ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M.Tech.
Electronics and Communication

(Effective for the students admitted from the Academic Year 2007-08)

Jawaharlal Nehru Technological University
Hyderabad – 500 085

Jawaharlal Nehru Technological University, Hyderabad
M. Tech (Electronics & Communication)

First Semester

Name of the Subject	Hours/Week	
	Lecture	Practical
Digital Data Communications	4	
Statistical Signal Processing	4	
Advanced Digital Signal Processing	4	
VLSI Architecture and Design Methodologies	4	
Coding Theory and Practice	4	
Elective I	4	
Communication Systems Simulation Laboratory	-	3

Elective - I

1. Spread Spectrum Techniques
2. RF & Microwave Integrated Circuits
3. VHDL Modeling of Digital Systems

Second Semester

Name of the Subject	Hours/Week	
	Lecture	Practical
Embedded & Real Time Systems	4	
Advanced Digital IC Design	4	
Computational Intelligence	4	
Telecommunication Switching	4	
Elective II	4	
Elective III	4	
VLSI & Embedded Systems Laboratory		3

Elective II

1. Advanced Computer Architecture
2. Image and Video Compression
3. Wireless and ATM Networks

Elective III

1. Fault Tolerant System Design
2. Cryptography and Network Security
3. Advanced Instrumentation and Systems Design

Third and Fourth Semesters

Seminar
Project

First Semester

DIGITAL DATA COMMUNICATIONS

UNIT I
DIGITAL MODULATION TECHNIQUES
FSK, MSK, BPSK, QPSK, 8-PSK, 16-PSK, 8-QAM, Band width good organization carrier recovery, DPSK, clock recovery, probability of error and bit error rate.

UNIT II
DATA COMMUNICATIONS
Serial, Parallel configuration, Topology, Transmission modes, codes, Error Control Synchronization, I.C.U.

UNIT III
Serial and Parallel Interfaces, Telephone Networks and Circuits, Data modems

UNIT IV
Data communication protocols, Character and block mode, Asynchronous and Synchronous Protocols, public Data Networks, ISDN.

UNIT V
LOCAL AREA NETWORKS:
Token ring, Ethernet, Traditional, Fast and GIGA bit Ethernet, FDDI

UNIT VI
DIGITAL MULTIPLEXING
TDM, TI carrier, CCITT, CODECS, COMBO CHIPS, North American Hierarchy, Line Encoding, T-Carrier, Frame Synchronization Inter Leaving Statistical TDM FDM, Hierarchy, Wave Division Multiplexing.

UNIT VII
WIRELESS LANS
IEEE 802.11 Architecture Layers, Addressing, Blue Tooth Architecture Layers, 12 Cap, Other Upper Layers.

UNIT VIII
MULTI MEDIA
Digitalizing Video and Audio Compression Streaming Stored and Live Video and Audio, Real Time Interactive Video and Audio, VOIP.

TEXT BOOKS

1. **W. Tomasi ,**Electronic communication systems, Pearson Fourth Edition

REFERENCE BOOKS

2. **B.A. Forouzen,** Data communication and networking

First Semester

STATISTICAL SIGNAL PROCESSING

UNIT I

SIGNAL MODELS AND CHARACTERIZATION: Types and properties of statistical models for signals and how they relate to signal processing. Common second-order methods of characterizing signals including autocorrelation, partial correlation, cross-correlation, power spectral density, and cross-power spectral density.

UNIT II

SPECTRAL ESTIMATION: Nonparametric methods for estimation of power spectral density, autocorrelation, cross-correlation, transfer functions, and coherence from finite signal samples.

UNIT III

REVIEW OF SIGNAL PROCESSING: A review on random processes, A review on filtering random processes, Examples.

UNIT IV

STATISTICAL PARAMETER ESTIMATION: Maximum likelihood estimation, Maximum a posteriori estimation, Cramer-Rao bound

UNIT V

EIGEN STRUCTURE BASED FREQUENCY ESTIMATION: Pisarenko, MUSIC, ESPRIT. Their application sensor array direction finding.

UNIT VI

SPECTRUM ESTIMATION: Moving Average (MA), Auto Regressive (AR), Auto Regressive Moving Average (ARMA), various non-parametric approaches.

UNIT VII

WIENER FILTERING: The finite impulse case, causal and non-causal infinite impulse responses cases.

UNIT VIII

ADAPTIVE SIGNAL PROCESSING: Least Mean Squares Adaptation, Recursive Least Squares Adaptation, Kalman Filtering

TEXT BOOKS

1. **Steven M. Kay**, Fundamentals of Statistical Signal Processing: Estimation Theory, Prentice-Hall, 1993
2. **Monsoon H. Hayes,** Statistical Digital Signal Processing and Modeling, USA, Wiley, 1996

REFERENCE BOOKS

1. **Dimitris G. Manolakis, Vinay K. Ingle, and Stephen M. Kogon,** Statistical and Adaptive Signal Processing, , Artech House, Inc., 2005, ISBN 1580536107

First Semester

ADVANCED DIGITAL SIGNAL PROCESSING

UNIT I

Signals and Information.. Signal Processing Methods, Review of DSP, linear algebra, Applications of Digital Signal Processing speech coding, communications, Radar and sonar,

UNIT II

Discrete-Time Fourier Transforms (DTFT's), FFT and short-time Fourier transform (STFT) applications, Frequency Representation of Signals and Systems, Frequency and Phase Responses, Review of discrete-time signals and system concepts; z-transform- properties

UNIT III

Sampling, Analog to Digital Conversion. Multirate processing, and over sampling, Frequency response and transform analysis

UNIT IV

Filter structures and filter design, Lattice filters , Quadrature mirror filters, PR filters and wavelet transforms. STFT and nonparametric spectrum estimation. Period gram- averaging and windowed period gram.

UNIT V

Least Square Error Estimation: Wiener Filter, Block-Data Formulation of the Wiener Filter, Interpretation of Wiener Filter as Projection in Vector Space, Analysis of the Least Mean Square Error Signal, Formulation of Wiener Filters in the Frequency Domain, Some Applications of Wiener Filters, Implementation of Wiener Filters.

UNIT VI

Introduction, State-Space Kalman Filters, Sample Adaptive Filters, Recursive Least Square (RLS) Adaptive Filters, The Steepest-Descent Method, LMS Filter, Multirate Fundamentals, Rate Conversion, Filter Banks.

UNIT VII

Linear Prediction Coding, Forward, Backward and Lattice Predictors, Short-Term and Long-Term Predictors, MAP Estimation of Predictor Coefficients, Formant-Tracking LP Models, Sub-Band Linear Prediction Model, Signal Restoration Using Linear Prediction Models.

UNIT VIII

Power Spectrum and Correlation, Fourier Series: Representation of Periodic Signals, Fourier Transform: Representation of Aperiodic Signals, Non-Parametric Power Spectrum Estimation, Model-Based Power Spectrum Estimation, High-Resolution Spectral Estimation Based on Subspace Eigen-Analysis. INTERPOLATION: Introduction, Polynomial, Model based interpolation

TEXT BOOKS

1.**J.G. Proakis and D.G. Manolakis**, Digital Signal Processing: Principles, Algorithms, and Applications, 4th ed., Prentice-Hall, 2007.

2. **A.V. Oppenheim, R.W. Schafer and J.R. Buck**, Discrete-Time Signal Processing, Prentice-Hall, 2nd ed., 1999 (ISBN: 0-13-754920-2).

REFERENCE BOOKS

3. **J.G. Proakis, C.M. Rader**, F. Ling and C.L. Nikias, Advanced Digital Signal Processing, MacMillan, 1992.

4.**T.W. Parks and C.S. Burrus**, Digital Filter Design, Wiley, 1987.

5.**S. Haykin**, Adaptive Filter Theory, Prentice-Hall, 2002.

6. **A. Sayed,** Fundamentals of Adaptive Filtering, Wiley-IEEE, 2003.

First Semester

VLSI ARCHITECTURE AND DESIGN METHODOLOGIES

UNIT I

The Impact of VLSI on Computer Architecture
VLSI Technology Overview and Trends
VLSI design methodologies: Custom, semi-custom, synthesis, simulation and verification at the system, behavior, logic, circuit and layout levels. (Data path: synthesis, bit slice approach, ah hoc logic, structured logic-control: ad hoc.Finite state machines, use of PLAs.)

UNIT II

Advanced Microprocessor Architecture and Memory Systems in VLSI

UNIT III

Multi-Processor Arrays and Interconnect Topologies: Architectures and algorithms, systolic arrays methods.

UNIT IV

Timing Design of VLSI systems: Asynchronous schemes, Timing and clocking-asynchronous versus synchronous, single and two-phase clocking schemes, clock generation, buffering and clock distribution.

UNIT V

FPGA Architecture: FPGA Structure, Programming techniques, Device Dependent/Independent Technologies, Tips & Tricks Rules.

UNIT VI

CPLD Architecture: CPLD Structure, Programming Techniques.

UNIT VII

Low-Power VLSI Design: Design methods, estimation techniques.

UNIT VIII

Applications: Digital signal and image processing, numerical linear algebra, robotics, real-time computing, telecommunications, super-computing.

TEXT BOOKS

1. **Michael John Sebastian Smith,** Application Specific Integrated Circuits, Addison Wesley.
2. **P.K. Chan and S. Mourad,** Digital Design Using Field Programmable Gate Array, Prentice Hall, 1994
3. **S. Trimberger,** Field Programmable Gate Array Technology, Kluwer Academic Publications, 1994.

REFERENCE BOOKS

4. **J. Old Field and R. Dorf,** Field Programmable Gate Arrays, John Wiley and Sons, Newyork, 1995.
5. **John P. Uyemura,** Introduction to VLSI Circuits and Systems, John Wiley
6. **Eugine D. Fabricus,** Introduction to VLSI Design, McGraw Hill

First Semester

CODING THEORY & PRACTICE

UNIT I

Information Theory: Entropy, Information rate, Source coding: Shannon-Fano and Huffman coding techniques, Mutual Information, Channel capacity of Discrete Channel, Shannon-Hartly law, Trade-off between bandwidth and SNR.

UNIT II

Introduction and Overview Error Control Codes: Examples of the Use of Error Control Codes, Basic Notions, Coding Gain, Characterization of Error Control Codes Performance of Error Control Codes, Comparison of Uncoded and Coded Sytems

UNIT III

Convolution Codes: Convolution Encoders, Structural Properties of Convolution Codes, Trellis Diagrams, Viterbi Algorithm, Performance Analysis.

UNIT IV

Linear Block Codes: Linear Block Codes and their Properties, Standard Array, Syndromes, Weight Distribution, Error Detection/Correction Properties, Modified Linear Block Codes

UNIT V

Finite Fields: Groups, Rings, Fields, Properties of Finite Fields, Extension Fields, Polynomials over Finite Fields, Minimal Polynomials, Conjugates

UNIT VI

Cyclic Codes: General Theory, Shift Register Implementations, Shortened Cyclic Codes, CRCs for Error Detection.

UNIT VII

BCH and RS Codes: Algebraic Description, Frequency Domain Description, Decoding Algorithms for BCH and RS Codes

UNIT VIII

Applications : Concatenated Codes, Interleaves, The Compact Disc, Codes for Magnetic Recording

TEXT BOOKS

1. **Stephen B. Wicker**, Error Control Systems for Digital Communication and Storage, Prentice Hall, 1995, ISBN 0-13-200809-2

2. **Kennedy,** Electronic Communication Systems, McGraw Hill.

REFERENCE BOOKS

1. **John Proakis,** Digital communications, TMH\

2. **Simon Haykin,** Communication Systems

First Semester

SPREAD SPECTRUM TECHNIQUES (ELECTIVE I)

UNIT I

Introduction to Spread Spectrum Communications: Non-spread communications, Spread spectrum communications, Basic spread spectrum signal types, Examples using spread spectrum signals: Applications - pulsed/partial-band noise jamming: Applications - multiple users of the same channel: Applications - convert communications:

UNIT II

BPSK Direct Sequence Spread Spectrum: Direct sequence spread spectrum transmitter, DS-BPSK modulation, Review of random process and power spectrum density, PSD analysis of digital signals, PSD analysis of DS-BPSK modulated signal, DS-BPSK receiver

UNIT III

Review of Digital Communications Concepts: Probability of error for DS-BPSK communications, Overview of digital communication systems, Signal detection for M-ary base band communications.

UNIT IV

Frequency-Hop Spread Spectrum: QPSK and DS-QPSK: Slow-hop signals, Coherent slow-hop SS: Non-coherent fast-hop SS

UNIT V

Linear Recursive Sequences: Desired properties of the spreading waveform, Approach to spreading sequence generation, Basic correlation functions, Finite Field Basics, Linear shift register sequences and sequence generator fundamentals, M-sequences

UNIT VI

M-Sequences: Properties of M-sequences, PSD of spreading waveforms generated from M-sequences: Partial auto-correlation functions: Generation of specific delays of an M-sequence:

UNIT VII

Basics of Delay Lock Loop: Code tracking, Baseband DLL, Baseband DLL with noise **Tracking Loops** :Equivalent linear model of baseband DLL, Loop performance, Baseband DLL summary, non-coherent delay-lock tracking loop: Briefing of other tracking loops.

UNIT VIII

Digital Receiver: Basic digital receiver structure: Digital timing recovery: Digital matched filter: Digital phase recovery: Digital phase locked loop: Help on course project – DLL
Code acquisition: Introduction to initial synchronization, Analysis on acquisition effectiveness

TEXT BOOK

1. **Peterson, Ziemer, and Borth,** *Introduction* to Spread Spectrum Communications, Pearson 1995, ISBN: 0024316237

REFERENCE BOOK

1. Don Torrieri, Principles of communication, Springer Publications, ISBN: 978-0-387-22782-5

First Semester

RF AND MICROWAVE INTEGRATED CIRCUITS (ELECTIVE I)

UNIT I

Background: Micro strip circuits: Interconnect and passive components, Properties of connectors and cable at GHz frequencies , RF properties of lumped components , Theory of time-domain reflectometer (TDR) and vector network analyzer (VNA)

UNIT II

Front-end circuits at GHz frequencies: Tuned, narrowband RF amplifiers, Broadband RF amplifiers, Gain-bandwidth enhancement techniques, Low-noise amplifier (LNA) design Mixers, Theory of noise figure measurement.

UNIT III

Background for understanding oscillators: Microstrip resonators, Phase noise in oscillators Theory of phase noise measurement, VCO design

UNIT IV

Synthesizers: Phase-locked loops (PLLs) and classical control theory, Frequency synthesizers (integer-N, fractional-N)

UNIT V

Antennas, filters and matching networks: Fundamentals of radiation, Dipole and microstrip patch antennas, Filter response shapes

UNIT VI

Microstrip filters: Commensurate-line; stepped-Z; end- coupled; hairpin, combline and interdigital edge-coupled

UNIT VII

Power amplifiers: Class A, AB, C, E topologies

UNIT VIII

AM/FM modulation and demodulation

TEXT BOOKS

1. **Thomas H. Lee,** Planar Microwave Engineering, Cambridge University Press

REFERENCE BOOKS

1. **Thomas H. Lee,** The Design of CMOS RF Integrated Circuits (2nd ed.), Cambridge University Press.

First Semester

VHDL MODELING OF DIGITAL SYSTEMS (ELECTIVE I)

UNIT I

Introduction: An Overview of Design Procedures used for System Design using CAD Tools. Design Entry. Synthesis, Simulation, Optimization, Place and Route. Design Verification Tools. Examples Using commercial PC Based on VHDL Elements of VHDL Top Down Design with VHDL Subprograms, Controller Description VHDL Operators.

UNIT II

Basic Concepts in VHDL: Characterizing Hardware Languages, Objects and Classes, Signal Assignments, Concurrent and Sequential Assignments.

UNIT III

Structural Specification of Hardware: Parts of Library, Primitives, Wiring Interactive Networks. Modeling A Test Bench Binding Alternative Top Down Wiring.

UNIT IV

Design Organization and Parameterization: Definition and Usage of Subprograms, Packaging Parts and Utilities, Design parameterization, Design Configuration, Design Libraries. Utilities for High Level Descriptions-Type Declaration and Usage,.

UNIT V

VHDL Operators, Subprogram Parameter Types and Overloading, Other Types and Type related issues, Predefined Attributes, User Defined Attributes, packing Basic Utilities.

UNIT VI

Dataflow Description in VHDL: Multiplexing and Data selection, State Machine Description, Open Collector Gates, Three State Bussing. A general Data Flow Circuit, Updating Basic Utilities.

UNIT VII

Behavioral Description of Hardware: Process Statement Assertion Statements, Sequential Wait Statements Formatted ASCII I/O Operators, MSI-Based Design.

UNIT VIII

CPU Modeling for Description in VHDL: Parwan CPU, Behavioral Description of Parwan, Bussing Structure, Data Flow Description Test Bench for the Parwan CPU. A More Realistic Parwan. Interface Design and Modeling. VHDL as a modeling Language

TEXT BOOK:

1. **Z. NAWABI,** VHDL Analysis and Modeling of Digital Systems. (2/E), McGraw Hill, (1998)

REFERENCE BOOK:

1. **PERRY,** VHDL, (3/E) McGraw Hill

First Semester

COMMUNICATION SYSTEMS SIMULATION LABORATORY
(Using MATLAB)

1. Convolution Encoding and Decoding
2. Channel coding Techniques.
3. Filter Designing
4. Interleaving and De-interleaving
5. Puncturing and Inverse Puncturing
6. Channel Estimation
7. Wavelet Transforms
8. Viterbi Decoder
9. Noise Estimation
10. QPSK and GMSK modulator and demodulator Designing

Second Semester

EMBEDDED AND REAL TIME SYSTEMS

UNIT I

Embedded Computing: Introduction, Complex Systems and Microprocessor, The Embedded System Design Process, Formalisms for System Design, Design Examples.

UNIT II

The 8051 Architecture: Introduction, 8051 Micro controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/ output, Interrupts.

UNIT III

Basic Assembly Language Programming Concepts: The Assembly Language Programming Process, Programming Tools and Techniques, Programming 8051. Data transfer and logical instructions

UNIT IV

Arithmetic operations, Decimal Arithmetic, Jump and Call instructions, Further Details on Interrupts.

UNIT V

Applications: Interfacing with Keyboards, Displays, D/A and A/D Conversions, Multiple Interrupts, Serial Data Communication.

UNIT VI

Introduction to Real-Time Operating Systems: Tasks and Task States, Tasks and Data, Semaphores and Shared Data, Message Queues, Mailboxes and pipes, Timer Functions, Events, Memory Management, Interrupt Routines in an RTOS Environment

UNIT VII

Basic Design Using a Real-Time Operating System: Principles, Semaphores and Queues, Hard Real-Time Scheduling Considerations, Saving Memory and Power, An example RTOS like MC-OS (Open Source). Embedded Software Development tools: Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System. Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

UNIT VIII

Introduction to advanced architectures: ARM and SHARC, Processor and memory organization and Instruction level parallelism. Networked embedded systems: Bus protocols, I^2C bus and CAN bus, Internet-Enabled Systems, Design Example-Elevator Controller

TEXT BOOKS

1. **Wayne Wolf,** Computers and Components, Elseveir
2. **Kenneth J. Ayala,** The 8051 Microcontroller, Third Edition, Thompson
3. **David E. Simon,** An Embedded Software Primer, Pearson Education

REFERENCE BOOKS

1. **Raj Kamal,** Embedded Systems, TMH
2. **Ajay V Deshmukhi,** Micro Controllers, TMH
3. **Frank Vahid and Tony Givargis,** Embedded System Design, John Wiley

Second Semester

ADVANCED DIGITAL IC DESIGN

UNIT I
Review of MOSFET characteristics, scaling and small-geometry effects and MOSFET capacitances. MOS inverters. CMOS inverter, static characteristics, switching characteristics, power dissipation issues.

UNIT II
Combinational MOS Logic Circuits: MOS logic circuits with depletion loads, CMOS logic gates, complex logic gates, CMOS transmission gates, pseudo-NMOS, domino logic gates. Multilevel gate circuits and design.

UNIT III
Sequential MOS Logic Circuits: The SR latch circuit, clocked latch and flip-flop, CMOS D-latch and edgetriggered circuits, Schmitt trigger circuit.

UNIT IV
Dynamic Logic Circuits: Pass transistor logic, synchronous dynamic circuit techniques, high-performance dynamic CMOS circuits.

UNIT V
Semiconductor Memories: ROM circuits, SRAM circuits, DRAM circuits, drivers and buffers, design issues in memory and array structures.

UNIT VI
Low-Power CMOS Logic Circuits: Overview of power consumption, low-power design through voltage scaling, estimation and optimization of switching activity, quasi-adiabatic logic circuits, Multi-threshold CMOS, SOI-MOSFET design issues.

UNIT VII
BiCMOS Logic Circuits: Basic BiCMOS circuits, static behavior, switching characteristics in BiCMOS logic circuits, BiCMOS applications.

UNIT VIII
Input-Output Circuits: ESD protection, input and output buffer design, on-chip clock generation and distribution, latchup and its prevention.

TEXT BOOK:
1. **S.M. Kang and Y. Leblebici,** CMOS Digital Integrated Circuits, Third Edition, McGraw Hill Publishing Co.

REFERENCE BOOKS:
1. **R.L. Geiger, P.E. Allen and N.R. Strader,** VLSI Design Techniques for Analog and Digital Circuits, McGraw Hill Publishing Co.
2. **J.M. Rabaey,** Digital Integrated Circuits, 2nd Edition, Prentice Hall.
3. **M. Ercegovac, T. Lang and J. H. Moreno,** Introduction to Digital Systems, John Wiley & Sons Inc, 1998.

Second Semester

COMPUTATIONAL INTELLIGENCE

UNIT I

Computational Intelligence: Inception, Research Agenda

Neural Networks and Neuro computing: Introduction, Generic models of computational neurons, Architecture of neural networks a basic taxonomy, learning in neural networks, selected classes of learning methods, Generalization abilities of neural networks, enhancement of gradient based learning in neural networks.

UNIT II

Fuzzy Sets: Introduction, Basic definitions, Types of membership functions, characteristics of Fuzzy set, membership function determination, Fuzzy relations and Set theory operations and their properties, Triangular norms, Triangular norms as the models of operation on Fuzzy sets

UNIT III

Information based characteristics of Fuzzy sets, Matching Fuzzy sets, Numerical representation of Fuzzy sets, Rough sets and Fuzzy sets, Shadowed sets, The frame of Cognition, Probability and Fuzzy Sets, Hybrid Fuzzy Probabilistic Models of Uncertainty

UNIT IV

Computations with Fuzzy Sets: Introductory remarks, The extension principle, Fuzzy numbers, Fuzzy rule based computing, Fuzzy controller and Fuzzy control, Rule based systems with nonmonotonic operations.

UNIT V

Evolutionary Computing: Introduction, Gradient based and probabilistic optimization as examples of single point search technique, Genetic algorithms, Schemata Theorem, From Search space to GA search space, Exploration and exploitation of the Search space, experimental studies, Classes of evolutionary computation.

UNIT VI

Fuzzy Neural System: Introduction, Neuro computing in Fuzzy set technology, Fuzzy sets in preprocessing and enhancement of the training data, Uncertainty representation in neural networks, Neural calibration of membership function, Knowledge based learning schemes, Linguistic interpretation of neural networks, Hybrid fuzzy neural computing structures

UNIT VII

Fuzzy Neural Networks: Logic based neurons, logic neurons and fuzzy neural networks with feedback, Referential logic based neurons, Learning in Fuzzy neural networks, Case studies

UNIT VIII

CI Systems: Introduction, Fuzzy encoding in evolutionary computing, Fuzzy crossover operations, Fuzzy metarules in genetic computing, Relational structures and their optimization, The satisfiability problems, Evolutionary rule based modeling of analytical relational ships, genetical optimization of neural networks

TEXT BOOKS

1. **Witol Pedrycz,** Computational Intelligence an Introduction, CRC Press, ISBN 0849326435

REFERENCE BOOKS

1. **Bernd Reusch,** Computational Intelligence: Theory and applications, Springer, 1997, ISBN 3540628681
2. **Hans-Paul,** Advances in Computational Intelligence, Springer 2003, ISBN 3540432698
3. **Bart Kosko,** Fuzzy logic and Neural nets, Prentice-Hall, 1998

Second Semester

TELECOMMUNICATION SWITCHING

UNIT I

Telecommunication Switching Systems: Introduction, Elements of switching systems, switching network configuration, principles of cross bar switching.

UNIT II

Electronic Space Division Switching, Time Division Switching, Combination Switching.

UNIT III

Telephone Networks: Subscriber Loop Systems, Switching Hierarchy and routing, transmission plan, numbering plan, charging plans.

UNIT IV

Signaling Techniques: In Channel Signaling, Common Channel Signaling, Network traffic load and parameters, grade of service and blocking probability.

UNIT V

Data Communication Networks: Introduction, network architecture, layered network architecture, protocols, data communications hardware, data communication circuits.

UNIT VI

Public switched data networks, connection oriented and connection less service, Circuit Switching, packet switching and virtual circuit switching concepts, OSI reference model, LAN, WAN, MAN and Internet, Repeaters, Bridges, Routers and gate ways.

UNIT VII

Integrated Services Digital Network (ISDN): Introduction, motivation, ISDN architecture, ISDN interfaces, functional grouping, reference points, protocol architecture, signaling, numbering, addressing, BISDN.

UNIT VIII

DSL Technology: ADSL, Cable Modem, Traditional Cable Networks, HFC Networks, Sharing, CM & CMTS and DOCSIS

SONET: Devices, Frame, Frame Transmission, Synchronous Transport Signals, STSI, Virtual Tributaries and Higher rate of service

TEXT BOOKS

1. **Thyagarajan Viswanath,** Telecommunication Switching Systems and Networks, PHI, 2000
2. **Wayne Tomasi,** Advanced Electronic Communication Systems, PHI, 2004

REFERENCE BOOKS

1. **J. Bellamy,** Digital Telephony , John Wiley, 2nd Edition, 2001
2. **Achyut S. Godbole,** Data Communications and Networks, TMH, 2004
3. **B. A. Forouzan,** Data Communication and Networking, TMH, 3rd Edition, 2004.

Second Semester

ADVANCED COMPUTER ARCHITECTURE (ELECTIVE II)

UNIT I

Fundamentals of Computer design- Technology trends-cost-measuring and reporting performance quantitative principles of computer design.

UNIT II

Instruction set principles and examples-classifying instruction set-memory addressing-type and size of operands-addressing modes for signal processing-operations in the instruction set-instructions for control flow-encoding an instruction set-the role of compiler.

UNIT III

Instruction level parallelism (ILP)-over coming data hazards-reducing branch costs-high performance instruction delivery-hardware based speculation-limitation of ILP

UNIT IV

ILP software approach-compiler techniques-static branch protection-VLIW approach- H.W. support for more ILP at compile time- H.W. verses S.W. solutions.

UNIT V

Memory hierarchy design-cache performance-reducing cache misses penalty and miss rate-virtual memory- protection and examples of VM.

UNIT VI

Multiprocessors and thread level parallelism-symmetric shared memory architectures-distributed shared memory-Synchronization-multi threading.

UNIT VII

Storage systems-Types-Bises-RAID-errors and failures-bench marking a storage device-designing a I/O system.

UNIT VIII

Inter connection networks and clusters-interconnection network media-practical issues in interconnecting networks-examples-clusters-designing a cluster

TEXT BOOKS

1. **John L. Hennessy and David A. Patterson Morgan Kufman**, Computer Architecture a quantitative approach third edition, (An Imprint of Elsevier)

REFERENCE BOOKS

1. **Kai Hwang and A. Briggs** .Computer Architecture and parallel Processing, International Edition McGraw-Hill
2. **Dezso Sima, Terence Fountain, Peter Kacsuk,** Advanced Computer Architectures, Pearson

Second Semester

IMAGE AND VIDEO COMPRESSION (ELECTIVE II)

UNIT I

The challenge of digital audiovisual compression: data volume, error visibility, streaming, real-time, compatibility.

UNIT II

An overview of existing audiovisual compression standards (e.g. JPEG, H.261, H.263, MPEG-1, MPEG-2, MPEG-4).

UNIT III

Visual coding theory and approaches: transform-based coding; hybrid coding; basic codec structure, intra/inter frames, macroblock structure, configuration of coding tools;

UNIT IV

Advanced and unrestricted motion estimation, context-based arithmetic coding, overlapped-block motion estimation.

UNIT V

JPEG: DCT coding, coefficient quantization and Huffman coding.

UNIT VI

MPEG-1: I-,B- and P-pictures, user defined quantization matrix. MPEG-2: Compatibility, scalability, interlaced tools, profiles and levels.

UNIT VII

MPEG-4: VOS and VOPS, layered codec structure, VOP bounding, alpha plane encoding (shape coding), half-pixel resolution motion estimation, advanced and unrestricted mode, padding/shape-adaptive DCT, scalability, error robustness, profiles.

UNIT VIII

Future developments in audiovisual compression and related issues: (e.g. MPEG-7, visual object segmentation, video analysis). Non-normative coding techniques (e.g. fractal coding, region-based, wavelets).

TEXT BOOKS

1. **William B. Pennebaker and Joan L. Mitchell,** JPEG: Still Image Data Compression Standard,
2. **John Watkinson,** MPEG Hand Book, Elsivier, 2004, ISBN: 024080578X

REFERENCE BOOKS

1. **Arun N. Netravali, Barry G. Haskell, Atul Puri, Atul Puri, Arun N. Netravali,** Digital Video: An introduction to MPEG
2. **Herve Benoit, Benoit, Herve Benolt**, Digital Television: MPEG-1, MPEG-2 and Principles of the DVB System

Second Semester

WIRELESS AND ATM NETWORKS (ELECTIVE II)

UNIT I
PCS Architecture, Cellular telephony, Cordless telephony and low tier PCS, Third and Fourth generation wireless systems

UNIT II
Mobility management, handoff, roaming management for SS& and CT2, handoff Detection, strategies for handoff detection, channel assignment, link transfer types, hard Handoff soft handoff; IS-41 signaling, IS-41 handoff and authentication, CDPD architecture, CDPD air Interface, radio resource allocation.

UNIT III
GSM architecture, location tracking, data services, HSCPD, GPRS, OSM network signaling, GSM mobility management, GSM short message service, International Roaming for GSM, VoIP for GSM networks.

UNIT IV
GPRS functional groups, architecture, network nodes, interfaces, procedures, billing, evolving from GSM to GPRS

UNIT V
WAP protocols, W-CDMA and CDMA 2000, QOS in 3G, paging network architectures, wireless local loop architectures, Bluetooth core Protocols:

UNIT VI
Introduction to wireless LANS, 802.11 WLANs, physical and MAC layers, Wireless ATM and HIPERLAN, 802.15 WPAN,

UNIT VII
Bluetooth, interference between Bluetooth and 802.11, wireless geolocation system architecture, standards, performance measures

UNIT VIII
Introduction to other wireless LAN standards 802.lle, 802.16, 802.17, 802.19, 802.20.

TEXT BOOKS:

1. **Yi-Bing Lin, Imrich Chlamtac,** Wireless and mobile network architectures, John Wiley, 2001
2. **Kaveh Pablavan, P. Krishnamurthy,** Principles of wireless networks, Pearson education, 2002

REFERENCE BOOKS:

1. **P. Venkataram, S. S. Manvi, B. P. Vijaykumar,** WLANs: Architectures, Protocols and Applications, Pearson education (In Press), 2005
2. **Marlyn Mallick,** Mobile and wireless design essentials, Wiley, 2003

Second Semester

FAULT TOLERANT SYSTEM DESIGN (ELECTIVE III)

UNIT I

Introduction to Test and Design for Testability (DFT) Fundamentals.

Modeling: Modeling digital circuits at logic level, register level and structural models. Levels of modeling.

Logic Simulation: Types of simulation, Delay models, Element evaluation, Hazard detection, Gate level event driven simulation

UNIT II

Fault Modeling: Logic Fault models, Fault detection and redundancy, Fault equivalence and fault location. Single Stuck and multiple stuck- Fault models. Fault simulation applications, General techniques for combinational circuits.

UNIT III

Fault Simulation: Applications, General Fault Simulation Techniques, Fault Simulation for Combinational Circuits, Fault Sampling, Statistical Fault Analysis

UNIT IV

Testing for single stuck faults (SSF): Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits. Functional testing with specific fault models. Vector simulation-ATPG vectors, formats, Compaction and compression, Selecting ATPG Tool

UNIT V

Testing for Bridging Faults: The Bridging fault model, Detection of Nonfeedback Bridging faults, Detection of Feedback Bridging Faults, Bridging Fault Simulation, Test Generation for Bridging faults

UNIT VI

Design for Testability: Testability tradeoffs, techniques, Scan architectures and testing-controllability and absorbability, generic boundary scan, full integrated scan, storage cells for scan design. Board level and system level DFT approaches. Boundary scans standards. Compression techniques different techniques, Syndrome test and signature analysis.

UNIT VII

Compression Techniques: General Aspects of compression techniques, Ones-Count Compression, Transition Count Compression, Parity Check Compression, Syndrome Testing, Signature Analysis.

UNIT VIII

Built-in self-test (BIST)- BIST Concepts and test pattern generation. Specific BIST Architectures – CSBL, BEST, RTS, LOCST, STUMPS, CBIST, CEBS, RTD, SST, CATS, CSTP, BILBO. Brief Ideas on some advanced BIST concepts and design for self-test at board level.

Memory BIST (MBIST): Memory test architectures and techniques- Introduction to memory test, Types of memories and integration, embedded memory testing model. Memory test requirements for MBIST. Brief ideas on embedded core testing.
Introduction to automatic in circuit testing (ICT), JTAG Testing features.

TEXT BOOKS

1. **Miron Aramaic, Melvin A. Breur, Arthur D. Friedman**, Digital Systems Testing and Testable Design, Jaico Publishing House, 2001.

REFERENCE BOOKS

1. **Alfred Crouch**, Design for Test for Digital ICs & Embedded Core Systems, Prentice Hall.
2. **Robert J. Feugate, Jr. Steven M. Mentyn**, Introduction to VLSI Testing, Prentice Hall, Englehood Cliffs, 1998.

Second Semester

CRYPTOGRAPHY A ND NETWORK SECURITY (ELECTIVE III)

UNIT I

Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Inter-network security.

Classical Techniques: Conventional Encryption model, Steganograpjy, Classical Encryption Techniques.

UNIT II

Modern Techniques: Simplified DES, Block Cipher principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation.

Algorithms: Triples DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.

UNIT III

Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

Public Key cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT IV

Number Theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's Theorems, Testing for primarily, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

Message authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT V

Hash and MAC algorithms: MD file, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.

Digital signatures and Authentication protocols: Digital signatures, Authentication protocols, Digital signature Standards.

UNIT VI

Authentication Applications: Kerberos, X.509 directory Authentication Service.

Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT VII

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management.

Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.

UNIT VIII

Intruders, Viruses and Worms: Intruders, Viruses and Related threats.

Fire Walls: Fire wall Design Principles, Trusted systems.

TEXT BOOKS

1. **William Stallings,** Cryptography and Network Security: Principles and Practice, Pearson Education.
2. **William Stallings,** Network Security Essentials (Applications and Standards) Pearson Education.

REFERENCE BOOKS

1. **Eric Maiwald** ,Fundamentals of Network Security (Dreamtech press)
2. **Charlie Kaufman, Radia Perlman and Mike Speciner,** Network Security – Private Communication in a Public World, Pearson/PHI.
3. **Whitman, Principles** of Information Security, Thomson.
4. **Robert Bragg,** Network Security The Complete reference, Mark Rhodes, TMH
5. **Buchmann,** Introduction to Cryptography, Springer.

Second Semester

18. ADVANCED INSTRUMENTATION & SYSTEMS DESIGN (ELECTIVE III)

UNIT I
Accuracy of measurement systems in the steady state, Dynamic characteristics of measurement systems.

UNIT II
Loading effects in measurement systems. Signals & Noise in measurement systems. Measurement system Elements.

UNIT III
Sensing elements: Review of electrical, electromagnetic, piezoelectric, electro-chemical sensing elements.

UNIT IV
Semiconductor sensors, fiber optic sensors, Digital transducers.

UNIT V
Signal conditioning elements. Signal Processing elements and software.

UNIT VI
Intrinsically Safe Measurement systems (a) Electronic systems (b) Fiber optic systems.
Ultrasonic measurement systems, spectro-photometric & Gas chromatographic measurement systems.

UNIT VII
Data Acquisition Systems, Communication systems for Measurement, Distributed sensing Mechanism and Multiplexing technique.

UNIT VIII
Modern Industrial Instrumentation System design for process control.
Marine instrumentation, nuclear instrumentation, Aero-space instrumentation, semiconductor instrumentation, Geoscientific instrumentation - concepts.

TEXT BOOKS:
1. Doeblin, Measurement Systems Applications & Design, McGraw Hill.
2. J.P. Bentley – Longman, Principles of Measurement Systems .

REFERENCE BOOKS
1. E.B. Jones, Butterworth, Instrumentation Technology, London.
2 J. Dakin & B. Culshaw, Optical Fiber Sensors, Artech House.

Second Semester

VLSI AND EMBEDDED SYSTEMS LABORATORY

PART-A

1. Layout Extraction for Digital Circuits
2. Parasitic Values Estimation from Layout.
3. Layout Vs Schematic
4. Net List Extraction
5. Design Rule Checks

PART-B

1. Serial data transmission using 8051 microcontroller
2. Look Tables for 8051 microcontroller
3. Timing Subroutines for 8051
4. Interface Keyboard to the 8031 based microcontroller systems
5. Interface A/D AND D/A converters to the 8031 based microcontroller systems