Experiments for IBM PC; Author: W. J Tompkms; Publisher: Prentice Hall.
5. Digital Signal Processing A Computer base Approach; Author: S.K. Mitra Publisher: Mc.Graw Hill, 2nd Edition ,2001
6. Digital Signal Processing: Principles, Algorithms and Application; Author: John G. Proakis, Dimitria G. Manolakis Publisher: 3rd Edition, Prentice Hall, 1995.
7. Biomedical Engineering Handbook, Author: J.D. Bronzino, Publisher: CRC press.
8. Textbook of Medical Physiology; Author: A C Guyton; Publisher: Prism Books (PVT) Ltd.
9. Fundamentals of Anatomy and Physiology, Author: F.H.Martini, Publisher: Prentice Hall

ECE-575: EMBEDDED SYSTEMS

UNIT - I:
The concept of embedded systems design: definitions and constraints, hardware and processor requirements, embedded microcontroller cores, embedded memories, examples of embedded systems.

UNIT –II:
Technological aspects of embedded systems: special purpose processors; input-output design and I/O communication protocols; design space exploration for constraint satisfaction; co-design approach; example system design, interfacing between analog and digital blocks, signal conditioning, digital signal processing. sub-system interfacing, interfacing with external systems, user interfacing. Design trade offs due to process compatibility, thermal considerations etc.

UNIT –III:
Software aspects of embedded systems: real time programming languages and operating systems for embedded systems. specification refinement and design; design validation; Real Time operating system issues with respect to embedded system applications; time constraints and performance analysis.

REFERENCE BOOKS:

1. Readings in Hardware/Software Co-Design by G. De Micheli, Rolf Ernst, and Wayne Wolf, eds. Morgan Kaufmann, Systems-on-Silicon Series
2. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid and Tony D. Givargis, Addison Wesley.
3. Programming Embedded Systems in C and C++ by Michael Barr, O'Reilly.
4. An Embedded Software Primer by David E. Simon, Addison Wesley.
5. The Art of Designing Embedded Systems by Jack Ganssle, Newnes.

ECE-576: CRYPTOGRAPHY AND NETWORK SECURITY

UNIT-I: Introduction
Confidentiality -- Data Integrity -- Authentication -- Non-Repudiation. -- Overview of Issues involved. Classical Encryption Techniques: Monoalphabetic, Substitution Methods, Polyalphabetic Substation Methods -- Permutation Methods -- Cryptanalysis of these Methods.

UNIT-II: Modern Encryption Techniques
Simplified DES -- DES -- Triple DES -- Block Cipher , Design Principles -- Block Cipher Modes of Operation. IDEA -- Security Issues Involved with these methods. Confidentiality Using Conventional Encryption: Placement of Encryption -- Traffic Confidentiality -- Key Distribution -- Random Number , Generation.

UNIT-III: Introduction to Number Theory
(Basics Pertaining to Security Related Algorithms). Public Key Cryptography : Principles -- RSA Algorithm. Message Authentication and Hash Functions -- Hash an MAC Algorithms. Digital Signatures and Authentication Protocols -- Authentication Applications

UNIT-IV: Basic Network Security
Basic Overview of Electronic Mail Security, IP Security, WEB Security, System Security: Intruders, Viruses and Worms -- Firewalls

REFERENCE BOOKS:

1. Cryptography and Network Security, William Stallings. (Second Edition) Pearson Education Asia.
2. Network Security: The Complete Reference by Roberta Bragg, Mark Phodes-Ousley, Keith Strassberg Tata Mcgraw-Hill
3. Handbook of Applied Cryptography

ECE-577: WIRELESS COMMUNICATION

UNIT – I: Introduction
A brief introduction to evolution of mobile radio communications, technologies and choices. Development of Wireless networks, Cellular Concept – System Design: Fundamentals: Frequency reuse, channel Assignment, Handoff Strategies, Interfaces and System Capacity, Trunking and Grade of Service; Improving coverage and capacity in Cellular Systems- Cell Splitting, Sectoring, Repeaters and Range Extension, Microcell & Picocell Zone Concept, multipath effects in mobile communication, mobile communication – antennas.
Large – Scale Propagation: basic propagation mechanisms – Reflection, Diffraction, Scattering. Outdoor propagation Model – Longly Rice model, Durkin's model, Okumura model, Hata model, PCS extension; Indoor Propagation Model; Partition loses, Log distance Path loss Model, Attenuation Factor model, Ray tracing & site specific modeling.
Small Scale Propagation: small scale multi path propagation. Small scale multi path measurements, Parameters of multi path channels, types of multi path fading, Rayleigh and Ricean distribution, Clarke's model, multi path space factors, fading rate variance.

UNIT – II: Spread spectrum
Spread spectrum modulation techniques, Equalization Technique – Linear equalizer and Nonlinear equalization, algorithms for adaptive equalization, Diversity techniques – space, polarization, frequency and time, Speech coding – quantization, ADPCM, frequency domain coding, Vocoders, linear predictive coders, GSM codec. Multiple Access Techniques: Frequency Division Multiple Access (FDMA – Wideband and narrow band), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access – Frequency Hopped multiple Access (FHMA), Code Division Multiple Access (CDMA). Space Division Multiple Access (SDMA), Spectral efficiency of different access technologies, Packet ratio protocols – ALOHA, carrier sense Multiple Access (CSMA/CD, CSMA/CA), Packet reservation Multiple Access (PRMA), capacity of cellular systems

UNIT – III: Evolution of Modern Mobile Wireless Communication systems
WPAN, IEEE 802.15, DECT, PACS, brief survey of: 1G wireless networks, 2G wireless cellular networks, GSM (radio subsystem, operation subsystem), GSM multiple access scheme, GSM channel organization, call setup procedure, 2.5G networks, GPRS network architecture, classes of GPRS equipments. IS-95 systems, 3G (UMTS) (without details) of network architecture.

UNIT – IV: WLAN & cellular networks
Fundamentals of WLAN (802.11) transmission technology (spread spectrum and infrared transmission) logical architecture, CSMA/CA, CSMA/CD, assess method, MAC frame format system performance. Cellular and WLAN integration: (step towards 4G networks) benefits of integration. Suitable point of integration, integration architecture. A brief overview of WiMax technology (broadband wireless communication).

REFERENCE BOOKS:

1. Wireless Communications by T. S. Rappaport, 2nd Edition, Pearson Education.
2. Wireless Communications & Network 3G and beyond Itisaha Mishra, Tata Mc-Graw Hill Education Pvt. Ltd.
3. Mobile cellular Telecommunications by W. C. Y. Lee, 2nd Edition, McGraw Hill.
4. Wireless Communication by T. L. Singal, Tata Mc-Graw Hill Education Pvt. Ltd.
5. Wireless Communication and Networks by V. K. Garg, Elsevier.
6. Wireless Digital Communication by Kamilo Feher, PHI.
7. Wireless Communication and Networks by William Stalling, 2nd Ed, LPE, Pearson.
8. Introduction to CDMA Wireless Communication by Mosa ali Abu Rgheff, Elsevier.
9. 3G Networks by Sumit Kasera & Nishit Narang, Tata McGraw Hill.

ECO-611: ADVANCED COMPUTER ARCHITECTURE

UNIT-I: Introduction
Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors.

UNIT-II: Pipelining
Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.

UNIT-III: Hierarchical memory technology
Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

UNIT-IV: Instruction-level parallelism
Basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors. Multiprocessor architecture: taxonomy of parallel architectures.

UNIT-V:
Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.

REFERENCE BOOKS:

1. Hennessey and Patterson: Computer Architecture A Quantitative Approach, Elsevier.
2. Kai Hwang: Advanced Computer Architecture - Parallelism, Scalability, Programmability, Tata McGraw Hill.

ECE-612: FPGA DESIGN

UNIT –I:
Evolution of programmable devices: Introduction to AND-OR structured Programmable Logic Devices PROM, PLA, PAL and MPGAs; Combinational and sequential circuit realization using PROM based Programmable Logic Element (PLE); Architecture of FPAD, FPLA, FPLS and FPID devices.

UNIT – II:
FPGA Technology: FPGA resources - Logic Blocks and Interconnection Resources; Economics and applications of FPGAs; Implementation Process for FPGAs Programming Technologies - Static RAM Programming, Anti Fuse Programming, EPROM and EEPROM Programming Technology; Commercially available FPGAs - Xilinx FPGAs, Altera FPGAs; FPGA Design Flow Example - Initial Design Entry, Translation to XNF Format, Partitioning, Place and Route, Performance Calculation and Design Verification.

UNIT – III:
Technology Mapping for FPGAs: Logic Synthesis - Logic Optimization and Technology Mapping; Lookup Table Technology Mapping - Chortle-crf Technology Mapper, Chortle-d Technology Mapper, Lookup Table Technology Mapping in mis-pga, Lookup Table Technology Mapping in Asyl and Hydra Technology Mapper; Multiplexer Technology Mapping - Multiplexer Technology Mapping in mis-pga.

UNIT – IV:
Routing for FPGAs: Routing Terminology; Strategy for routing in FPGAs; Routing for Row-Logic Block Architecture: Logic Block Functionality versus Area-Efficiency - Logic Block Selection, Experimental Procedure, Logic Block Area and Routing Model and Results.

UNIT – V:
Based FPGAs - Segmented channel routing, 1-channel routing algorithm, K – channel routing algorithm and results.

REFERENCE BOOKS:

1. FPGA-Based System Design Wayne Wolf, Verlag: Prentice Hall
2. Modern VLSI Design: System-on-Chip Design (3rd Edition) Wayne Wolf, Verlag

ECE-613: APPLICATION SPECIFIC INTEGRATED CIRCUITS

UNIT –I: Introduction to ASICS, CMOS Logic and Library Design

Types of ASICs, Design flow, CMOS transistors, CMOS Design rules, Combinational Logic Cell, Sequential logic cell, Data path logic cell, Transistors as Resistors, Transistor Parasitic Capacitance, Logical effort Library cell design, Library architecture .

UNIT –II: Programmable ASICS, Logic Cell and I/Os

Antifuse static RAM, EPROM and EEPROM technology, PREP benchmarks, Actel ACT, Xilinx LCA, Altera FLEX, Altera MAX DC & AC inputs and outputs - Clock & Power inputs, Xilinx LCA, Xilinx EPLD, Altera MAX 5000 and 7000, Altera MAX 9000, Altera FLEX

UNIT –III: Logic Synthesis, Simulation and Testing

Design systems, Logic Synthesis, Half gate ASIC, Schematic entry, Low level design language, PLA tools -EDIF- CFI design representation. Verilog and logic synthesis, VHDL and logic synthesis, types of simulation, boundary scan test fault simulation, automatic test pattern generation.

UNIT –IV: ASIC Construction, Floor Planning, Placement and Routing

System partition, FPGA partitioning, partitioning methods, floor planning, placement, physical Design flow, global routing, detailed routing, special routing, and circuit extraction

REFERENCE BOOKS:

1. M.J.S. Smith, Application Specific Integrated Circuits, Addison -Wesley Longman Inc.1997.
2. Farzad Nekoogar and Faranak Nekoogar, From ASICs to SOCs: A Practical Approach, Prentice Hall PTR, 2003.
3. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.
4. Nekoogar F.. Timing Verification of Application-Specific Integrated Circuits (ASICs). Prentice Hall PTR, 1999.

ECO-614: WIRELESS SENSOR NETWORKS

UNIT-I: Ad-hoc Wireless Networks

Applications of Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks: Medium Access Scheme, Routing, Multicasting, Transport Layer Protocols, Quality of Service Provisioning, self-organization, Security Addressing and Service Discovery - Energy management Scalability-Deployment Considerations, Ad Hoc Wireless Internet.

UNIT-II: Comparison with Ad-hoc wireless networks

Challenges for WSNs – Difference between sensor networks and Traditional sensor networks, types of applications, Enabling Technologies for Wireless Sensor Networks –Single Node Architectures, Hardware Components, Energy Consumption of Sensor Nodes, Issues in Designing a Multicast Routing Protocol.

UNIT-III: Data Dissemination

Flooding and Gossiping, Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs Gateway Concepts, Need for gateway, WSN to Internet Communication, Internet to WSN Communication –WSN Tunneling MAC Protocols for Sensor Networks, Location Discovery, Quality of Sensor Networks, Evolving Standards, Other Issues- Low duty cycle and wake up concepts- The IEEE802.15.4 MAC Protocols- Energy Efficiency

UNIT-IV: Geographic Routing

Mobile nodes - Gossiping and Agent based Unicast Forwarding-Energy Efficient Unicast, Broadcast and Multicast, Geographic Routing, Mobile nodes, Security Application Specific Support - Target detection and tracking-Contour/ edge detection- Field sampling.

REFERENCE BOOKS:

1. Holger Karl and Andreas Wiilig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons Limited 2008.
2. I.F .Akyildiz and Weillian, "A Survey on Sensor Networks", IEEE Communication Magazine, August 2007.
3. Jon S. Wilson, "Sensor Technology hand book", Elsevier publications, 2005.
4. Anna Hac, "Wireless Sensor Networks Design" ,John Wiley& Sons Limited Publications 2003.
5. C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks", Pearson Edition 2005.

ECE-615: COGNITIVE RADIO

UNIT I - SOFTWARE DEFINED RADIO

Basic SDR – Software and Hardware Architecture of an SDR – Spectrum Management – Managing unlicensed spectrum – Noise Aggregation

UNIT II - SDR AS PLATFORM FOR COGNITIVE RADIO

Introduction – Hardware and Software architecture – SDR development process and Design – Application software – Component development – Waveform development – cognitive waveform development

UNIT III - COGNITIVE RADIO TECHNOLOGY

Introduction – Radio flexibility and capability – Aware – Adaptive –Comparison of Radio capabilities and properties – Available Technologies – IEEE 802 Cognitive Radio related activities – Application.

UNIT IV - CR- TECHNICAL CHALLENGES

Design Challenges associated with CR – Hardware requirements – Hidden primary user problem – detecting spread spectrum primary users – sensing duration and frequency – security

UNIT V - SPECTRUM SENSING

Overview – Classification - Matched filter – waveform based sensing – cyclostationary based sensing – Energy detector based sensing – Radio Identifier – Cooperative sensing- other sensing methods

REFERENCE BOOKS:

1. Paul Burns, Software Defined Radio for 3G, Artech House, 2002.
2. Tony J Rouphael, RF and DSP for SDR, Elsevier Newnes Press, 2008.
3. Jouko Vanakka, Digital Synthesizers and Transmitter for Software Radio, Springer, 2005
4. P Kenington, RF and Baseband Techniques for Software Defined Radio, Artech House, 2005

ECE-616: REMOTE SENSING TECHNIQUES & APPLICATIONS

UNIT-I: Transmission of Solar Radiation through the Atmosphere

Solar radiation spectrum; Radio infrared and optical windows of the earth's atmosphere; Spectrum of solar radiation transmitted through the atmosphere, Emissions from the disturbed sun, Reflection, Absorption and Emission from Earth and Atmosphere.

Variation of the earth's reflectivity with angle of incidence, wavelength and geographical location; Seasonal variation of reflectivity; Solar radiation reflected from the earth; Absorption of solar radiation by the earth; Thermal radiation from the earth; Thermal radiation from the atmospheric constituents; Thermal emission from cloud, rain, snow and fog; Radio noise and interference at satellite heights.

UNIT-II: Sensors and Cameras

Optical and infrared detectors and filters, Optical and infrared cameras; Microwave and Millimetrewave radiometers; Scanning systems, Mechanical and Electronic systems; Scatterometer; Altimeter.

UNIT-III: Remote Sensing Satellites

Orbits of remote sensing satellites; Remote sensing satellites – LANDSAT; Indian Remote Sensing (IRS) Satellites; INSAT, NOAA Series; NASA's Upper Atmosphere Research Satellites (UARS); TRMM satellite.

UNIT-IV: Remote Sensing of Atmosphere and Sea State

Passive and active remote sensing; Side Looking Airborne Radar (SLAR); Synthetic Aperture Radar (SAR); Along Track Scanning Radiometer (ATSR). Laboratory measurements of remote sensing parameters; Tropical rainfall measurements; Microwave sensing of sea surface.

UNIT-V: Interpretation of Sensing Data

Photo-interpretation, image and pattern recognition; Spectral interpretation of remote sensing imagery; Interpretation of thermal maps; Colour coding and enhancement; Computer interpretation of images.

REFERENCE BOOKS:

1. MONOJIT MITRA: Satellite communications , Prentice Hall of India
2. S. KINGLEY & S. ONEGAN: Understanding radar systems, Standard Publisher & Distribution.
3. SKOLNIK : Introduction to radar systems , TMH

ECE-617: BIOMEDICAL ELECTRONICS

UNIT-I: Physiological systems and Signals

Biology of the heart, circulatory and respiratory systems, auditory systems, physiology of nerve and muscle cells, fundamental organization of brain and spinal cord.

UNIT-II: Biosignals

Origin of bioelectric signals, electrocardiogram (ECG), phonocardiogram (PCG), encephalogram (EEG) and electromyogram (EMG). Spectral characteristic of biosignals.

UNIT-III: Physiological Transducers

Electrodes: silver-silver chloride electrodes, electrodes for ECG,EEG, EMG, Microelectrodes. Performance characteristics of transducers, classification of transducers based on Electrical principle involved: Resistive position transducer, resistive pressure transducer, inductive pressure transducer, capacitive pressure transducer; Self generating inductive transducer: linear variable differential transformer (LVDT), Piezoelectric Transducer. Transducers for body temp measurement, photoelectric transducers, pH measurement.

UNIT-IV: Recording Systems
Preamplifier, Signal conditioning: Differential amplifier, current to voltage converter, instrumentation amplifier; biomedical filters: LPF, HPF, bandpass, band stop (Notch filter); 4-20ma transmitter, source of noise in low level measurement, Recording systems for ECG, PCG, EEG and EMG.

UNIT-V: Medical Imaging Systems
X-ray imaging, Computed tomography, ultrasonic imaging systems, Magnetic resonance imaging system, thermal imaging systems. Therapeutic equipments: Cardiac pacemaker, cardiac defibrillators, haemodylysis machine, lithotisptors, ventilators, bionic ear.

REFERENCE BOOKS:

1. L. Cromwell, F. J. Weibell, E.A. Pfeiffer. "Biomedical Instrumentation and Measurement" Pearson Education, 2003
2. R.S. Khandpur, "Handbook of Biomedical Instrumentation" TATA McGRAW HILL, 2005
3. J. Enderle, S. Blanchard, J. Bronzino. "Introduction to Biomedical Engineering", Academic Press, 2000

ECE-618: BIOMEDICAL IMAGE PROCESSING

UNIT-I: Medical Imaging
X-ray imaging, computer assisted tomography magnetic resonance imaging, nuclear magnetic resonance imaging. Image enhancement: Fundamental enhancement techniques, medical image enhancement with nonlinear filters.

UNIT-II: Segmentation
Image segmentation basics, medical image segmentation by clustering, fuzzy clustering, segmentation by neural network, deformable modules and gradient vector flaw deformable modules, case studies of segmentation of brain, heart etc.

UNIT-III: Image reconstruction
Image reconstruction from projections: Principle of tomography, algebraic and Fourier domain reconstruction technique .

UNIT-IV: Image registration
Physical basics of spatial distortion in medical images, fundamental of registration; application of image registration for image guided surgery.

UNIT-V: Medical image compression
Fundamental and standards of image compression; issues related with medical image compression; medical image.

REFERENCE BOOKS:

1. Ultrasonic Imaging and Signal Processing; Author: K Shun, M F Insana; Publisher: SPIE
2. Biomedical Engineering Handbook, Author: J.D. Bronzion, Publisher: CRC press.
3. Biomedical Digital Signal Processing: C language examplesand Laboratory
4. Experiments for IBM PC; Author: W. J Tompkms; Publisher: Prentice Hall.
5. Digital processing of Biomedical Images; Publisher: Plenum Publishers.
6. Biomedical Imaging, Visualization and analysis; Author: Richard A. Robb; Publisher: Wiley –Liss.
7. Adaptive Blind Signal and Image Processing; Author: A Cichocki, Shun-ichi Amari; Publisher: John Wiley and Sons.
8. Medical Image Database ; Author: Stephen T C Wong; Publisher: KAP.
9. Fundamentals of Digital Image Processing, Author: A.K Jain
10. Handbook of Medical Imaging and Processing, Editor: Issac Bankman.

ECE-619: ADVANCED BIOELECTRONIC DEVICES

UNIT-I: MOS

Metal - Oxide - Semiconductor (MOS) : MOS Structure, Modes of operation, Metal Oxide Semiconductor Field effect Transistor (MOSFET).

UNIT-II: EIS

Electrolyte – Insulator – Semiconductor (EIS) : EIS Structure, Site binding Theory, Electrical double layer theory.

UNIT-III: MOSFET Based Bioelectronic devices

Biosensor overview, Ion Sensitive Field Effect Transistor (ISFET), Enzyme Field Effect Transistor (ENFET), Chemical Field Effect Transistor (CHEMFET), Reference Field Effect Transistor (REFET), Immune Field Effect Transistor (IMFET), Organic Thin Film Transistor (TFT), Cell-Based Biosensors & Sensors of Cell Metabolism, Light Addressable Potentiometric Sensors (LAPS)

UNIT-IV: Interfacing

Interfacing of biological Systems with electronic systems, non-conventional bioelectronic devices, conducting polymer based ISFET

UNIT-V: Modeling & Simulation

Models of bioelectronic devices: SPICE and Electrochemical models of ISFET & CHEMFET.

REFERENCE BOOKS:

1. Bioelectronics Handbook, MOSFETs, Biosensors,& Neurons, **Author:** Massimo Grattarola, Giuseppe Massobrio, **Publisher:** McGraw Hill.
2. Advanced Semiconductor and Organic Nanotechnology; **Author:** H. Markov , **Publisher:** Academic Press
3. Biomaterial Science , **Author:** Ruddy Ratner, **Publisher:** Academic Press.
4. Biomedical Engineering Handbook, **Author:** J.D. Bronzion, **Publisher:** CRC press.

5. Commercial Biosensors: Applications to Clinical,Bioprocess and Environmental Samples, **Author:** G. Ramsa, **Publisher:** Wiley-Interscience.
6. Introduction to bioanalytical sensors , **Author:** A.J.Cunningham, **Publisher:** Wiley Interscience.
7. Biosensors in Environmental Monitoring, **Author:** U.Bilitewski,A.Turner; **Publisher:** Taylor Francis.
8. Biochip Technology; **Author:** J Cheng,L Kricka; **Publisher:** Taylor and Francis.
9. BioPhysics; **Author:** R Glaser; **Publisher:** Springr

ECO-620: RESEARCH METHODOLOGY

UNIT-I: Definition and objectives of Research

Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

UNIT-II: Quantitative Methods for problem solving:

Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT-III :Tabular and graphical description of data:

Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis

UNIT-IV: Structure and Components of Research Report

Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing

REFERENCE BOOKS

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047-0,2006.
3. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
4. Fuzzy Logic with Engg Applications, Timothy J.Ross, Wiley Publications, 2nd Ed[d]