Course Curriculum

Of

M.TECH.

VLSI DESIGN

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER- I

Course Code	Course Title	Hrs/week			Credits	Hours
		L	T	P		
EC-501	Analog VLSI Circuits	3	0	0	3	3
EC-503	Digital Signal Processing & its Applications	3	0	0	3	3
EC-505	Solid State Devices	3	0	0	3	3
EC-507	Digital Systems Design	3	0	0	3	3
EC-5XX	Elective-I	3	0	0	3	3
EC-551	VLSI CAD Lab-I	0	0	3	2	3
EC-553	Digital Signal Processing Lab	0	0	3	2	3
	Total	**15**	**0**	**6**	**19**	**21**

SEMESTER-II

Course Code	Course Title	Hrs/week			Credits	Hours
		L	T	P		
EC-502	Embedded Systems	3	0	0	3	3
EC-504	Digital Integrated Circuits	3	0	0	3	3
EC-506	Integrated Circuit Fabrication	3	0	0	3	3
EC-5XX	Elective-II	3	0	0	3	3
EC-5XX	Elective-III	3	0	0	3	3
EC-554	VLSI CAD Lab-II	0	0	3	2	3
EC-552	Embedded Systems Lab	0	0	3	2	3
	Total	**15**	**0**	**6**	**19**	**21**

SEMESTER-III

Course Code	Course Title	Hrs/week			Credits	Hours
		L	T	P		
EC-603	RF Circuit Design	3	0	0	3	3
EC-6XX	Elective-V	3	0	0	3	3
EC-600	Project Phase-I	0	0	12	6	12
EC-601	Seminar	1	0	0	3	1
	Total	**7**	**0**	**12**	**15**	**19**

SEMESTER-IV

Course Code	Course Title	Hrs/week			Credits	Hours
		L	T	P		
EC-600	Project Phase-II	0	0	24	12	24
	Total	**0**	**0**	**24**	**12**	**24**

Grand Total of Credits= 65

Course Description

EC-501 Analog VLSI Circuits [3 0 0 3]

Analog MOS circuits, single stage amplifiers, differential amplifiers, passive and active current mirrors, frequency and transient responses, noise, feedback, operational amplifiers, stability and frequency compensation, analog switches, switched-capacitor circuits, oscillators.
Filters & A/D Converters: Sampled Data Analog Filters, Over Sampled A/D Converters and Analog Integrated Sensors: First-order and Second SC Circuits- Bilinear Transformation – Cascade Design-Switched-Capacitor Ladder Filter-Synthesis of Switched-Current Filter – Nyquist rate A/D Converters-Modulators for Over sampled A/D Conversion

Texts/References:

1. Neil H. E. Weste & Kamran Eshraghian, "*Principles of CMOS VLSI Design*", Pearson education asia, 2/e
2. Wayne Wolf, "*Modern VLSI Design*", Pearson Education, 4th Indian Reprint 2005
3. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley, 1986
4. DA. And Eshrachian K, "*Basic VLSI design- systems & circuits*", PHI, 1988
5. B Razavi, "*Design of Analog CMOS Integrated Circuits*", Mc Graw Hill, 2000.

EC-503 Digital Signal Processing & its Applications [3 0 0 3]

Signals, systems & signal processing, classification of signals, discrete-time signals & systems, analysis of discrete-time linear time – invariant systems, difference equations, Z-transform and its application to the analysis of linear time invariant systems, DFT: its properties and applications, FFT algorithms, implementation of discrete-time systems, design of FIR and IIR digital filters, multirate digital signal processing and its applications, adaptive filtering, digital signal processor architecture (fixed-point & floating point), development tools for digital signal processing systems, analysis of finite worldlength effect in digital signal processing system, applications & design studies.

Texts/References:

1. Proakis, J. G. and Manolakis, D, G., "*Digital Signal Processing – Principles, Algorithms and Applications*", Third Edition, Pearson Education, 2003.
2. Mitra, Sanjit K., "*Digital Signal Processing – A Computer-Based Approach",* Tata McGraw Hill, 1998.
3. Hayes, M.H., "*Digital Signal Processing (Schaum's Outlines Series)*" Tata McGraw Hill, 2004.
4. Kuo, S.M, and Gan, Woon-Seng, "*Digital Signal Processors – Architectures, Implementations and Applications",* Pearson Education, 2005.
5. Vijay K. Madisetti, "*The Digital Signal Processing Handbook",* CRC Press, 1997.

EC-505 Solid State Devices [3 0 0 3]

Basic semiconductor physics, Diodes(PN junction, schottky, contact), Junction Transistors(BJT, HBT), Field Effect Transistors (JFET, MESFET, MOSFET, HEMT), Special purpose MOS devices including memories and imagers. Other semiconductor devices.

Texts/References:

1. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley, 1986
2. R. F. Pierret, Addison, "*Semiconductor Device Fundamentals*", Wesley, 1996
3. S M Sze, "*Physics of Semiconductor Devices*", Wiley, 2nd edition
4. S S Islam, "*Semiconductor Physics & Devices*, Oxford University Press, 2006

EC-507 Digital Systems Design [3 0 0 3]

Review of digital concepts, MSI and LSI circuits and their applications, Synchronous state machine design and analysis-models, latches and flip-flops, setup and hold time requirements, Mealy and Moore FSM design, dealing with asynchronous inputs, synchronizers and meta stability, clocking aspects, clock skew, Asynchronous machines analysis and design- models for asynchronous FSMs, detection and elimination of timing defects in asynchronous FSMs, Memory, CPLDs and FPGAs.

Texts/References:

1. Richard F Tinder, "*Engineering Digital Design*", 2nd ed, Academic Press
2. John F Wakerly, "*Digital Design- principles and practices*," 3rd edition, Pearson Education Asia
3. David J Comer, "*Digital Logic and State Machine Design*", 3rd edition, Oxford University Press
4. William I Fletcher, "An Engineering Approach to Digital Design" Prentice Hall of India.
5. Marcovitz, "Logic Design" 2nd Edition, Tata McGraw Hill

EC- 551 VLSI CAD Lab-I [0 0 3 2]

Hardware Description Langauges; Verifying behaviour prior to system construction - simulation and logic verification; Exposure to high-level design tools including high-level synthesis, logic synthesis, Modelling and design using VHDL, FPGA based design. VHDL Implementation: Two bit counter design using FSM, Parallel to Serial Converter, VHDL Calculator using FSM to perform simple calculations like addition, multiplication and subtraction, A simplified HDL UART, VHDL implementation of I2C Bus, Design of hardware multiplier using sequential circuit components, ALU Design which should be able to add, subtract, NOR and NAND the numbers.

EC- 553 Digital Signal Processing Lab [0 0 3 2]

Objective: Design and implementation of real-time digital signal processing (DSP) systems using a DSP microprocessor. Includes several structured laboratory exercises, such as sampling, digital filtering, and FFT with emphasis on system design.

There will be two design projects in the course. The projects will require application of the theory learned in the classroom to practical signal processing. Basic knowledge of MATLAB will be needed. There will be also two discovery projects. A short report will be due upon each project completion.

EC- 502 Embedded Systems [3 0 0 3]

Introduction to Embedded Systems - definitions and constraints; hardware and processor requirements; special purpose processors; input-output design and I/O communication protocols; design space exploration for constraint satisfaction; co-design approach; example system design; Formal approach to specification; specification languages; specification refinement and design; design validation; Real Time operating system issues with respect to embedded system applications; time constraints and performance analysis.

Texts/ References:

1. D. E. Simon, "*An Embedded Software Primer*", Pearson Education.
2. D. W. Lewis, "*Fundamentals of Embedded Software*", Pearson Education
3. M. A Mazidi, "*The 8085 Microcontroller and Embedded System*", Pearson Education
4. Peterson Galvin, "*Operating Systems Concepts*", John Wiley
5. Tammy Noergaard, "*Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers (Embedded Technology)*

EC-504 Digital Integrated Circuits [3 0 0 3]

Basics of Mosfet ,Introduction to digital IC design, MOS inverter-Resistive load ,Depletion load,CMOS inverter,Switching Charecterstics of MOS inverter, design of combinational logic gates in CMOS- static and dynamic CMOS -design,CMOS Transmission gates, Power consumption in CMOS gates,Low power CMOS logic ckts ,MOS memory circuits, BiCMOS Logic ckts, Design of sequential logic circuits, Set up time,Hold time requirements

Texts/References:

1. Rabaey J.M, Chandrakasan A, Nikolic B , "Digital Integrated Circuits- A Design Perspective", Second Edition, Prentice Hall
2. S M Kang and Y Lebici,"CMOS Digital Integrated Circuits-analysis and design", 3rd ed, McGraw Hill

EC-506 Integrated Circuit Fabrication [3 0 0 3]

Environment for IC Fabrication-Clean room technology,Wafer cleaning process, Basic I.C. processing step, oxidation,Lithographic techniques:Mask generation, Diffusion: Ficks laws, sheet resistivity, Evaluation and Measurement techniques, Etching techniques, Ion implantation,Plasma and rapid Thermal techniques:Plasma etching,RIE techniques,RTP for annealing. Epitaxy ,Chemical vapour deposition: high and low temperature/pressure depositions.,Metallization,Thin Film and Thick film technology:hybrid circuits,circuit elements-diodes,resistors,inductors,contacts and interconnection,Self aligned silicides,Shallow junction formation,Standard bipolar NMOS and CMOS process sequences,Testing,Bonding,Packaging, Novel structures in bipolar and MOS: VMOS etc. Introduction

to process modeling, SUPREM.,Introduction to MEMS-LIGA,Bulk Micromachining,Surface micromachining

Texts/References:

1. S K Gandhi,"VLSI Fabrication Principles:Silicon and Gallium Arsenide", 2nd ed, Wiley
2. G S May, S M Sze,"Fundamental of Semiconductor fabrication", Wiley

EC-552 Embedded Systems Lab

Introduction to 8051 assembly language programming, Program counter, data types & directives, flag, Registers, Stack, Time Delay Generation, I/O Port programming, Arithmetic instructions, Logic instructions, Single bit instructions, Timer and counter programming, Serial communication, Interrupt programming, 8051 interfacing

EC- 554 VLSI CAD Lab-II [0 0 3 2]

Circuit design and simulation, Layout Algorithms - Circuit partitioning, placement, and routing algorithms; Design rule verification; Circuit compaction; Circuit extraction and post-layout simulation; Automatic Test Program Generation; Silicon compiler, Array processors, Detailed coverage of HDLs and high level synthesis algorithms and issues. Verilog Implementation: Two bit counter design using FSM, Parallel to Serial Converter, Calculator using FSM to perform simple calculations like addition, multiplication and subtraction, A simplified HDL UART, Verilog implementation of I2C Bus, Design of hardware multiplier using sequential circuit components, ALU Design which should be able to add, subtract, NOR and NAND the numbers.

EC-603 RF Circuit Design [3 0 0 3]

Introduction: Importance of Radiofrequency Design, RF Behavior of Passive Components, Chip Components and Circuit Board Considerations, General Transmission Line Equation, Microstrip Transmission Lines

Single- and Multiport Networks: Interconnecting Networks, Network Properties and Applications, Scattering Parameters

RF Filter: Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter

Active RF Components and Modeling: Semiconductor Basics, RF Diodes, Bipolar-Junction Transistor, RF Field Effect Transistors, High Electron Mobility Transistors, Diode Models, Transistor Models

Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks

RF Transistor Amplifier: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High Power, and Multistage Amplifiers.

Oscillators and Mixers: Basic Oscillator Model, High Frequency Oscillator Configuration, Basic Characteristics of Mixers.

Texts/References:

1. Reinhold Ludwig, Pavel Bretchko, "*RF Circuit Design*", 1st Indian Reprint, 2001, Pearson Education Asia
2. B Razavi, "Design of Analog CMOS Integrated Circuits", Mc Graw Hill, 2000.

LIST OF ELECTIVES FOR M.TECH. (ELECTRONICS AND COMM. ENGINEERING)

Sr. No.	Course Title	Hrs/week			Credits
		L	T	P	
1	Image Processing	3	0	0	3
2	VLSI Technology and Process Modeling	3	0	0	3
3	Solid State Circuits	3	0	0	3
4	Genetic Algorithms and Applications	3	0	0	3
5	Digital Voice and Picture Communication	3	0	0	3
6	Computer Networks	3	0	0	3
7	Reconfigurable Computing	3	0	0	3
8	Fluctuation Phenomena in Microelectronics	3	0	0	3
9	Semiconductor Device Modeling	3	0	0	3
10	Integrated Circuit Technology	3	0	0	3
11	Neural Networks and Fuzzy Systems	3	0	0	3
12	Quantum Computing	3	0	0	3
13	Testing and Fault Tolerance	3	0	0	3
14	Process Characterization and Device Modeling	3	0	0	3
15	ASIC Design and FPGA	3	0	0	3
16	Memory Design and Testing	3	0	0	3
17	Hardware Description Languages	3	0	0	3
18	System on Chip	3	0	0	3
19	RF Design	3	0	0	3
20	Sensor Technologies and MEMS	3	0	0	3
21	Advanced Computer Architecture	3	0	0	3
22	Data structure & Algorithm Analysis	3	0	0	3
23	Computational Technique	3	0	0	3
24	Low Power VLSI Design	3	0	0	3
25	Cluster & Grid Computing	3	0	0	3
26	Real Time Systems and Software	3	0	0	3
27	Neural Network	3	0	0	3
28	Algorithm for VLSI Design Automation	3	0	0	3
29	Process, Devices & Circuit Simulation	3	0	0	3
30	Nano Technology	3	0	0	3
31	Hardware-Software Co-design	3	0	0	3
32	Digital Image Processing	3	0	0	3
33	Cryptology and Crypto chip Design	3	0	0	3
34	Advanced Computational Methods	3	0	0	3

1. Image Processing

Digital Image Processing: Definition, Examples of Fields that use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Digital Image Fundamentals: Image Sensing, and Acquisition, Image Sampling and Quantization, Basic Relationship between Pixels, Linear and Non-linear Operations.
Image Enhancement in Spatial Domain: Basic Gray Level Transformations, Histogram Processing, Enhancements using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing, Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.
Fourier Transformation and Frequency Domain. Smoothing Frequency Domain Filters, sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation.
Colour Image Processing: Colour Models, Pseudocolour Image Processing, Basics of Full Colour Image Processing. Colour Transformations, Smoothing and Sharpening.
Image Compression: Image Compression Models, Elements of Information Theory, Error Free Compression, Lossy Compression, Image Compression Standards.
Point Detection, Line Detection and Edge Detection, Edge Linking and Boundary Detection.

Texts/ References:

1. A. K. Jain, "*Fundamentals of Digital Image processing*", PHI, 2002
2. R. C. Gonzalez and R. E. Woods, "*Digital Image Processing*", Pearson Education, 2002
3. G. A. Baxes, "*Digital Image Processing*", John Wiley, 1994 (Int. Ed.)
4. R.J. Schalkoff, "*Digital Image Processing and Computer Vision*", John Wiley, 1989
5. Sid Ahmed, "*Image Processing*", McGraw -Hill, 1994

2. VLSI Technology and Process Modeling

Unit processes; diffusion, oxidation, CVD, epitaxy, ion implantation, metallization, sputtering, mask making, lithography, bonding, encapsulation, isolation techniques; junction, oxide, V groove, trench, SOI, SOS, Modern processing techniques; RIE, RIBE, LPCVD, PECVD, laser enhanced CVD, EB, IB and X-ray lithography, Pattern generation techniques; Bipolar IC processing, MOS/CMOS processing; Modern trends in IC processing, Process modeling of unit processes; Introduction to process simulators.

Texts/References:

1. S M Sze, G S May, "*Fundamentals of semiconductor fabrication*", Wiley
2. S. Wolf, "*The Submicron MOSFET, volume 3 of Silicon Processing for the VLSI Era*", Lattice Press, 1995
3. Carver Mead and Lynn Conway, "*Introduction to VLSI Systems*", BS Publications, Indian Reprint 2003
4. Neil H. E. Weste & Kamran Eshraghian, "*Principles of CMOS VLSI Design*", Pearson education asia, 2/e
5. Wayne Wolf, "*Modern VLSI Design*", Pearson Education, 4th Indian Reprint 2005

3. Solid State Circuits

OPAMP design techniques and performance characteristics; opamp instrumentation in low and high power circuits; Phase lock techniques; PLL design parameters and systems; Analog multipliers and modulators; Switched Capacitor circuits; Bipolar, CMOS and BIMOS logic; CVSL, domino, C2MOS, pass transistor logic and PLAs; low voltage low power circuits.

Texts/References:

1. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley
2. S. Wolf, "*The Submicron MOSFET, volume 3 of Silicon Processing for the VLSI Era*", Lattice Press, 1995
3. Carver Mead and Lynn Conway, "*Introduction to VLSI Systems*", BS Publications, Indian Reprint 2003
4. Neil H. E. Weste & Kamran Eshraghian, "*Principles of CMOS VLSI Design*", Pearson education asia, 2/e
5. Wayne Wolf, "*Modern VLSI Design*", Pearson Education, 4th Indian Reprint 2005

4. Genetic algorithms and its applications

Introduction to Optimization

What is optimization, categories of optimization, minimum seeking algorithm

Natural Optimization Methods

Simulated annealing, evolutionary algorithms(GAs, EP, ES, GP etc.),A simple evolutionary algorithm

Selection Schemes, Crossovers, Mutation

Applications

Muti Objective Evolutionary Optimization

Some Case Studies

Texts/references:

1. David A coley,"*An introduction to genetic Algorithms for Scientists and engineers*", world Scientific Publishing Company,(1997).
2. Mitsuo Gen,Runwei Cheng, Wiley-Interscience*,"Genetic Algorithms and Engineering Design",* 1st edition,(1997)
3. Thomas Back*,"Evolutionary algorithms in theory and practice evolution strategies,Evolutionary programming,Genetic Algorithms*",Oxford University Press,(1996).
4. Kalyanmoy Deb*,"Multi Objective Optimization using Evolutionary Algorithms*", John Wiley and Sons(2001).
5. William M,"Evolutionary Algorithms: *The Role of Mutation and Recombination",* (Natural Computing Series),Springer-Verlag(2000)

5. Digital Voice and Picture Communication

Digital speech communication; Digital TV communication; Characteristics of speech signals; Characteristics of picture signals; Subjective and objective testing; Bit rates in speech and picture communication CCITT recommendations for speech digitization; HDTV, Low resolution TV and Videoconferencing requirements; Time domain waveform coding of speech-PCM, DPCM,ADPCM, DM and subband coding; Frequency domain waveform coding of speech-LTC, ATC; Parameter coding of speech-channel, format and LPC vocoders; Coding of monochrome and colour video signals-Transform and Adaptive transform coding; Subband coding; Vector quantization; Interframe and Hybrid coding; Delayed decision and run length coding; Effects of transmission errors; Audio and Video conferencing; Video telephone.

Texts/ References:

1. John R. Barry, Edward A. Lee, and David G. Messerschmitt, **"***Digital Communication: Third Edition***"**
2. Arun N. Netravali and Barry G. Haskell, ***"****Digital Pictures: Representation, Compression and Standards (Applications of Communications Theory)***"**
3. Arun N. Netravali and Barry G. Haskell, "*Digital Pictures: Representation, Compression and Standards (Applications of Communications Theory)***"**
4. John R. Barry, Edward A. Lee, David G. Messerschmitt, "*Digital Communication*"
5. Walter S. Ciciora, James Farmer, Michael**,** *"Modern Cable Television Technology: video, voice, and data communications"*

6. Computer Networks

Introduction to Computer networks : reference models : OSI model, TCP/IP model, Comparison of TCP/IP and OSI models, Network Types and Topologies: LANs, WANs, others and hybrids, Ethernet, Token Bus, Token Ring; Star, Ring, Bus, Other. Network Hardware: Wiring, Network Interface Cards, Hubs, Routers, Switches. Introduction to Novell netware, and ARPANET.
Introduction to Distributed Systems : Characteristics of distributed Systems, examples, resource sharing, system models : architectural fundamentals.
Networking and internetworking : Network types, principles, IP. Inter process communication : external data representation, client server communication, group communication.
Operating system support : operating system layers, protection, process and threads, O.S. architecture.

Texts/ References:

1. Andrew S. Tanenbaum, "*Computer Networks*" (2nd ed.), Prentice Hall of India, 1988.
2. Martin, "*Computer network and Distributed processing*"
3. Rakesh Narang, "*Novell Netware Tips - Tricks – Technologies*", BPB Publication
4. David E. McDysan & Darren L. Spohn, "*ATM - Theory and Application*", Mc Graw Hill 1994
5. IEEE Networks Magazine Sep '92 onwards

7. Reconfigurable Computing

FPGA architectures, CAD for FPGAs: overview, LUT mapping, timing analysis, placement and routing. Reconfigurable devices-from fine-grained to coarse-grained devices, Reconfiguration modes and multi-context devices, Dynamic reconfiguration, System level design for reconfigurable systems; heuristic temporal partitioning and ILP- based temporal partitioning. Behavioral synthesis.

Texts/ References:

1. Uwe Meyer-Baese, "*Digital Signal Processing using Field Programmable Gate Arrays*", Springer 2001.
2. Oppenheim, Schafer and Buck, "*Discrete-Time Signal Processing*", 2nd edition, Prentice Hall, 1999.
3. Maya Gokhale and Paul S,Graham, "*Reconfigurable Computing:Accelerating*

Computation with FPGA"

4. Svetlana P. Kartashev , Steven I. Kartashev, "*Supercomputing Systems : Reconfigurable Architectures (Hardcover Designing and Programming Modern Computer Systems)*"

5. Maya Gokhale, Paul S. Graham, "*Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays*"

8. Fluctuation Phenomena in Microelectronics

Stochastic variables of interest in physical electronics (e.g. carrier concentration, potential, barrier heights, mobility, diffusion constant, G-R time, avalanche coefficients etc.). Thermodynamic considerations. Manifestation of stochastic processes in physical electronics. Instrumentation.

Texts/References:

1. S M sze, G S May, "*Fundamentals of semiconductor fabrication*", Wiley
2. S. Wolf, "*The Submicron MOSFET, volume 3 of Silicon Processing for the VLSI Era*", Lattice Press, 1995
3. DA. and Eshrachian K, "*Basic VLSI design systems & circuits*", PHI, 1988
4. Geigar BR, Allen PE & Strader ME, "*VLSI design techniques for analog & digital circuit*", Mc Graw Hill, 1990
5. Charles A. Harper , Jerry E. Sergent, "*Hybrid Microelectronics Handbook (Hardcover)*", International Society for Hybrid Microelectronics

9. Semiconductor Device Modeling

Physics and Properties of Semiconductors, P-N Junction, Bipolar transistor, State-of-the-Art Bipolar Transistor Technology, Metal-Semiconductor Contacts, Metal-Oxide-Silicon System, MOS Field-Effect Transistor, State-of-the-Art MOS Technology.

Texts/References:

1. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley, 1986
2. R. F. Pierret, Addison, "*Semiconductor Device Fundamentals*", Wesley, 1996
3. S M Sze, "*Physics of Semiconductor Devices*", Wiley, 2nd edition
4. S M sze,G S May, "*Fundamentals of semiconductor fabrication*", Wiley
5. S. Wolf, "*The Submicron MOSFET, volume 3 of Silicon Processing for the VLSI Era*", Lattice Press, 1995

10. Integrated Circuit Technology

IC components - their characterization and design. Analysis and design of basic logic circuits. Linear ICs. Large Scale Integration. Computer simulation of ICs and layout design. High Voltage ICs. GaAs MESFET and GaAs ICs. Failure, reliability and yield of ICs. Fault modeling and testing.

Texts/References:

1. R.S. Muller and T.I. Kamins, "*Device Electronics for Integrated Circuits*", Wiley, 1986
2. DA. And Eshrachian K, "*Basic VLSI design systems & circuits*", PHI, 1988
3. Geigar BR, Allen PE & Strader ME, " *VLSI design techniques for analog & digital circuit*",Mc Graw Hill, 1990
4. Carver Mead and Lynn Conway, "*Introduction to VLSI Systems*", BS Publications, Indian Reprint 2003
5. Neil H. E. Weste & Kamran Eshraghian, "*Principles of CMOS VLSI Design*", Pearson education asia, 2/e

11. Neural Networks and Fuzzy Systems

Neurons and neural networks, basic models of artificial neural networks: simple layer perception, feed forward multilayer perceptron, Hopfield networks, competitive learning networks, applications of neural networks for matrix algebra problems, adaptive filtering and adaptive pattern recognition, dynamic system identification, dynamic system modeling using recurrent neural networks, approximation/optimization problems, VLSI implementation of neural networks.

Fuzzy sets - basic definitions and extensions, Measure of fuzzyness, The extension principle and applications, Fuzzy relations and Fuzzy graphs, Fuzzy analysis, Possibility theory, Fuzzy numbers, Fuzzy positioning, Fuzzy grammers and Automata.Applications - Fuzzy approximate reasoning & Expert systems, Fuzzy control, pattern recognition, Decision making in Fuzzy environment, Fuzzy scene analysis, Fuzzy linear and goal programming.

Texts/ References:

1. Li Min Fu," Neural Networks in Computer Intelligence", McGraw-Hill, Inc.
2. M. H. Hassun, "Fundamentals of Artificial Neural Networks", PHI.
3. Neural Networks - by Simon Haykin
4. Fuzzy logic with engineering application - by ROSS J.T (Tata Mc)
5. Neural Networks & Fuzzy Logic - by Bart Kosko

12. Quantum Computing

Bits and qubits. Introduction to quantum states with motivating examples. Comparison with classical discrete state systems.
Linear algebra. Review of linear algebra. Vector spaces, linear operators, Dirac notation.
Quantum mechanics. Postulates of quantum mechanics. Evolution and measurement. Entanglement.
Computation and algorithms. Models of quantum computation. Quantum circuits, finite state systems, machines and algorithms.
Quantum complexity. Quantum complexity classes and their relationship to classical complexity. Comparison with probabilistic computation.

Texts/References:

Nielsen, M.A. & Chuang, I.L. (2000), "Quantum computation and quantum information", Cambridge University Press.

Gruska, J. (1999), “Quantum computing”, McGraw-Hill
Kitaev, A.Y., Shen, A.H. & Vyalyi, M.N. (2002), “Classical and quantum computation”, AMS.

13. Testing and Fault Tolerance

Physical Faults and their Modelling: Stuck-at Faults, Bridging Faults
Fault Collapsing; Fault Simulation, Deductive, Parallel, and Concurrent Fault Simulation Critical Path Tracing
ATPG for Combinational Circuits: D- Algorithm, Boolean Difference, Podem
Random, Deterministic and Weighted Random Test Pattern Generation Aliasing and its effect on Fault Coverage
PLA Testing, Cross Point Fault Model and Test Generation
Memory Testing - Permanent, Intermittent and Pattern Sensitive Faults, Marching tests
Delay Faults; ATPG for Sequential Circuits
Time Frame Expansion; Controllability and Observability Scan Design, BILBO, Boundary Scan for Board Level Testing, BIST and Totally Self checking Circuits
System level Diagnosis; Introduction
Concept of Redundancy, Spatial Redundancy, Time Redundancy, Error Correction Codes, Reconfiguration Techniques
Yield Modelling Reliability and effective area utilization.

Text/References:

Hideo Fujiwara, “ Logical testing & design for testability”, The MIT Press.
Mike Tien Chienlee, “ High level Test Synthesis of Digital VLSI circuits”, Artech House Boston London.
Viswani D.Agarval Michael L.Bushnell, " Essentials of Electronic Testing for Digital
Memory & Mixed Signal VLSI Circuit ", Kluwer Academic Publications, 1999.

14. Process and Device Characterization & Measurements:

Physical Characterization: Thin Film Thickness- Measurements-ellipsometry, surface profiling, spectrophotometry, FTIR
Critical Dimension Measurements: Optical microscope, Scanning Electron Microscope, Transmission Electron Microscope
Material and Impurity Characterization: SIMS, XRD, EDAX
Electrical Characterization: Four-probe technique, Hall effect, sheet resistance C-V measurements, DLTS, Carrier lifetime, impurity profiling, I-V measurements, Process and SPICE model parameter Extraction.

Text /References:

W.R. Reunyan, “ Semiconductor Measurements And Instrumentation”, Mc-Graw Hill.
Schroder, “Semiconductor Material And Device Characterization”
Philips F. Kare and Greydon B. Lauabee, “ Characterization of semiconductor Materials”, Mc-Graw Hill.
K.V. Ravi, “Imperfections And Impurities In Semiconductor Silicon”, John Wiley And Sons.

15. ASIC Design and FPGA:

Introduction To ASICS, CMOS Logic And ASIC 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.

Review of VHDL/Verilog: Entities and architectures

Programmable Asics, Programmable ASIC Logic Cells And Programmable ASIC I/O Cells, Anti fuse - 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 I/O blocks.

Programmable ASIC Interconnect, Programmable ASIC Design Software And Low Level Design Entry Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX - Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation.

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 -

circuit extraction - DRC. Design using Xilinx family FPGA

Text/References:

M.J.S .Smith, - " Application - Specific Integrated Circuits " - Addison –Wesley Longman Inc., 1997

Skahill, Kevin," VHDL for Programmable Logic", Addison-Wesley, 1996

John F. Wakherly, " Digital Design: Principles and Practices", 2nd Edn 1994, Prentice Hall International Edn

Charles W. Mckay, "Digital Circuits a proportion for microprocessors", Prentice Hall

16. Memory Design and Testing:

Random Access Memory Technologies, Static Random Access Memories (SRAMs): SRAM Cell Structures-MOS SRAM Architecture-MOS SRAM Cell and Peripheral Circuit Operation-Bipolar SRAM Technologies-Silicon On Insulator (SOl) Technology- Advanced SRAM Architectures and Technologies-Application Specific SRAMs. Dynamic Random Access Memories (DRAMs):

DRAM Technology Development-CMOS DRAMs-DRAMs Cell Theory and Advanced

Cell Strucutures-BiCMOS DRAMs-Soft Error Failures in DRAMs-Advanced DRAM

Designs and Architecture-Application Specific DRAMs.

Nonvolatile Memories, Masked Read-Only Memories (ROMs)-High Density ROMs-Programmable Read-Only Memories (PROMs)-Bipolar PROMs-CMOS PROMs-Erasable (UV) - Programmable Road-Only Memories (EPROMs)-Floating-Gate EPROM Cell-One- Time Programmable (OTP) EPROMS-Electrically Erasable PROMs (EEPROMs)- EEPROM Technology And Arcitecture-Nonvolatile SRAM-Flash Memories (EPROMs or EEPROM)-Advanced Flash Memory Architecture.

Memory Fault Modeling, Testing, And Memory Design For Testability And Fault Tolerance RAM Fault Modeling, Electrical Testing, Peusdo Random Testing-Megabit DRAM Testing-Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing-Application Specific Memory Testing.

Semiconductor Memory Reliability And Radiation Effects

Text/Reference:

A.K Sharma, " Semiconductor Memories Technology, Testing and Reliability", IEEE Press.
Luecke Mize Care, " Semiconductor Memory design & application", Mc-Graw Hill.
Belty Prince, " Semiconductor Memory Design Handbook"
Memory Technology design and testing 1999 IEEE International Workshop on: IEEE Computer Society Sponsor (S)

17. Hardware Description Languages:

Basic concepts of hardware description languages. Hierarchy, Concurrency, logic and delay modeling. Architecture of event driven simulators. Syntax and Semantics of VHDL. Variable and signal types, arrays and attributes. Operators, expressions and signal assignments. Entities, architecture specification and configurations. Component instantiation. Concurrent and sequential constructs. Use of Procedures and functions, Examples of design using VHDL. Syntax and Semantics of Verilog. Structural, Data-flow and Behavioral styles of hardware description. Variable types, arrays and tables. Operators, expressions and signal assignments. Modules, nets and registers, Concurrent and sequential constructs. Tasks and functions, Examples of design using Verilog. Synthesis of logic from hardware description. Case Study and Mini Project

Texts / References:

Douglas Perry, "VHDL", McGraw Hill International (NY), 1993, The Institute of Electrical and Electronics Engineers.
Navabi," VHDL Analysis & Modeling of digital systems",1998, McGraw Hill .
S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall (NJ, USA), 1996.
J. Bhaskar, "Verilog HDL Synthesis - A Practical Primer", Star Galaxy Publishing, Allentown, PA) 1998.
Stefan Sjoholm & Lennart Lindth,"VHDL for Designers", Prentice Hall.
Peter J Ashenden, "The Designer's Guide to VHDL ", Morgan Kaufmann Publishers.
"IEEE std 1364-95, Verilog Language Reference Manual", IEEE Press (NY, USA), 1995.

18. System on Chip (SoC):

System on Chip Technology Challenges, System On a Chip (SOC) components. SoC Design Methodology. Parameterized Systems-on-a-Chip. System-on-a-chip Peripheral Cores. SoC and interconnect centric Architectures. System level design representations and modeling languages. Target architecture models. Intra-chip communication. Graph partitioning algorithms. Task time measurement. Interconnect latency modeling. Back annotation of lower level timing to high-level models. Synthesis of SOC components. System Level, Block Level and Hardware/Software Co-verification. SOC components: emulation, co-simulation, Physical Verification.

Text/References:

Wayone Wolf," Modern VLSI Design: SOC Design"
Prakash Rashnikar, Peter Paterson, Lenna Singh" System-On-A-Chip Verification methodlogy & Techniques", Kluwer Academic Publishers.

Alberto Sangiovanni Vincentelli," Surviving the SOC Revolution: A Guide to Platformbased Design", Kluwer Academic Publishers.

19. RF Design:

Introduction to RF Electronics. Basic concepts in RF design. MOS Review. Path Loss. Small Signal Model. Receiver Design. RF Transreceivers. Low Noise RF amplifiers and Mixers. RF Power amplifiers. RF Oscillators.

Text/References:

Behzad Razavi, "RF Microelectronics", Pearson Education.
Reinhold Ludwig, Paul Bretchko,"RF Circuit Design: Theory & Applications "
Peter b. Kenington, "High Linearity RF Amplifier Design ", Artech House Microwave Library.
Jeremy Everard, "Fundamentals of RF Circuit Design With Low Noise Oscillators", John Wiley & Sons Ltd.

20. Sensor Technologies and MEMS:

Sensors types and classification – mechanical, acoustic, magnetic, thermal, chemical, radiation and biosensors. Microsensors. Sensors based on surface-acoustic wave devices. Micromachining techniques MEMS for automative, communication and signal processing applications. Modeling and simulation of microsensors and actuators. Sensors and smart structures. Micro-opto-electro-mechanical sensors and system.

Text /References:

Ristic L (ed), "Sensor Technology and Devices", Artech House, London, 1994.
Sze S.M. (ed), "Semiconductor Sensors", John Wiley, New York, 1994 Wise
K.D. (Guest Editor) "Integrated Sensors, Microp-actuators and micro-systems (MEMS)", Special Issue of proceedings of IEEE, Vol. 86, No.8, August 1998.

21. Advanced Computer Architecture

Parallel computer models: The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.
Program and network properties: Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms
System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.
Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors
Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline

Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines
Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization,

Text/ References:

1. Kai Hwang, "Advanced computer architecture"; TMH.
2. D. A. Patterson and J. L. Hennessey, "Computer organization and design," Morgan Kaufmann, 2nd Ed.
3. J.P.Hayes, "computer Architecture and organization"; MGH.
4. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication.
3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI.
4. R.K.Ghose, Rajan Moona & Phalguni Gupta, "Foundation of Parallel Processing"; Narosa Publications.

22. Data structure & Algorithm Analysis

Arrays: representation and basic operations, Linked list : Singly linked list, Doubly linked list and Circular linked list- definition, representation and their basic operation, Stacks and queues : insertion, deletion, Trees : Binary Search trees, AVL trees, B-trees and B+ trees : insertion, deletion, traversal (in order, preorder and post order)
Introduction to algorithm Design: Growth of functions, Summations and Recurrences, The substitution method, the iteration method, the master method, Divide and Conquer paradigm, Dynamic programming, Greedy Algorithms.
Sorting and Order Statistics: Merge Sort, Heap sort, Quick sort, Priority Queues
Searching and Disjoint Sets: Hash Tables, Binary Search Trees, Red-Black trees, Disjoint-set Operations - Linked list representation of disjoint sets, Disjoint set forests,
NP-Complete Problem: Polynomial-time non-deterministic algorithms, NPCompleteness and Reducibility,NP-Completeness Proof and NP Complete problems.

Text/References:

1. T .H. Cormen, C. E. Leiserson, R. L. Rivest "Introduction to Algorithms", PHI.
2. A .V. Aho, J . E . Hopcroft, J . D . Ulman "The Design & Analysis of Computer Algorithms", Addison Wesley.
3. V . Manber "Introduction to Algorithms – A Creative Approach", Addison Wesley.
4. Ellis Harwitz and Sartaz Sahani "Fundamentals of Computer Algorithms", Computer Science Press.

23. Computational Technique

Roots Finding for Non Linear equation: functions and Polynomials, Zeros of a function, Roots of a Nonlinear equation, Bracketing, Bisection and Newton-Raphson

Methods, Globally convergent methods in more than one dimension
Interpolation & Approximation: Interpolation, Polynomial fits, Chebyshev approximation
Numerical Integration: Evaluation of Integrals, Elementary Analytical Methods, Trapezoidal and Simpson's Rules, Summation of series, Gaussian Quadrature, and orthogonal polynomials, Multidimensional Integrals, Numerical differentiation and Estimation of errors.
Optimization: Extremisation of functions, Optimization and simple search, Simplex method of Nelder and Mead, Powells method, Gradient based methods
Numerical Solution of Linear equation & matrix eigen value problem: Vectors and Matrices, Solutions of linear algebraic equations by direct and iterative methods, Gaussian elimination, LU, Cholesky and singular value decompositions, Matrix diagonalization methods, Eigenvalue problems

Text/References:
1. Pradip Niyogi, "Numerical Analysis & Algorithms", TMH, 2003
2. Kreyszig, E, "Advanced Engineering Mathematics", John Wiley & Sons, Seventh Edition, 1993
3. Kendal Atkeinson "Introduction to Numerical Analysis" John viley

24. Low Power VLSI Design

Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Physics of power dissipation in CMOS devices.
Device & Technology Impact on Low Power Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.
Power estimation, Simulation Power analysis**:** SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation.
Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.
Low Power Design
Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library **Logic level:** Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic

Text/References:
1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002
2. Rabaey, Pedram, "Low power design methodologies" Kluwer Academic, 1997
3. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000

25. Cluster & Grid Computing

Cluster Computing :Parallel systems,Cluster Architecture, Parallel

Paradigms,Parallel, Programming with MPI, Resource management and scheduling
Grid Computing Grids and Grid Technologies, Programming models and Parallelization Techniques, Standard application development tools and paradigms such as message-passing and parameter parallel programming,Grid Security Infrastructure, Data Management, Application Case Study: Molecular Modelling for Drug Design and Brain Activity Analysis, Resource management and scheduling, Setting up Grid, deployment of Grid software and tools, and application execution.

Text/References:
1. R. Buyya (editor), High Performance Cluster Computing , Vol1. and Vol.2, Prentice Hall, USA, 1999.
2. I. Foster and C. Kesselman (editors), The Grid : Blueprint for a New Computing Infrastructure , Morgan Kaufmann Publishers , 1999.
3. R. Buyya, "Economic-based Distributed Resource Management and Scheduling for Grid Computing, Ph.D. Thesis, Monash University, Melbourne, Australia, April 2002

26. Real Time Systems and Software

Introduction, Real-time Versus Conventional Software, Computer Hardware for Monitoring and Control, Software Engineering Issues. Process and State-based Systems model, Periodic and Sporadic Process, Cyclic Executives, CE definitions and Properties, Foreground-Background Organiazations, Standard OS and Concurrency – Architectures, Systems Objects and Object-Oriented Structures, Abstract Data Types, General Object Classes. Requirements and Design Specifications: Classification of Notations, Data Flow Diagrams, Tabular Languages, State Machine, Communicating Real Time State Machine- Basic features, Timeing and clocks, Sementics Tools and Extensions, Statecharts-Concepts and Graphical Syntax, Semantics and Tools. Declarative Specifications: Regular Expressions and Extensions, Traditional Logics. Operating Systems: Real Time Functions and Sevices, OS Architectures-Real Time UNIX and POSIX, Issues in Task management- Processes and Threads, Scheduling, Synchronization and communication

Text/References:
1. Real – Time Systems and software by Alan C. Shaw ; John Wiley & Sons Inc

27. Algorithm for VLSI Design Automation

Logic synthesis & verification
Introduction to combinational logic synthesis, Binary Decision Diagram, Hardware models for High-level synthesis.
VLSI automation Algorithms:
Partitioning: problem formulation, classification of partitioning algorithms, Group migration algorithms, simulated annealing & evolution, other partitioning algorithms.
Placement, floor planning & pin assignment: problem formulation, simulation base

placement algorithms, other placement algorithms, constraint based floor plannning, floor planning algorithms for mixed block & cell design. General & channel pin assignment.
Global Routing: Problem formulation, classification of global routing algorithms, Maze routing algorithm, line probe algorithm, Steiner Tree based algorithms, ILP based approaches.
Detailed routing: problem formulation, classification of routing algorithms, single layer routing algorithms, two layer channel routing algorithms, three layer channel routing algorithms, and switchbox routing algorithms.

Text/References:
1. Naveed Shervani, "Algorithms for VLSI physical design Automation", Kluwer Academic Publisher, Second edition.
2. Christophn Meinel & Thorsten Theobold, "Algorithm and Data Structures for VLSI Design", KAP, 2002.
3. Rolf Drechsheler : "Evolutionary Algorithm for VLSI", Second edition
4. Trimburger," Introduction to CAD for VLSI", Kluwer Academic publisher, 2002

28. Process, Devices & Circuit Simulation

Introduction, Main data structure & program organization, Geometrical manipulations, Ion implantation, A novel measurement technique for 2D implanted ion distributions, Introduction to partial differential equation solver, the merged multi grid method, Isothermal device modeling & simulation, Non Isothermal device modeling & simulation, hydrodynamic device modeling & simulation

Text/References
1. Circuit, Device and Process Simulation: Mathematical and Numerical Aspects by Graham F. Carey (Editor), W. B. Richardson, C. S. Reed, B. Mulvaney, John Wiley & Sons; 1 edition.
2. Process and Device Simulation for MOS-VLSI Circuits, edited by P. Antognetti, D.A. Antoniadis , Robert W. Dutton, W.G. Oldham, kluwer Academic Publisher, 2000.

29. Nano Technology

Introduction
Introduction to nanoscale systems, Length energy and time scales, Top down approach to Nano lithography, Spatial resolution of optical, deep ultraviolet, X-ray, electron beam and ion beam lithography, Single electron transistors, coulomb blockade effects in ultra small metallic tunnel junctions
Quantum Mechanics
Quantum confinement of electrons in semiconductor nano structures, Two dimensional confinement (Quantum wells), Band gap engineering, Epitaxy, Landaeur – Buttiker formalism for conduction in confined geometries, One dimensional confinement, Quantum point contacts, quantum dots and Bottom up approach, Introduction to quantum methods for information processing.

Molecular Techniques
Molecular Electronics, Chemical self assembly, carbon nano tubes, Self assembled mono layers, Electromechanical techniques, Applications in biological and chemical detection, Atomic scale charcterization techniques, scanning tunneling microscopy, atomic force microscopy

Text /References:

1. Beenaker and Van Houten "Quantum Transport in Semiconductor Nanostructures in Solid state Physics" Ehernreich and Turnbell, Academic press, 1991
2. David Ferry " Transport in Nano structures" Cambridge University press 2000
3. Y. Imry " Introduction to Mesoscopic Physics, Oxford University press 1997
4. S. Dutta " Electron Transport in Mesoscopic systems" Cambridge University press 1995

30. Hardware-Software Co-design

Introduction : Motivation hardware & software co-design, system design consideration, research scope & overviews

Hardware Software back ground: Embedded systems, models of design representation, the virtual machine hierarchy, the performance3 modeling, Hardware Software development,

Hardware Software co-design research : An informal view of co-design, Hardware Software tradeoffs, crosses fertilization, typical co-design process, co-design environments, limitation of existing approaches, ADEPT modeling environment.

Co-design concepts : Functions, functional decomposition, virtual machines, Hardware Software partitioning, Hardware Software partitions, Hardware Software alterations, Hardware Software trade offs, co-design.

Methodology for co-design : Amount of unification, general consideration & basic philosophies, a framework for co-design.

Unified representation for Hardware & Software : Benefits of unified representation, modeling concepts

An abstract Hardware & Software model : Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model

Performance evaluation: Application of t he abstract Hardware & Software model, examples of performance evaluation

Text/References:

1. Sanjaya Kumar, James H. Ayler "The Co-design of Embedded Systems: A Unified Hardware Software Representation", Kluwer Academic Publisher, 2002
2. Gomaa, Software Design Methods for Concurrent and Real-time Systems, Addison-Wesley, 1993.
3. H. Kopetz, Real-time Systems, Kluwer, 1997.
4. R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.

31. Digital Image Processing

Introduction And Digital Image Fundamentals

Digital Image Representation, Fundamental Steps in Image Processing, Elements of Digital image processing systems, Sampling and quantization, some basic relationships like neighbours, connectivity, Distance measure between pixels, Imaging Geometry.
Image Transforms Discrete Fourier Transform, Some properties of the two-dimensional fourier transform, Fast fourier transform, Inverse FFT.
Image Enhancement: Spatial domain methods, Frequency domain methods, Enhancement by point processing, Spatial filtering, Lowpass filtering, Highpass filtering, Homomorphic filtering, Colour Image Processing.
Image Restoration: Degradation model, Diagnolization of Circulant and Block-Circulant Matrices, Algebraic. Approach to Restoration, Inverse filtering, Wiener filter, Constrained Least Square Restoration, Interactive Restoration, Restoration in Spatial Domain.
Image Compression: Coding, Interpixel and Psychovisual Redundancy, Image Compression models, Error free comparison, Lossy compression, Image compression standards.
Image Segmentation: Detection of Discontinuities, Edge linking and boundary detection, Thresholding, Region Oriented Segmentation, Motion based segmentation.
Representation and Description: Representation schemes like chain coding, Polygonal Approximatiion, Signatures, Boundary Segments, Skeleton of region, Boundary description, Regional descriptors, Morphology.
Recognition and Interpretation: Elements of Image Analysis, Pattern and Pattern Classes, Decision-Theoretic Methods, Structural Methods, Interpretatiion.
Text/ References:
1. Rafael C. Conzalez & Richard E. Woods, "Digital Image Processing", AWL.
2. A.K. Jain, "Fundamental of Digital Image Processing", PHI.
3. Rosefield Kak, "Digital Picture Processing",
4. W.K. Pratt, "Digital Image Processing",

32. Cryptology and Crypto chip Design

Basic concepts:
Information system reviewed, LAN, MAN, WAN, Information flow, Security mechanism in OS,, Targets: Hardware, Software, Data communication procedures
Threats to Security: Physical security, Biometric systems, monitoring controls, Data security, systems, security, Computer System security, communication security.
Encryption Techniques: Conventional techniques, Modern techniques, DES, DES chaining, Triple DES, RSA algorithm, Key management.
Message Authentication and Hash Algorithm: Authentication requirements and functions secue Hash Algorithm, NDS message digest algorithm, digital signatures, Directory authentication service
Firewalls and Cyber laws: Firewalls, Design Princples, Trusted systems, IT act and cyber laws, Virtual private network
Future Threats to Network: Recent attacks on networks, Case study
Applications: AES algorithm. Crypto chip design: Implementation of DES, IDEA AES algorithm, Development of digital signature chip using RSA algorithm
Text/References:
1. William Stalling "Cryptography and Network Security" Pearson Education
2. Charels P. Pfleeger "Security in Computing" Prentice Hall
3. Jeff Crume "Inside Internet Security" Addison Wesley

33. Advanced Computational Methods

Solution of two or more nonlinear equations by iterative methods (Picard and Newton's methods) Spline interpolation, cubic splines, Chebyshev polynomials, Minimax approximation. Eigenvalues and vectors of a real symmetric matrix – Jacobi method. Eigenvalue problem for ordinary differential equations. Numerical solution of a parabolic equation. Explicit method, simple implicit method and Crank-Nicholson method. Stability. Numerical Solution of elliptic problems. Dirichlet and Neumann problems (Cartesian and Polar coordinates). Numerical solution of hyperbolic equations. Explicit method. Method of characteristics. Stability. The finite element method – Ritz, collocation and Galerkin methods. Boundary value problems for ordinary differential equations. Shape functions. Assembly of element equations.

Text/References:

1. Smith G. D. "Numerical Solution of Partial Differential Equation", Oxford, 1965.
2. Chapra, S.C, Canale R P "Numerical Methods for Engineers" 3rd Ed., McGraw-Hill 1998.
3. Kreyszig, E, "Advanced Engineering Mathematics", John Wiley, 8th ed., 2002.
4. Gerald, C.F., "Applied Numerical Analysis", 6th Ed., Pearson, 1999.