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	Advanced Digital Communication	3-1-0	80	20	-	100
ECC-503	Advanced Microprocessors and Microcontrollers	3-1-1	50	20	30	100
	Elective I	3-1-0	50	20	30	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	3-1-1	50	20	30	100
	Elective – II	3-0-1	50	20	30	100
	Elective –III	3-1-0	80	20	-	100
				Internal	**External**	
ECC-578	**Seminar**	0-0-3		60	40	100
	Credits	20				

THIRD SEMESTER

Paper Code	Title	Credit	Mark Distribution			
			End Semester	Sessional	Practical	Total
XXX	***Open Elective***	3-1-0	80	20	-	100
	Elective –IV	3-0-1	50	20	30	100
	Elective -V	3-1-0	80	20	-	100
ECC-602	**PROJECT – I** (BASED ON SPECIALIZATION)	0-0-10	80	-	120	200
	Credits	22				

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	MEMS and Micro System	3-0-1	50	20	30	VLSI Design
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**
ECE-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	3-1-0	50	20	30	VLSI Design
ECE-620	Low Power VLSI Design	3-1-0	80	20	-	VLSI Design & Bioelectronics
ECE-621	VLSI Technology	3-0-1	50	20	30	VLSI Design
ECE-614	Wireless sensor networks	3-0-1	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
ECE-622	Artificial Intelligence	3-1-0	80	20	-	Advanced Communication System

Open Elective courses offered by Department Electronics and Communication Engineering

Paper Code	**Title**	Credit	End Semester	Sessional	Practical	**Specialization**
ECO-623	Basics of Digital Electronics and Communication	3-1-0	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, Synchronous and Asynchronous Digital Counters and shift registers, Mealy machine, Moore machine, State diagrams, State table minimization, realization of Mealy and Moore machine.

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.

UNIT-V: DIGITAL DESIGN WITH VERILOG

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

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: ADVANCED DIGITAL COMMUNICATIONS

UNIT I: INTRODUCTION

Elements of Digital Communication System: Communication channels and their characteristics - mathematical models for channels - representation of digitally modulated signals - performance of memoryless modulation methods - signaling schemes with memory- CPFSK - CPM.

UNIT II: OPTIMUM RECEIVERS FOR AWGN CHANNELS

Waveform and Vector Channel Models: Detection of signals in Gaussian noise – optimum detection and error probability for band limited signalling and power limited signalling – non coherent detection - comparison of digital signalling methods - lattices and constellations based on lattices - detection of signalling schemes with memory - optimum receiver for CPM - performance analysis for wireline and radio communication systems; Introduction to partially coherent, double differentially coherent communication systems.

UNIT III: CHANNEL CODING

Introduction to Linear Block Codes: Convolution coding - Tree, Trellis and state diagrams – systematic - non-recursive and recursive convolutional codes - the inverse of a convolutional encoder and catastrophic codes - decoding of convolutional codes - maximum likelihood decoding - Viterbi algorithm and other decoding algorithms - distance properties – punctured convolutional codes - dual k codes - concatenated codes - MAP and BCJR algorithms – turbo coding and iterative decoding - factor graphs and sum-product algorithms - LDPC codes - trellis coded modulation - performance comparison.

UNIT IV: PULSE SHAPING AND EQUALIZATION

Pulse Shaping: Characterization of band limited channels - ISI - Nyquist criterion – controlled ISI - channels with ISI and AWGN - pulse shaping for optimum transmissions and reception; Equalization: MLSE - linear equalization - decision feedback equalization - ML detectors - iterative equalization - turbo equalization - adaptive linear equalizer - adaptive decision feedback equalization - blind equalization.

UNIT V: SYNCHRONIZATION

Signal Parameter Estimation: Carrier phase estimation - symbol timing estimation – joint estimation of carrier phase and symbol timing - performance characteristics of ML estimators.

REFERENCE BOOKS:

1. John G. Proakis and Masoud Salehi, “Digital communications”, 5th Edition, Tata McGraw Hill, 2008.
2. Ian A. Glover and Peter M. Grant, “Digital Communications”, 2nd Edition, Pearson Education, 2008.
3. Bernard Sklar, “Digital Communications: Fundamentals and Applications”, 2nd Edition, Pearson Education, 2002.
4. Marvin K.Simon, M. Hinedi and William C. Lindsey, “Digital Communication Techniques: Signal Design and Detection”, Prentice Hall of India, 2009.
5. John R. Barry, Edward A. Lee, David G. Messerschmitt, “Digital Communication”, Kluwer Academic Publishers, 2004.

ECC-503: ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

UNIT-I:

8085 Architecture, its register organization, Pin diagram, and Timings diagram, Machine language instruction formats, Addressing modes, Instruction set, Assembler directives. Program example.

UNIT-II:

Pin diagram, Minimum and Maximum Mode and Bus Timings, Ready and Wait states and 8086 based micro-computing system, Machine language instruction formats, Addressing modes, Instruction set, Assembler directives. Architectural features of 80386, 486.

UNIT-III:

ALP, programming with an assembler, stack structure, Interrupts, Service subroutines and Interrupt programming and Macros.

UNIT-IV:

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

UNIT-V:

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

Source Coding - Introduction to information theory, uncertainty and information, average mutual information and entropy, source coding theorem, Shannon-fano coding, Huffman coding, Arithmetic coding, Lempel-Ziv algorithm, run-length encoding and rate distortion function.

UNIT II

Channel capacity and coding - channel models, channel capacity, channel coding, information capacity theorem, random selection of codes. Error control coding: linear block codes and their properties, decoding of linear block code, perfect codes, hamming codes, optimal linear codes and MDS codes.

UNIT III

Cyclic codes - polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, burst error correction, fire codes, golay codes, CRC codes, circuit implementation of cyclic codes. BCH codes: minimal polynomials, generator polynomial for BCH codes, decoding of BCH codes, Reed-Solomon codes and nested codes.

UNIT IV

Convolutional codes - tree codes and trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, generation function, matrix description of convolutional codes, viterbi decoding of convolutional codes, distance bounds for convolutional codes, turbo codes and turbo decoding.

UNIT V

Trellis Coded Modulation - concept of coded modulation, mapping by set partitioning, ungerboeck's TCM design rules, TCM decoder, Performance evaluation for Additive White Gaussian Noise (AWGN) channel, TCM for fading channels.

REFERENCES:

1. Ranjan Bose, "Information theory, coding and cryptography", Tata McGraw Hill, 2002.
2. Viterbi, "Information theory and coding", McGraw Hill, 1982.
3. John G. Proakis, "Digital Communications", 2nd Edition, McGraw Hill, 1989.

ECC-506: ADVANCED DIGITAL SIGNAL PROCESSING

UNIT I: INTRODUCTION TO RANDOM SIGNAL PROCESSING

Basic Concepts of signal processing, Discrete Random Processes- Distribution functions, Ensemble Averages, moment, Stationary and Non-stationary processes, Bias and Estimation, Autocovariance, Autocorrelation, Crosscovariance, Crosscorrelation.

UNIT II: DIGITAL FILTERS

FIR & IIR filter realization- Parallel & cascade forms. FIR design: Windowing Techniques-Need and choice of window-Linear phase characteristics. IIR design: Butterworth and Chebyshev approximation, digital design using impulse invariant and bilinear transformation.

UNIT III: 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 IV: LINEAR PREDICTION

Linear Prediction of Signals-Forward and Backward Predictions, Wiener Hopf Equation, normal equations for linear prediction filtering, Levinson-Durbin algorithm, Wiener smoothing prediction filter, Application of Weiner smoothing to noise cancelling

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 circuits – flip flops, Digital Counters, Memories.

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 Parasitics, 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. Design of Analog CMOS Integrated Circuits by Behzad Razavi , McGraw-Hill,2001.
2. CMOS Analog Circuit Design by Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition, 2010.
3. 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.
4. Analog Integrated Circuit Design by David A. Johns, Ken Martin, Wiley Student Edition, 2013.
5. 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.

UNIT – IV: DESIGN FOR TESTABILITY

Ad-hoc design for testability- test points, Controllability and Observability of digital circuits , boundary scan partial/ full scan, serial and non-serial scan; boundary scan standard.

UNIT-V: BIST AND MEMORY TESTING

Built in Self test, Architecture of BIST, LFSR and Compaction Techniques, Memory Testing: Memory architecture, types of faults in memory and March Test.

REFERENCE BOOKS:

1. Bushnell and V D Agarwal," Essential of Electronics Testing", Kluwer.
2. Laung, Cheng and Xiaoqing" VLSI Test principles and architectures"Elsevier.
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 MEMS AND MICROSYSTEM

UNIT I:

Introduction to MEMS, Micro-System; Evolution of Micro-System; Integrated Microsystem: Micromechanical Structure; Micro-Sensor, Micro-Actuator, Sensor Characteristic; Physical Principle of Sensing; Application of Smart Material and Microsystem.

UNIT II:

MEMS Materials and their Preparation: Overview, Atomic Structure and the Periodic Table, Atomic Bonding, Crystallinity; Metals: Physical and Chemical Properties, Metallization, Semiconductors: Semiconductors: Electrical and Chemical Properties, Semiconductors: Growth and Deposition; Ceramic, Polymeric, and Composite Materials.

UNIT III:

Microsystem: Silicon Capacitive Accelerometer, Piezoresistive Pressure Sensor, Conductometric Gas Sensor, Electrostatic Comb Drive, Magnetic Microrelay, Smart Material: Thermoresponsive Material, Piezoelectric Material, Electrostatic/ Electromagnetic Material, Rheological Material, Electrochromic Material, Biomimetic Material, Smart Gel.

UNIT IV:

Mechanics of beam and diaphragm structures: Stress and Strain; Stress and Strain of Beam Structures; Vibration Frequency by Energy Method; Vibration Modes and the Buckling of a Beam; Damped and forced vibration; Basic Mechanics of Diaphragms.

UNIT V:

Electronics Circuit and Control for Micro and Smart System: Semiconductor Devices; Electronics Amplifier; Practical Signal Conditioning Circuit for Microsystem; Circuit for Conditioning Sensed Signal; Introduction to control System.

REFERENCE BOOKS:

1. "Analysis and Design Principles of MEMS Devices", Minhang Bao, ELSEVIER, 2005, ISBN: 0 444 51616
2. "Microsystem Design", Stephen D.Senturia, Kluwer Academic publishers, ISBN: 0-7923-7246-8
3. " Microsensors, MEMS, and Smart Devices" Julian W. Gardner, Vijay K. , Awadelkarim, John Wiley & Sons, Ltd, ISBN 0-471-86109-X
4. "Handbook Of Modern Sensors Physics, Designs, and Applications", Jacob Fraden, Springer, ISBN 0-387-00750-4

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, 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

Fourier series and Fourier transform, linear system, 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:

What is Embedded system, General computing system, Classification, Purpose of Embedded System, Core of Embedded System, RISC, CISC, Harvard and Von Neumann Architecture, Big Endian and Little Endian, Sensors and Actuators:7- segment LED, Optocoupler, Stepper Motor, Relay, Piezo Buzzer. Memories

UNIT –II:

Built process for Embedded process, Design Process: Concepts, software Design Process, Design Matrics, Steps in Design process, Design Challenge in Embedded system Design, Optimising the Design Matrics, Issues Related to Embedded software Development, Hardware software co design, Formalism of system design, Design process with example.

UNIT –III:

Architecture of 8051, AVR Microcontroller, ARM Microcontroller, Computer system buses: System buses, I/O buses, I/O type and Example, Communication Protocols: I^2C bus, CAN, USB and FireWire (IEEE1394). Parallel bus Protocol, Wireless and Mobile Protocol: IrDA, Bluetooth and IEEE 802.11

UNIT –IV:

Programming Concept, Embedded C Programming: Identifier, Data type, storage Class, Arithmetic Operation, Logical Operation, Relational Operation, Branching instruction, looping, Arrays and Pointer, Modifier, loops, functions, Pointers, input and output instruction, Function, Programming examples.

UNIT –V:

Real Time Operation System, Multiple Process in an application, Multiple threads in application, tasks, task and threads, task and data, Inter process communication and synchronisation, signals, concept of semaphores, Disabling and Enabling function, shared data problem, Queues and mailboxes.

REFERENCE BOOKS:

1. Embedded Systems Architecture, programming and design by Raj Kamal, McGraw Hill Education Private Limited.
2. Embedded Microprocessor Systems Real World Design by Stuart R. BaII, Third Edition, Newnes.
3. Introduction to Embedded systems by Shibu K V, McGraw Hill Education Private Limited.
4. Readings in Hardware/Software Co-Design by G. De Micheli, Rolf Ernst, and Wayne Wolf, eds. Morgan Kaufmann, Systems-on-Silicon Series
5. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid and Tony D. Givargis, Addison Wesley.
6. Programming Embedded Systems in C and C++ by Michael Barr, O'Reilly.
7. An Embedded Software Primer by David E. Simon, Addison Wesley.
8. 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 by 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

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.

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 1:

Overview; The Main Component of a Computer System; Standards and Organization; Computer Level Hierarchy; The von Neumann Model; Non von Neumann Model; Historical Development; Moore's Law; The General Concept of the System; IT system Architecture.

UNIT 2:

Data Representation in Computer System: Decimal to Binary conversion; Signed Integer Representation; Floating point Representation; Character Codes; Codes for Data Recording and Transmission; Error Detection and Correction.

UNIT 3:

Instruction Set Architecture: Instruction Format; Instruction type; Addressing; Instruction Level Pipelining; Memory: Types of Memory; Cache Memory; Virtual Memory.

UNIT 4:

I/O and Storage System: Amdahl's Law; I/O Architecture; Magnetics Disk Technology; Optical Disk; Magnetics Tape; RAID; Data Compression; Display; Printers; User Input Devices; Network Communication Devices.

UNIT 5:

Operating System: Overview; the Operating System Concept; Services and Facilities; Organization; Types of Computer Systems; Purpose of the User Interface; User Functions and Program Services; Types of User Interface; Command and Scripting Languages; Services to Programs

REFERENCE BOOKS:

1. "Advanced Computer Architecture and Parallel Processing", Hesham El-Rewini, Mostafa Abd-El-Barr, *A John Wiley & Sons, Inc Publication,* 2005, ISBN 0-471-46740-5
2. "Computer Systems Design and Architecture" , Vincent P. Heuring, Harry F. Jordan, *Addison-Wesley Longman,* Inc, 1997, ISBN 0-8053-4330-X
3. "The essential of computer organization and Architecture", Linda Null, Julia Lobur, Jones and Bartlett Publishers, 2003, ISBN 076370444X
4. "The Architecture Of Computer Hardware System Software And N Etworking", Irv Englander, John Wiley & Sons, Inc., ISBN-13: 978-0471-71542-9, 4th Edition

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 by Wayne Wolf, Verlag: Prentice Hall
2. Modern VLSI Design: System-on-Chip Design (3rd Edition) by 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, Emissions from the disturbed sun, Reflection, Absorption and Emission from Earth and Atmosphere.

Variation of the earth's reflectivity, Solar radiation, Absorption of solar radiation, Thermal radiation, 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. Qnegan "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. Pfeeiffer. “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 by Author: K Shun, M F Insana; Publisher: SPIE
2. Biomedical Engineering Handbook, Author by J.D. Bronzion, Publisher: CRC press.
3. Biomedical Digital Signal Processing by C language examplesand Laboratory
4. Experiments for IBM PC by W. J Tompkms; Publisher: Prentice Hall.
5. Digital processing of Biomedical Images; Publisher: Plenum Publishers.
6. Biomedical Imaging, Visualization and analysis by Richard A. Robb; Publisher: Wiley –Liss.
7. Adaptive Blind Signal and Image Processing by A Cichocki, Shun-ichi Amari; Publisher: John Wiley and Sons.
8. Medical Image Database by Stephen T C Wong; Publisher: KAP.
9. Fundamentals of Digital Image Processing by 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, Characteristics of 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 and EFFET.

UNIT-V: MODELING & SIMULATION

Models of bioelectronic devices: SPICE and Electrochemical models of ISFET, CHEMFET, REFET, IMFET.

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.

ECE-620: 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, Low Voltage Low-Power Logic Styles.

UNIT- IV: MULTIPLIER DESIGN

Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier.

UNIT – V: 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. Low Power CMOS-VLSI Circuit Design by Kaushik Roy and S. Prasad, John Wiley-2000.
2. Low-Voltage, Low-Power VLSI Subsystems by Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.
3. CMOS Digital Integrated Circuits by Analysis and Design by Sung-Mo Kang, Yusuf Leblebici, TMH, 2011

ECE-621 : VLSI TECHNOLOGY

UNIT-I: INTRODUCTION TO VLSI TECHNOLOGY

Classification of ICs, Features of ICs, Monolithic and Hybrid ICs.

Crystal Growth and Wafer Preparation:

Silicon crystal growths form the melt, GaAs crystal growth techniques, crystal orientations, various defects in crystal, wafer preparation and wafer specifications.

UNIT-II: EPITAXY

Epitaxy and its concepts, growth kinetics of epitaxy, Vapor Phase epitaxy, molecular beam epitaxy, silicon on insulator epitaxy

Oxidation:

Theory of growth of silicon dioxide layer, calculation of SiO_2 thickness and oxidation kinetics, dry oxidation, wet and high pressure oxidation, plasma oxidation, properties of oxidation, defects induced due to oxidation.

UNIT-III: LITHOGRAPHY

Photolithography and pattern transfer, optical and electron lithography, x-ray and ion beam lithography, photoresist and its type, etching- wet and dry etching, plasma etching , Reactive Ion etching(RIE), sputter etching , merits and demerits of etching.

UNIT-IV: ION IMPLANTATION

Implantation equipments,High energy implantation, Scattering phenomenon, Implantation damages and annealing.

Metallization:

Metallization applications, metallization choices, physical vapor deposition (PVD), patterning and problems in metallization.

UNIT-IV: DEVICE MODELING AND SIMULATION

Need and importance of semiconductor device simulators, understanding of Poisson's and continuity equation for semiconductor device simulation, key elements of physical device simulation, second order effects, introduction to simulation tools

REFERENCE BOOKS:

1. S. M. Sze, "VLSI Technology", Tata McGraw-Hill Education, 2003(2/E).
2. S. K. Gandhi, "VLSI Fabrication Principles: Silicon and Gallium Arsenide", John Wiley and Sons, 2009(2/E).
3. Stephen A Campbell, "The Science & Engineering of Microelectronic Fabrication", oxford series in electrical and computer engineering, Oxford university press, 2001.

ECE-622: ARTIFICIAL INTELLIGENCE

UNIT I:

Introduction to AI; Neural Network; Human Brain; Model of Neurons; Neural Network as Direct Graph; Feedback; Network Architecture; Knowledge Representation; Artificial Intelligence and Neural Network.

UNIT II:

Search Methodology: Problem Solving as Search; Data-Driven or Goal-Driven Search; Generate and Test; Depth-First Search; Breadth-First Search; Properties of Search Methods: Complexity, Completeness, Optimality, Irrevocability; Hill Climbing; Best-First Search; Beam Search; Identifying Optimal Paths: A* Algorithms, Uniform Cost Search, Greedy Search.

UNIT III:

Learning Process: Introduction; Error Correction Learning; Memory Base Learning; Hebbian Learning; Competitive Learning; Boltzmann Learning; Credit Assign Learning; Learning with a Teacher; Learning without a Teacher; Learning Task; Memory; Adaptation; Statistical Nature of the Learning Process.

UNIT IV:

Introduction to Perceptron, Multilayer Neural Networks: Back Propagation, Improving the performance of Back Propagation; Recurrent Network: Hopfield Networks, Bidirectional Associative Memories; Issues in Back propagation: Batch versus online Learning, Activation Function, Initialization of weight, Moment and speed of conversance, Stopping Criteria, Local Minima, Weight decay and Generation. Adaptive parameter, The number of Hidden Neurons.

UNIT V:

Fuzzy logic: Introduction, Fuzzy set, Set operation, Boolean logic, Basic Concept of Fuzzy set, Representation of Fuzzy Set, Fuzzy set Properties, Operation of Fuzzy set, Algebraic Operations on Fuzzy Sets, Classical Relations, Classical Reasoning, Fundamentals of Fuzzy Relations, Operations on Binary Fuzzy Relations, Types of Fuzzy Relations, Fuzzy Reasoning, Examples.

REFERENCE BOOKS

1. "Neural Networks A comprehensive foundation", Simon Haykin, Prentice Hall International, Inc., ISBN 0139083855, Second Edition.
2. "Artificial Intelligence A modern approach", Stuart J. Russell and Peter Norvig, Prenyice Hall, Inc., ISBN 0131038052, 1995.
3. "Artificial Intelligence Illuminated", Ben Coppin, Jones and Batlett Publishers, 2004, ISBN 0763732303
4. "Artificial intelligence A system Approach", M.Tim Jones, Infinity Science Press LLC, 2008, ISBN: 978-0-9778582-3-1

ECO-623: BASICS OF DIGITAL ELECTRONICS AND COMMUNICATION

UNIT-I:

Binary Systems: Introduction to Digital Systems, Number systems, binary number system, Decimal to binary & binary to decimal conversion, representation of binary using hexadecimal

Boolean Algebra and Logic Gates: Basic definitions, operators of Boolean algebra, basic theorems and properties of Boolean algebra, basic gates -AND, OR, NOT, XOR, NAND, NOR - only truth table & gate representation, Boolean functions, canonical or standard forms,

UNIT-II:

Introduction to communication, need for modulation, modulation and demodulation techniques AM, FM and PM (Qualitative Analysis only), Block diagram of AM and FM transmitter and Receiver (Qualitative analysis) Sampling theorem, channel capacity, PAM, PPM, PWM and PCM, Digital modulation technique ASK, PSK, QPSK (Qualitative Analysis only).

UNIT-III:

Introductory Aspects of Multiplexing and Multiple Accesses: FDM, TDM, FDMA, TDMA, CDMA and OFDM. Satellite Communication: Introduction, to Orbit, types of orbits, Block diagram of satellite transponder.

UNIT-IV:

Evolution of Communication: 1^{st} generation, 2^{nd} generation, 3^{rd} generation & 4^{th} generation mobile communication, Basics of cellular communication (GSM, CDMA)-Cell architecture, Base stations, relay stations and principles of communication, Introduction to Bluetooth, Wi-Fi, Wi-Max and LTE network.

REFERENCE BOOKS:

1. Floyd T L " Digital Fundamentals", 7th Edition. (Pearson Education Asia), 2002
2. M. Morris Mono, Digital Logic and Computer Design, 4 th Edition, Pearson, 2009
3. Simon Haykins, An Introduction to Analog and Digital Communication, Wiley Student Edition, 2008.
4. B. P. Lathi, Modern digital and analog Communication systems, 3rd Edition 2005 Oxford University press.
5. Harold P.E, Stern Samy and A Mahmond, Communication Systems, Pearson Edition, 2004.
6. Dennis Roody and John Coolen, Electronic Communication, 4th Edition, 2008.