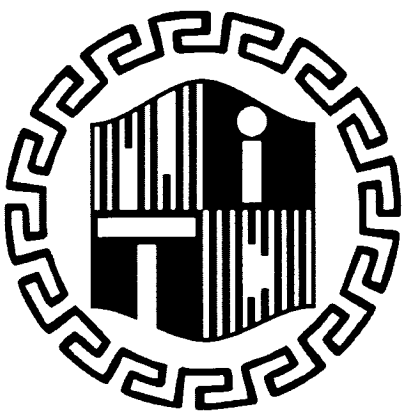
SCHEME OF INSTRUCTION AND SYLLABI

M.TECH DEGREE IN

ELECTRONICS AND COMMUNICATION ENGINEERING

EFFECTIVE FROM 2013-2014



National Institute of Technology Delhi

(NIT DELHI)

NATIONAL INSTITUTE OF TECHNOLOGY DELHI

M. Tech (**Electronics and Communication Engineering**) Course Structure

		M.Tech (ECE) I Year I Semester		
S. No.	**Course No.**	**Course Title**	**(L – T – P)**	**C**
1	EC 561	Advanced Digital Communication Systems	(3 – 0 – 0)	3
2	EC 563	Advanced Error Control Codes	(3– 0 – 0)	3
3	EC 564	Advance Microwave Engineering	(3 – 0 – 0)	3
4	EC 579	Advance Optical Communication Systems	(3 – 0 – 0)	3
5	EC 593	Computer Communication	(3 – 0 – 0)	3
6	EC 565	Communication Lab -I	(0 – 0 – 6)	3
		Total	**(15 – 0 – 6)**	**18**

		M.Tech (ECE) I Year II Semester		
S. No.	**Course No.**	**Course Title**	**(L – T – P)**	**C**
1		Elective I	(3 – 0 – 0)	3
2		Elective II	(3 – 0 – 0)	3
3		Elective III	(3 – 0 – 0)	3
4		Elective IV	(3 – 0 – 0)	3
5		Elective V	(3 – 0 – 0)	3
6	EC 566	Minor Project	(0 – 8 – 0)	4
7	EC 568	Communication Lab II	(0 – 0 – 6)	3
		Total	**(15 – 8 – 6)**	**22**

		M.Tech (ECE) II Year I Semester		
S. No.	**Course No.**	**Course Title**	**(L – T – P)**	**C**
1		Dissertation		16
			Total	**16**

		M.Tech (ECE) II Year II Semester		
S. No.	**Course No.**	**Course Title**	**(L – T – P)**	**C**
1		Dissertation		16
			Total	**16**

Department of ECE

Master of Technology in Electronics & Communications Engineering

New PG Scheme, July 2012 (SPGB & Senate)

Indicative Relative Weightage in %; if different, course teacher may declare the distribution at the start of Semester

Subject Code	Course Title	core. /elect	Exam. Duration	Theor y	Practi cal	CWS	PRS	MTE	ETE	PRE
EC561	Advanced Digital Communication Systems	C	2	-		20	-	40	40	-
EC563	Advanced Error Control Codes	C	2	-		20	-	40	40	-
EC564	Advanced Microwave Engg.	C	2	-		20	-	40	40	-
EC579	Advanced Optical Communication Systems	C	2	-		20	-	40	40	-
EC593	Computer Communication	C	2	-		20	-	40	40	-
EC565, EC568	Comm. Lab-I, II	C	-	-		-	40	-	-	60
EC566	Minor Project	C	-	-		-	60	-	-	40
EC650A	Dissertation	C	-	-		-	-	-	-	100
EC650B	Dissertation	C	-	-		-	-	-	-	100
EC571	Satellite Communication and Radar Engg.	E	2	-		20	-	40	40	-
EC572	Wireless and Mobile Adhoc Networking	E	2	-		20	-	40	40	-
EC573	Cryptography	E	2	-		20	-	40	40	-
MA502	Modeling and Simulation	E	2	-		20	-	40	40	-
EV505	Digital system design	E	2	-		20	-	40	40	-
EV534	Micro Electro-mechanical Systems (MEMS)	E	2	-		20	-	40	40	-
CP527	Information system security	E	2	-		20	-	40	40	-
EC598	Advanced Networking analysis	E	2	-		20	-	40	40	-
CP518	Security in computing	E	2	-		20	-	40	40	-
CP555	Public key infrastructure and Trust management	E	2	-		20	-	40	40	-
CP506	Selected topics in Cryptography	E	2	-		20	-	40	40	-
EC575	Design of Microstrip Antennas	E	2	-		20	-	40	40	-
EV520	Microelectronic Devices and Circuits	E	2	-		20	-	40	40	-
EC577	Estimation and Detection	E	2	-		20	-	40	40	-
EC578	Design of MIC's & MMIC's	E	2	-		20	-	40	40	-
EC580	Advanced Mobile Systems	E	2	-		20	-	40	40	-
EC581	Photonic Integrated Devices and Systems	E	2	-		20	-	40	40	-
EC582	Smart and Phased Array Antenna Design	E	2	-		20	-	40	40	-
EV531	Analog and Mixed Signal ICs	E	2	-		20	-	40	40	-
EC588	EMI/EMC	E	2	-		20	-	40	40	-
EC590	Wireless Sensor Networks	E	2	-		20	-	40	40	-
EC592	Computational Electromagnetics	E	2	-		20	-	40	40	-
EC562	Advanced Digital Signal & Image Processing	E	2	-		20	-	40	40	-
EC594	Advanced Photonic Devices and Components	E	2	-		20	-	40	40	-
EC596	Telecomm. Technology & management	E	2	-		20	-	40	40	-
EC598	Advanced Networking analysis	E	2	-		20	-	40	40	-
EV514	VLSI Technology	E	2	-		20	-	40	40	-
EV501	Digital CMOS ICs	E	2	-		20	-	40	40	-
EC595	Advance topics in Communication	E	2	2		30	-	30	40	-

List of subjects include ELECTIVES also (not limited to the listed subjects; courses from other PG programmes from ECE Dept. as well as other departments may get included as and when floated)

Department of Electronics & communication Engineering

Master of Technology (Electronics & communication Engineering)

I SEMESTER

EC561 Advanced Digital Communication Systems

Cr. 3: (3-0-0)

Baseband modulation and demodulation: Detection of binary signals in Guassian noise, ISI, Equalization, Carrier and symbol synchronization, Signal design for band limited channels.

Band pass modulation and demodulation: Modulation techniques, Coherent and Non coherent detection, Error performance for binary system, Symbol error performance for M-ary systems.

Communication link Analysis: Link budget analysis, Simple link analysis, System trade-offs. Modulation and coding trade-offs. Spread spectrum: signal PN sequences, DS-CDMA, FH-CDMA, Jamming consideration.

Communication through fading channels:

Linear and Nonlinear multiuser detection techniques

References:

1. Sklar; Digital Communications, Pearson.
2. Proakis; Digital Communications, TMGH

EC563 Advanced Error Control Codes

Cr. 3: (3-0-0)

Error Control coding for wireless fading channels, Channel Estimation and Adaptive channel coding, Joint Source and Channel coding . Non binary Linear Block Codes, Hard and soft decision decoding, Coding and Decoding of BCH, Reed Solomon Codes, Convolutional codes: Coding and Decoding , Distance bounds, Performance bounds Turbo codes: Coding, Decoding Algorithms, Performmance comparision , Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparision.

References:

1. Stephen G. Wilson; Digital Modulation & Coding;. Prentice Hall Inc.
2. Ranjan Bose; Information Theory Coding and Cryptography, TMH
3. .Blahut R.E. , Theory and practic of errer control codes, AWL1983.
4. J.G.Proakis; Digital Communication

EC571 Satellite Communication and Radar Engg.

Cr. 3: (3-0-0)

Orbital parameters launching systems, Subsystem of stellite, Transponder and utilization, Satellite link design, Frequency Reuse and polarization. Earth station design and relay links, Multiplexing and multiple Access techniques. Introduction to spread spectrum, Lower Earth Orbit satellites Fundamentals of radar systems, Radar modalities, basic operating principles (detection, ranging, Doppler, importance of phase), radar system components.

References:

1. Introduction to Radar Systems: Merrill I. Skolnik, McGraw-Hill
2. Satellite communication systems, B. G. Evans, Published by IET

EC573 Cryptography

Cr. 3: (3-0-0)

Cryptography: Basic Terms and Concepts, Brief History of Cryptography and Cryptanalysis. Uses and misuses. Basic Number Theory - Divisibility, Primality, Bases, Congruences, Modular Arithmetic, GCD'S, Euclidian algorithm, Fermat and Euler Theorms, Finding large primes, Pohlig-Hellman, RSA.

Elementary and Historical Ciphers - Caesar cipher, Transposition and Substitution, Poly- alphabetic ciphers, Product ciphers, DES, IDEA and Exponentiation ciphers. Cipher Modes - Block ciphers, Stream ciphers, Public vs. Private keys, Meet-in-the-middle, LFSRS. Authentication methods - One-way ciphers, Authentication functions, Message digests, MDS, SHA, Tripwire, Kerberos. Privacy-enhanced communication - Privacy, non-repudiation, Digital signatures, Certificate hierarchies, X.509, PGP, PKI. Introduction to secure transaction standards.

Key Management - Threshold schemes, Random number generation, Key escrow, Key recovery. Applications - Mental Poker, Quadratic residues, Oblivious transfer and Zer-knowledge proofs. Digital cash, Digital voting and Contract signing.

References :

1. William Stallings "Cryptography and Network Security: Principles and Practice", Pearson Education, 2000.
2. Kernal Texpalan, "Communication network Management:, PHI, 1992.
3. D.E. Corner," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
4. Sharma, Vakul, "Handbook of cyber Laws", Macmillan India Ltd, 2002.

EC575 Design of Microstrip Antennas

Cr. 3: (3-0-0)

Fundamental Properties of Single layer Microstrip Patch Antenna. Microstrip Radiators

Analytical Models for Microstrip Patch Antennas. Full wave Analysis of Microstrip Patch Antennas.

Rectangular Microstrip Patch Antennas. Circular Dish and Ring Patch Antennas.

Circularly Polarized Microstrip Patch Antennas. Enhancing the Bandwidth of Microstrip Patch Antennas.

Improving the Efficiency of Microstrip Patch Antennas.

Reference:

1. Microstrip Antenna Design Handbook by Ramesh Garg, Prakash Bhartia, Inder Bahl, Apisak Ittipiboon. Artech House.
2. Handbook of Antennas in Wireless Communication by Lal Chand Godara,CRC Press.
3. CAD of Microstrip Antenna for Wireless Applications by Robert A. Sainati, Artech House.
4. Compact and Broadband Microstrip Antenna by Kin-Lu Wong, John Wiley & Sons.
5. Microstrip Patch Antennas by Robert B. Waterhouse, Kluwer academic Publishers.
6. Handbook of Microstrip Antennas by J.R. James and P.S. Hall, Peter Peregrinus Ltd.

EC577 Estimation and Detection

Cr. 3: (3-0-0)

Classical Detection Theory:

Decision Theory; Binary Decisions , Gaussian Noise; Detection in Gaussian Noise; Discrete Representation for Signals; Solution of the Integral Equations; Decisions among a Number of Known Signals , Performance Bounds and Approximations, Detection in Nonwhite Gaussian Noise

Estimation of Parameters and Random Processes:

The theory of estimation; Bayes estimation; Estimation of (Nonrandom) signal parameter; Multiple parameter estimation, Estimation Bounds, ML estimation via Expectation-Maximization algorithm, Regularization

Joint Estimation and Detection:

Composite Hypotheses, Linear Estimation, Elements of Modern estimation and detection theory (as the time permits).

References:

1. H. L. Van Trees, Detection, Estimation, and Modulation Theory, vol. 1, Wiley Interscience, 2001.
2. C. W. Helstrom, Elements of Signal Detection and Estimation, Prentice Hall, 1995.
3. H. V. Poor, An Introduction to Signal Detection and Estimation, Springer, New York, 1994.

EC579 Advanced Optical Communication Systems

Cr. 3: (3-0-0)

Review of optical fiber waveguiding concepts, Advance fiber design: Dispersion issues, Dispersion shifted, Dispersion flattened, Dispersion compensating fiber, Design optimization of single mode fibres. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solition based communication. Transmitter design, Reciever PIN and APD diodes design, noise sensititvity and degradation, Receiver amplifier design. Transceivers for fiber optic communication pre amplifier type-optical receiver performance calculation - noise effect on system performance receiver modules.

Coherent, homodyne and heterodyne keying formats, BER in synchronous- and asynchronous-receivers,

sensitivity degradation, system performance, Multichannel, WDM, multiple access networks, WDM

components, TDM, Subcarrier and Code division multiplexing. Semiconductor laser amplifiers, Raman - and Brillouin - fiber amplifiers, Erbium doped – fiber amplifiers, pumping phenomenon, LAN and cascaded in-line amplifiers. Limitations, Post-and Pre-compensation techniques, Equalizing filters, fiber based gratings, Broad band compersation, soliton communication system, fiber soliton, Soliton based communication system design, High capacity and WDM soliton system.

Optical networks- Basic networks-sonnet/ SDH-wavelength routed networks - Nonlinear effects on network performance-performance of various systems (WDM DWDM + SOA) - Optical CDMA- solitons-Ultra high capacity networks.

References:

1. Fiber-Optic Communication System by Govind P. Agrawal
2. Franz and Jain, " Optical communication system ", Narosa Publications, New Delhi, 1995.

EC581 Photonic Integrated Devices and Systems

Cr. 3: (3-0-0)

Planar waveguides: Step-index and graded-index waveguides, guided and radiation modes. Strip and channel waveguides, anisotropic waveguides, segmented waveguide; electro-optic and acoustooptic waveguide devices. Directional couplers, optical switch; phase and amplitude modulators, filters, etc. Y-junction, power splitters, Arrayed waveguide devices, fiber pigtailing, Fabrication of integrated optical waveguides and devices. Waveguide characterisation, end-fire and prism coupling; grating and tapered couplers, nonlinear effects in integrated optical waveguides.
New materials and process technologies for optical device fabrication, advanced optical sources & detectors, amplifiers, their reliability issues, Optical integrated circuits, hybrid & monolithic systems, optical inter-connects, materials and processing for OEIC.
Optical sensors intrinsic & extrinsic, principles of pressure, temperature, displacement and velocity measurements.

References:

1. *Integrated Optics, by Robert G. Hunsperger, Springer*
2. Integrated Photonics: Fundamentals, By Ginés Lifante, John Wiley and Sons

EC593 Computer Communication

Cr. 3: (3-0-0)

Introduction to data communication. Concept of analog and digital signals. Bandwidth. Network architecture. Basics of OSI and TCP/IP reference models. Example architecture of other reference models.
Transmission media. Wired and wireless connectivity. FDM, TDM and CDMA. Circuit and packet switching. Frame relay and ATM switching. ISDN.
Local area network protocols. IEEE standards for LAN. Fibre optic networks. Satellite networks. Data link layer design issues: its functions and protocols.
Internet protocol. Routing algorithms. Congestion control algorithms. IP addressing schemes. Internetworking and sub-netting.
Transport and application layer design issues. Connection management. Transport protocol on top of X.25. File transfer and access management.
Traditional cryptography. The Data Encryption Standard. Key distribution problem. Public cryptography. Authentication and digital signatures.
Modelling and Analysis of Computer Communication Networks: Pure Birth and Birth-Death Process. Bernoulli Trials-Markov Chains. Poisson Process. Calculation of Delay-Little's Formula, Burke's Theorem. Queueing Models: M/M/1, M/M/1/N, M/M/S, M/M/S/N queues. Imbedded Markov Chains-M/G/1 queue. Network layout and reliability considerations.

References:

1. Stallings: Data communication & Networking
2. Tanenbaum: Computer Networks
3. Blake:
4. Jeremiah F. Hayes: Modelling and Analysis of Computer Communication Networks

EV505 Digital System Design

Cr. 3: (3-0-0)

Sequential Logic Design- Introduction, Basic Bistable Memory Devices, additional bistable devices, reduced characteristics and excitation table for bistable devices.
Synchronous Sequential Logic Circuit Design- Introduction, Moore, Mealy and Mixed type Synchronous State Machines. Synchronous sequential design of Moore, Melay Machines,
Algorithmic State Machine- An Algorithm with inputs, digital solution, Implementation of traffic light controller, ASM charts, Design Procedure for ASMs.
Data path and Control design.
Introduction to VHDL/Verilog- Data types, Concurrent statements, sequential statements, behavioral modeling.
Introduction to programmable logic devices- PALs, PLDs, CPLDs and FPGAs.

References:

1. Digital System Design, Ercegovac, Wiley.
2. Richard S. Sandige, Modern Digital Design, McGraw-Hill, 1990.
3. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill.
4. Navabi. Analysis and modeling of digital systems. McGraw Hill, 1998.
5. Perry. Modeling with VHDL. McGraw Hill, 1994.
6. Navabi. Verilog Digital Design. McGraw Hill, 2007.

EV501 Digital CMOS ICs

Cr. 3: (3-0-0)

Process flow and masking steps for MOS and CMOS technologies, Lambda based design rules- Electrical behavior of MOS transistors; Latch up in CMOS technology.
Layer properties of various conducting layers in MOS technology (diffusion, poly-silicon and metal): Sheet resistance, relative capacitance.
Fundamental time constant (τ) for a technology.
Design and analysis of NMOS (enhancement and depletion) and CMOS inverters; rationing of transistor size, logic threshold, logic low voltage level, rise and fall of delays.
Design of basic gates in NMOS technology; CMOS logic design styles: static CMOS logic (AND, NOR gates), complex gates, domino logic, pseudo NMOS logic, clocked CMOS (C2 MOS) logic.
Structured logic design: programmable arrays.
Design of latches and flip-flops, static memory cell and dynamic memory cell.
Sense amplifier- necessity, design, influence of Sense Amplifier on cell Architecture.
MOS scaling theory and scaling of interconnection.

References:

1. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw-Hill, 1998.
2. Neil H.E.Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Addison Wesley, 1998.
3. Rabaey et al., Digital Integrated Circuits, Pearson India, 2002.
4. K. Martin, Digital Integrated circuit design, Oxford University press, 2001.
5. A.Mukherji, Introduction to nMOS and CMOS VLSI system design, Prentice Hall Inc., 1986.
6. C.Mead and L.Conway, Introduction to VLSI systems, Addison Wesley, 1986.
Glasser and Dobberpuhl, Design and analysis of VLSI circuits, Addison Wesley, 1985.

II SEMESTER

EC562 Advance Digital Signal & Image Processing

Cr. 3: (3-0-0)

Introduction to Multirate systems and filter banks, 2D systems and mathematical preliminaries, Digital Representation of Binary & Gray Scale and colour Images, Linear operations on images.
Image sampling and quantization: 2D Sampling on rectangular and nonrectangular sampling lattice, Aliasing, Lloyd-Max quantizer etc.
Image Transforms: 2D Discrete Fourier transform, DCT, DST and Hadamard , Harr K-L Transforms & their applications to image processing.
Image restoration:Wiener filtering , smoothing splines and interpolation.
Image Enhancement Techniques: Gray scale transformation, Histogram matching and equalization, Smoothening:- Noise Removal, Averagins, Median, Min/Max. Filtering
sharpening of Images using differentiation, the laplaciam, High Emphasis filtering,
Image analysis: Edge detection, Boundary Lines & Contours.
Image representation by Stochastic models: ARMA models, 2D linear prediction.
Image Segmentation & Thresholding: Multiband Thresholding, Thresholding from Textures, Selective histogram Technique.
Image Compression: Compression Techniques using K-L Transform, Block Truncation Compression. Error free Comprerssion using Huffman coding & Huffman shift coding.

References:

1. Digital Signal Processing- Oppenheim A.V. & Schafer R.W. PHI.
2. Digital Signal Processing-by Mitra- (TATA McGraw Hill) Publications.
3. Digital Image Processing- by Gonzalez / Woods, (Pearson Education)
4. Digital Image Processing- by A.K. Jain
5. Digital Picture Processing- by Rosenfield & Kak

EC564 Advanced Microwave Engineering

Cr. 3 (3-0-0)

Review of Electromagnetic Theory, Transmission Lines and Waveguides, Impedance Matching and Tuning, Network Analysis, Microwave Semiconductor Devices.
Introduction to Microstrip lines, Parallel Striplines, Coplanar Striplines, Shielded Striplines, Slot lines, Integrated Fin line, Non-radiative guide, Transitions, Bends and Discontinuities. Generation of High Power Microwaves.

References:

1. Microwave Solid State Circuit Design, 2nd Edition by Inder Bahl, John Wiley & Sons.
2. Microwave Engineering, 3rd Edition by David M. Pozar, John Wiley & Sons.
3. Foundations of Microwave Engg. By Collin, John Wiley and Sons.

EC572 Wireless and Mobile Adhoc Networking

Cr. 3 (3-0-0)

Wireless Communication Standards, Characterization of the Wireless Channel, Receiver Techniques for Fading Dispersive Channels, Mobility Management in Wireless Networks, Mobile IP, Mobile Ad hoc Networks, Ad hoc Routing Protocols, Performance Analysis of DSR and CBRP, Cluster Techniques, Incremental Cluster Maintenance Scheme, Space time Coding for Wireless Communication.

References:

1. Wireless Communication and Networking by John W. Mark, Weihua Zhuang.
2. Wireless Adhoc Networks by M. Ilyas, CRC Press

EV534 Micro Electro Mechanical System (MEMS)

Cr.3: (3-0-0)

Micro Electro Mechanical System (MEMS) Origins. MEMS Impetus / Motivation.

Material for MEMS. The toolbox: Processes for Micro machining.

MEMS Fabrication Technologies. Fundamental MEMS Device Physics: Actuation. Fundamental

MEMS Devices: The Cantilever Beam. Microwave MEMS Applications: MEM Switch Design Considerations. The Micromachined Transmission Line. MEMS-Based Microwave Circuit and System.

References:

1. Micro-electromechanical (MEM) Microwave Systems by Hector J.De Los Santos, Artechhouse.
2. An Introduction to Micro-electromechanical System by Nadim Maluf, Artechhouse.

EC578 Design of MICs & MMICs

Cr. 3: (3-0-0)

Review of fundamentals of electronic conduction in compound semiconductors. Study of semiconductors like GaAs, InP. Fundamentals of band gap engineering. New materials and their growth techniques.

Dielectric material and their properties, thick film and thin film techniques, loss tangent, effective dielectric constant. Effect of dielectric height, metal thickness, width and freq. on dielectric constant.

Two and three terminal devices for MIC and MMIC applications. Study of MESFET and HEMT performance analysis and biasing arrangements. Review of planar transmission lines, their applications as distributed components. Device and circuit integration techniques, multi-layered structures, probing and coupling techniques, bonding techniques.

CAD for MIC and MMIC, Intr. to nonlinear analysis, synthesis and optimization. Application of foundry design rules, models and design rule checks, layout techniques, process tolerances.

Methods of measurements and testing of MIC and MMIC. Intr. to scalar and network measurements, full nonlinear, harmonic and noise characterization.

Applications of MIC and MMIC as, passive components, switches, mixers, oscillators, amplifiers. Intro. to Quasi-optical systems.

Reference:

1. Microwave Material and fabrication techniques by Laverghetta, Artech House
2. Microstrip Line and Slot Lines, KC Gupta, R garg, I Bahl, P Bhartia, Artech House
3. Computer Aided Analysis of Nonlinear Microwave Circuits, Paulo JC Rodrigues, Artech House
4. The RF and Microwave Circuit design Cookbook, SA Mass, Artech House

EC580 Advance Mobile Systems

Cr. 3: (3-0-0)

Introduction: Components of Mobile Communication systems, Operation of cellular system, Trunking Efficiency, Concept of Frequency reuse, Multipath propagation, Short term and Long term fading, Frequency selective fading, Signal Propagation Models.

Co-Channel Interference, Techniques for reducing Co-Channel Interference, Diversity Techniques, Other Interferences-Adjacent Channel Interference, Near End Far End Interference, Cross talk, Interference between systems, Hand off Techniques, Antennas for Base Station and Mobile Units

Analog cellular Mobile System: Channel structures, RF power level, Modulation, Spectrum & channel Designation, Network control activity, System operation , Principal functions, Mobile scanning, registration, Call origination, Call receipt, Handoff, call termination, security & Identification, Supervisory Audio Tone (SAT) Signalling Tone (ST), Signalling Format.

Digital Cellular Mobile Systems: Digital v/s Analog cellular systems, Modulation, ARQ Technique, Digital Speech coding, Digital Mobile Telephony, channel Equalization, Multiple Access Schemes- FDMA, TDMA, CDMA.

Introduction to Analog & Digial MARR, WLL system, 3-G Systems, Mobile Computing. Example systems: AMPS, MATS-D, CD-900, GSM,

References:

1. Mobile & Cellular Telecommunication by W.C.Y Lee. McGrawhill
2. Wireless Communications by T. S Rappaport, IEEE Press
3. Wireless & Mobile Communication Systems by D.P Agarwal & Qing Anzen, Thomson Press

EC 582 Smart and Phased array antenna design

Cr. 3: (3-0-0)

Microstrip radiators, printed dipole, slot, travelling wave, aperture coupled microstrip antennas, various microstrip antenna configurations

Rectangular, Circular disk, ring, Triangular patch antennas and their design. Feed networks for microstrip antennas and arrays.

Analytical models for microstrip antennas. Transmission line model, Cavity Model, Multiport Network Model, Model for Coaxial probe in microstrip antenna. Full wave analysis of microstrip antennas

Active and smart microstrip antennas, Design and analysis of microstrip antenna arrays.

References:

1. Microstrip Antenna design Handbook by R. Garg, P. Bharhia, I. Bahl, and A. Ittipiboo Pub. Artech House.
2. Microstrip Antennas: Theory & Design by J. R. James, P.S. Hall and C. wood Pub. Peter Peregrinns , UK
3. Microstrip antennas for wireless application Artech House

EV524 Analog and mixed signal ICs

Cr. 3: (3-0-0)

Review of MOS Transistor operation models and equivalent circuits for low and high frequency. Single-Stage Amplifiers, Differential Amplifiers. Passive and Active Current Mirrors: Cascode Current mirror, Wilson Current mirror. Cascode, CE-CC configurations for high frequency allpications.

Theory and design of MOS Operational Amplifier, Complete CMOS operational amplifier including frequency compensation.

Comparators and Voltage Reference Sources.

Switched Capacitor Circuits: Principles of operation of Switched Capacitor Circuits, Switched Capacitor Filters.

D/A and A/D converters.

Nonlinear Analog circuits: Timers, Function generators, Multipliers and PLL.

References:

1. Behzad, Razavi: Design of Analog CMOS Integrated Circuits, MGH, 2001.
2. Allen Holberg: CMOS Analog Integrated Circuit Design, Oxford University Press, 2002.
3. P. R. Gray, Hurst, Lewis and R. G. Meyer. Analysis and Design of Analog Integrated Circuits. John Wiley, 4th Ed. 2001.
4. A. B. Grebene, Bipolar and MOS analog integrated circuits design. John Wiley, 1984.
5. S. Soclof. Analog Integrated Circuits. Prentice Hall Inc., 1985.

EC588 EMI/EMC

Cr. 3: (3-0-0)

Electromagnetic Interference Shielding Fundamentals.

Characterization Methodology of EMI Shielding Materials.

EMI Shielding Enclosure and Access

Metal-Formed EMI Gaskets and Connectors.

Conductive Foam and Ventilation Structure.

Board-Level Shielding Materials and Components.

Composite Materials and Hybrid Structures for EMI Shielding.

Absorber Materials.

Grounding and Cable-Level Shielding Materials.

Introduction to E and H, near and far fields, Radiators, Receptors, and Antennas. Typical sources and characteristics of Radiated and Conducted Emissions.

Crosstalk and Electromagnetic coupling between PCB tracks, wires and cables, components, Emission Reduction Techniques, and Noise Immunity.

Systems EMC and antenna coupling, printed circuit boards, EMI and EMC control, EMC prediction Techniques.

References:

1. Advanced Materials and Design for Electromagnetic Interference Shielding by Colin Tong, CRC Press.
2. Principles and Techniques of Electromagnetic Compatibility, Second Edition by Christos Christopoulos, CRC Press.
3. Electromagnetic Compatibility: Principles and Applications, Second Edition by David Weston, CRC Press.

EC592 Computational Electromagnetics

Cr. 3: (3-0-0)

Review of Electromagnetic Theory, Classification of EM Problems. Analytical Methods-Separation of Variables. Finite Difference Methods. Variation Methods. Moment Method. Finite element Method. Transmission line Matrix Method. Monti-Carlo Method.

References:

1. Numerical Techniques in Electromagnetics IIed, by Matthew N.O. Sadiku, CRC Press.
2. 2-D Electromagnetic Simulation of Passive Microstrip Circuits by Alejandro Duenas Jimenez, CRC Press.

EC594 Advance Photonic Devices and Components

Cr. 3: (3-0-0)

Components for Fiber optic Networks- Couplers/Splitters- -semiconductor optical amplifier- bandwidth of SOPA- Polarization dependant gain noise- erbium doped fiber amplifiers- WD multiplexers / demultiplexers- Filters- isolator-circulators-Optical switches-wavelength converters- Fiber gratings- tunable sources tunable filters. Photonic crystal structures and devices.

Homo-and hetero-junctions, quantum wells, advanced semi-conductor materials Semiconductor optical amplifiers, LEDs and LDs: Device structure and Characteristics, DFB, DBR, and quantum well lasers, VCSELS & Laser diode arrays.

Computer aided design of integrated optical waveguide devices. Application of photonics to microwave devices. Nonlinear optical waveguides.

Engineering of DWDM systems. ITU standards and nomenclature, channel capacity, bit rate and modulation, network topologies, current performance and future research issues.

References:

1. Fiber Optic Communication systems, G.P.Aggarwal,Wiley Eastern
2. Introduction to Fiber Optics , A.Ghatak and K.Thyagrajan, Cambridge Univ. Press
3. Introduction to Optical Electronics, K.A. Jones, Harper & Row

EC596 Telecom Technology & Management

Cr. 3: (3-0-0)

Introduction to existing telecommunication technologies GSM, WLL, CDMA, Circuit, packet, frame relay and ATM switching, Broadband ISDN, Evolution of IS-95 and third generation systems,

Microcell networks planning in CDMA, Indoor planning, Sectorization and smart antenna,

Tariff rules and guidelines, Comparison of different wireless technologies.

References:

W. Stalling, Data Comm. & Networking

EC590 Wireless Sensor Networks

Cr. 3: (3-0-0)

Network architecture, wireless communication: the physical layer in WSN, WSN medium access control and link layer protocols, WSN services: synchronization and localization, topology control and routing, data-centric and content-based routing, Quality of Service and transport protocols, in-network aggregation and WSN security.

References:

1. Murthy & Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols," ISBN 0-13-147023-X, Pearson 2004
2. William Stallings, "Wireless Communications & Networks", ISBN: 0131918354, Prentice Hall; 2nd edition, November 12, 2004.

EC598 Advanced Networking Analysis

Cr. 3: (3-0-0)

Advanced network analysis: Application analysis using the Application form (AAF)

Binary-Hex-Decimal conversion , Building test packets, Calculating the cost of network problems(Analysis ROI), Key network calculations: Throughput , Latency and Bandwidth, Unattended captures: Triggered starts/stops, Analysis ROI worksheet/calculation

References:

1. CCNA Portable Command Guide, Second Edition by Scott Empson
2. Network Analysis by Laura Chappell

III SEMESTER

EC595 Advanced Topics in Communication

Cr. 3: (3-0-0)

Advanced topics in: Multiuser Detection Techniques, Wireless Networking, Optical Networking, Signal Processing, Mobile Communication, Computer Networking, and their applications.

References:

1. William Stallings, "Wireless Communications & Networks", ISBN: 0131918354, Prentice Hall; 2nd edition, November 12, 2004.
2. Mobile & Cellular Telecommunication by W.C.Y Lee. McGrawhill
3. Digital Signal Processing- Oppenheim A.V. & Schafer R.W. PHI.

Master of Technology (VLSI Design)

Semester-I

Program core subjects-

EV-501 Digital CMOS ICs Cr. 3: (3-0-0)

Process flow and masking steps for MOS and CMOS technologies, Lambda based design rules- Electrical behavior of MOS transistors; Latch up in CMOS technology.

Layer properties of various conducting layers in MOS technology (diffusion, poly-silicon and metal): Sheet resistance, relative capacitance.

Fundamental time constant (τ) for a technology.

Design and analysis of NMOS (enhancement and depletion) and CMOS inverters; rationing of transistor size, logic threshold, logic low voltage level, rise and fall of delays.

Design of basic gates in NMOS technology; CMOS logic design styles: static CMOS logic (AND, NOR gates), complex gates, domino logic, pseudo NMOS logic, clocked CMOS (C2 MOS) logic.

Structured logic design: programmable arrays.

Design of latches and flip-flops, static memory cell and dynamic memory cell.

Sense amplifier- necessity, design, influence of Sense Amplifier on cell Architecture.

MOS scaling theory and scaling of interconnection.

Ref:

7. Sung-Mo Kang & Yusuf Leblebici, *CMOS Digital Integrated Circuits Analysis and Design*, McGraw-Hill, 1998.
8. Neil H.E.Weste and Kamran Eshraghian, *Principles of CMOS VLSI Design*, Addison Wesley, 1998.
9. Rabaey et al., Digital Integrated Circuits, Pearson India, 2002.
10. K. Martin, Digital Integrated circuit design, Oxford University press, 2001.
11. A.Mukherji, *Introduction to nMOS and CMOS VLSI system design*, Prentice Hall Inc., 1986.
12. C.Mead and L.Conway, *Introduction to VLSI systems*, Addison Wesley, 1986.
13. Glasser and Dobberpuhl, *Design and analysis of VLSI circuits*, Addison Wesley, 1985.

EV-503 CAD Algorithms for Synthesis of Digital Systems Cr. 3: (3-0-0)

Role of CAD in digital system design, levels of design, modeling & description and support of languages, RTL, gate and system level synthesis; Technological alternatives and technology mapping;

CAD tools for synthesis, optimization, simulation and verification of design at various levels as well as for special realizations and structures such as microprogrammes, PLAs, gate arrays etc. Technology mapping for FPGAs.

Low power issues in high level synthesis and logic synthesis.

Ref:

1. G. D. Micheli. Synthesis and optimization of digital systems.
2. Dutt, N. D. and Gajski, D. D. High level synthesis, Kluwer, 2000.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms," McGraw-Hill, 1990.
4. N. Deo, Graph Theory, PH India.

EV-505 Digital System Design Cr. 3: (3-0-0)

Sequential Logic Design- Introduction, Basic Bistable Memory Devices, additional bistable devices, reduced characteristics and excitation table for bistable devices.

Synchronous Sequential Logic Circuit Design- Introduction, Moore, Mealy and Mixed type Synchronous State Machines. Synchronous sequential design of Moore, Melay Machines,

Algorithmic State Machine- An Algorithm with inputs, digital solution, Implementation of traffic light controller, ASM charts, Design Procedure for ASMs.

Data path and Control design.

Introduction to VHDL/Verilog- Data types, Concurrent statements, sequential statements, behavioral modeling.

Introduction to programmable logic devices- PALs, PLDs, CPLDs and FPGAs.

Ref:

1. Digital System Design, Ercegovac, Wiley.
2. Richard S. Sandige, *Modern Digital Design*, McGraw-Hill, 1990.
3. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill.
4. Navabi. Analysis and modeling of digital systems. McGraw Hill, 1998.
5. Perry. Modeling with VHDL. McGraw Hill, 1994.
6. Navabi. Verilog Digital Design. McGraw Hill, 2007.

EV-511 System Design Lab - 1 Cr. 2: (0-0-4)

Program electives-

EV-521 Computer Arithmetic & Micro-architecture Design Cr. 3: (3-0-0)

Computer arithmetic- conventional & higher radix number systems, residue & logarithmic number systems; sequential & parallel (and high speed) algorithms for addition, multiplication, division; evaluation of elementary functions- sin, cos, $\sin^{-1}$, $\cos^{-1}$, sinh etc; CORDIC method for trigonometric functions.

languages for design description (HDLs) like VHDL or Verilog; Modeling and simulation of circuits at various levels;

Data path design for high performance- pipelining & systolic arrays; Control design- sequential, hardwired & micro-programmed control.

Topics in design-yield and redundancy,

Low power design techniques.

References:

For Review

1. Kohavi, Switching & finite automata theory, Mc Graw Hill

Computer arithmetic

2. Ercegovac, Digital Systems, Wiely, 2004
3. Parhami, Computer Arithmetic- Algorithms & Hardware Design, Oxford Univ. Press
4. Koren, Computer Arithmetic Algebra, Prentice Hall Inc.

For Data-path/Control Design

5. Hayes, J P, Computer Architecture & organization, Mc Graw Hill, 2003

For HDLs

6. Navabi. Introduction to VHDL. Mc Graw Hill, 2000
7. Bhaskar. VHDL Primer. Prentice Hall India, 2001
8. Navabi. Verilog digital systems. Mc Graw Hill, 2000
9. Palnitkar, Verilog...., Pearson India/Prentice-Hall India

Low power design

10. Chandrakasan, A. P. Low-power design methodologies. IEEE Press, 1998.
11. Mead & Conway, VLSI circuit design
12. Raguram, R. Modeling and Simulation of Electronic circuits. PHIndia, 1996.
13. Weste and Eshraghian. Principles of CMOS VLSI design. Addison Wesley, 1998.
14. K. Roy and et al, Low power design, Wiley

EV-523 Graph Algorithms & Combinatorial Optimization Cr. 3: (2-0-2)

Graph Theory- basics, Planarization, triangulation, graph algorithms for shortest/longest paths, spanning tree, search etc.

Optmization problem- Convex sets and functions.

The SIMPLEX algorithm- forms of linear programming problem, geometry of LP, organization of Tableau. Computational considerations for simplex algorithm

Duality- dual of LP, dual simplex problem. Primal-dual algorithm.

Algorithms & complexity- shortest path, max-flow, Dijkshtra's algorithm, min-cost flow, algorithm for graph search and matching; spanning trees and matroids; Integer Linear programming, Greedy algorithm, approximation algorithms; branch-and-bound; dynamic programming.

Ref:

1. Narsingh Deo, Graph theory, Prentice Hall India, 2008.
2. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms," McGraw-Hill, 2007
3. S. Baase, Computer algorithms, Pearson India 2008.
4. Papadimitriou and Steiglitz, Combinatorial optimization, PH India, 2001.
2. Nemhauser and Wolsey, Integer and Combinatorial optimization, Wiley Inter-science 1999.

EV-525 VLSI Testing &Testability Cr. 3: (3-0-0)

Physical Faults and their modeling; 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 Differences, 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 & repair- Introduction; Concept of Redundancy, Spatial Redundancy, Time Redundancy, Error Correction Codes.

Reconfiguration Techniques; Yield Modeling, Reliability and effective area utilization.

Ref:

1. 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.
2. Bushnell and Agarwal, V. D. VLSI Testing. Kluwer.
3. Agarwal, V. D. and Seth, S. C. Test generation for VLSI chips. IEEE computer society press.
4. Hurst, S. L. VLSI testing: Digital and mixed analog/digital techniques. INSPEC/IEE, 1999.

EV-527 VLSI Technology Cr. 3 (3-0-0)

Basic IC processing steps.

Crystal growth and wafer preparation.

Epitaxy-basics of vacuum deposition, MBE. CVD- low and high temp/pressure depositions.

Diffusion –kinetics, Ficks law, sheet resistivity methods of diffusion.

Oxidation –properties of oxides, theory of oxidation, oxidation under different ambients.

Ion implantation.

Etching techniques.

CVD of polysilicon, oxides and nitrides.

Integrated circuit structures in bipolar and MOS.

Introduction to process simulation, SUPREM.

Ref:

1. S. M. Sze, *VLSI Technology*, McGRAW-HILL, 1988.
2. D. Nagchoudhuri, *Principles Of Microelectronic Technology*, Wheeler Publishing, 1998.
3. Stephen A. Campbell, *The Science and Engineering of Microelectronic Fabrication*, Oxford University Press, 1996.
4. Hong Xiao, *Introduction to Semiconductor Manufacturing*, Prentice Hall, 2001.
5. SK Gandhi, VLSI fabrication principles, John Wiley 1983.
6. AB Glaser, GE Subak-Sharpe, Integrated circuit engineering, Reading MA, Addison Wesley 1977

EC-529 Microelectronic Devices & Circuits Cr. 3: (3-0-0)

Brief recapitulation- band theory, FD statistics, recombination effects and bipolar junction devices. MOS devices-MOS capacitance, interface effects and characterization. MOSFET principles and characteristics, subthreshold region.

Various MOS structures-VMOS, DMOS etc. Parasitic effects in MOSFET and bipolar circuits. CCDs. High frequency devices-metal semiconductor contacts. MESFETS.

Hetero-junction devices-HEMTs, HBTs.

Device modeling: Bipolar devices-Gummel –Poon model and RC Distributed model.

MOS device modeling-long channel effects short channel structures scaled down device models, subthreshold conduction.

Reference:

1. S.M.Sze, *Physics of semiconductor devices*, Wiley Eastern, 1981.
2. D. Nagchoudhuri, Microelectronic Devices, Pearson Education India.
3. Y.P.Tsividis, *Operation and modeling of MOS transistor*, McGraw-Hill, 1987.
4. M.S. Tyagi, Introduction to Semiconductor material and devices, John.
5. Antognetti and Massobrio, *Device modeling with SPICE*, McGraw-Hill.
6. Clifton G. Fonstad, *Microelectronic devices and Circuits*, McGraw-Hill
7. International Edition, 1994.
8. Edward S.Yang, *Microelectronic devices*, McGraw-Hill.
9. Streetman, *Solid State Electronic Devices*, PHI.

EV-551 Special Topics in VLSI Design-1 Cr. 3 (2-0-2)

System modeling aspects for digital & analog systems; reduced order modeling for linear and non-linear systems; analog macromodeling & synthesis.

Ref: Relevant conference/journal papers.

Open elective I- (some suggestive choices)-

EC-5xx Advanced Error Control Codes
CP-5xx Advances in Compiler Design
CP-5xx Information System Security
CP-5xx Public Key Infrastructure and Trust Management

MA 501 G: Design of Experiments Cr. 3: (3-0-0)

Estimation: Criteria for the best estimator, Point estimation, Interval estimation, Confidence interval of mean and variance, maximum error of estimates.

Testing of hypothesis: Comparison of sample mean and proportion for large samples. Testing of hypothesis for small samples based on students "t" test, paired "t" test, F test and X^2 chi-square test. Testing of independents of attributes using X^2 test.

Analysis of Variance (ANOVA): Concept of experiments, One-Way classification. Mathematical Analysis of Model. Two-way classification. Terminology of experimental design. Completely randomized designs. Factorial and split-Plot designs, Incomplete Blocks design Latin square design, analysis of covariance. Sums of products, analysis of covariance table. Two factor experiments. Multi-factor experiments. 2nd factor experiments. Fractional replication.

MA 502 Simulation And Modeling Cr. 3: (2- 0 -2)

Definition of a system, System concepts, type of system, continuous & discrete systems, modeling process verification & validation.

Introduction of Probability Distributions and random processes, Central limit theorem.

Estimation of mean and variance, Confidence interval, Hypothesis testing, Normal distribution, t-test, ANOVA- an Introduction

Markov chains: CTMC and DTMC

Queuing models: Basic queuing models. Little's Theorem and network of queues.

Introduction, classification of simulation models, advantages and disadvantages of simulation. Concept of simulation time and real time. Discrete system simulation. Monte Carlo method, Random number generators.

Simulation of inventory systems

Introduction to simulation environment and software tools.

References

1. Principles of Operations Research, Wagner, PHI.
2. Simulation modeling and analysis, Law and Kelton, McGraw Hill.
3. Probability and Statistics with Reliability, Queuing and Computer Science Application, Kishore S Trivedi, Wiley.
4. System simulation, Gorden G., Prentice Hall of India.

Semester-II

Program core subjects-

EV-502 CAD Algorithms for VLSI Physical Design
Cr. 3: (3-0-0)

Introduction to VLSI Physical Design flow. Circuit partitioning, placement and routing algorithms. Design Rule-verification, Circuit Compaction; Circuit Extraction and post layout simulation.

FPGA design flow- partitioning, placement and routing algorithms.

Deep sub-micron issues; interconnects modeling and synthesis.

Ref:

1. Sait, S. M. and Youssef, H. VLSI Physical design automation. IEEE press, 1995.
2. Sherwani, N. VLSI physical design automation. Kluwer, 1999.
3. Sarrafzadeh, M. and Wong, C. K. An introduction to VLSI physical design, Mc Graw Hill, 1996.
4. Brown, S. D., Francis, R. J., Rose, J. and Vranesic, Z G. Field programmable Gate arrays. Kluwer, 1992.
5. Betz, V., Rose, J. and Marquardt, A. Architecture and CAD for Deep-submicron FPGAs. Kluwer, 1999.
6. T. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms," McGraw-Hill, 1990.

EV-512 System Design Lab - 2 Cr. 2: (0-0-4)

Program elective subjects-

EV-522 System Level Design & Modeling Cr. 3: (3-0-0)

System level design, description languages- SystemC, SDL, SpecChart etc.

Hardware-software codesign- partitioning, interface synthesis, case studies.

Application specific processors, Retargetable compilers, instruction set-simulation and co-simulation.

Architectural synthesis for DSP applications.

Formal Verification of digital hardware systems- BDD based approaches, functional equivalence, finite state automata, ω-automata, FSM verification. Model checking.

Ref:

1. Gajski, Gupta and Vahid, Specifications and design of Embedded systems
2. Topics on formal verification to be covered using topics from literature.

EV-524 Analog and Mixed Signal ICs Cr. 3: (2-0-2)

Review of MOS Transistor operation models and equivalent circuits for low and high frequency. Single-Stage Amplifiers, Differential Amplifiers. Passive and Active Current Mirrors: Cascode Current mirror, Wilson Current mirror. Cascode, CE-CC configurations for high frequency allpications.

Theory and design of MOS Operational Amplifier, Complete CMOS operational amplifier including frequency compensation.

Comparators and Voltage Reference Sources.

Switched Capacitor Circuits: Principles of operation of Switched Capacitor Circuits, Switched Capacitor Filters.

D/A and A/D converters.

Nonlinear Analog circuits: Timers, Function generators, Multipliers and PLL.

Ref:

1. Behzad, Razavi: Design of Analog CMOS Integrated Circuits, MGH, 2001.
2. Allen Holberg: CMOS Analog Integrated Circuit Design, Oxford University Press, 2002.
3. P. R. Gray, Hurst, Lewis and R. G. Meyer. Analysis and Design of Analog Integrated Circuits. John Wiley, 4th Ed. 2001.
4. A. B. Grebene, Bipolar and MOS analog integrated circuits design. John Wiley, 1984.

3. S. Soclof. Analog Integrated Circuits. Prentice Hall Inc. , 1985.

EV-526 Formal Verification of Digital Hardware & Embedded Software Cr. 3: (3-0-0)

Formal Verification of digital hardware systems- BDD based approaches, functional equivalence, finite state automata, ω-automata, FSM verification. Model checking; various industry & academia CAD tools for formal verification.

Verification, validation & testing - Debugging techniques for embedded software, instruction set simulators, clear box technique, black box testing, evaluating function test,

Text/References:

1. Embedded systems Design- Artist Roadmap for Research & Development, LNCS-3436, Springer.
2. J. W. Valvano, Eembedded microcomputer systems- Real Time Interfacing, , Thomson press (Cengage India)
3. Computers as components- Principles of embedded computing system design. Wolf, W., Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)
4. Verification, validation & testing in software engineering, A. Dasso and A. Funes, Idea Group Inc.
5. Advanced Formal Verification, R. Drechsler, Kluwer.
6. Hardware-Software codesign for data flow dominated embedded systems, R. Niemann, Springer.
7. Readings in Hardware/Software codesign, Micheli, Ernst, Wolf, Morgan Kaufmann.

EV-528 Memory Design & Testing Cr. 3: (3-0-0)

Processing technology for Memories: Multipoly Floating Gate and Control Gate, Trench Capacitors and thin Oxide.

Memory Modeling and testing faults in SRAMs, Marching Tests; Delay Faults.

Semiconductor memory architecture, Space of memory faults- fault primitives.

Preparation of Circuit Simulation: Definition & location of open, short, and bridge fault, Simulation methodology.

Test for single cell and two port SRAMs, Functional fault modeling and testing of RAMS,

Fault Diagnosis & Repair Algorithms.

Built –in self Test and design for testability of RAMs.

Built in self repair architecture.

Trend in Embedded Memory testing.

Ref:

1. Pinaki Mazumder, Kanad Chakraborty, Testing and Testable Design of High-Density Random-Access Memories (Frontiers in Electronic Testing), Kluwer academic pub.
2. Said Hamdioui, Testing Static Random Access Memories: Defects, Fault Models and Test Patterns (Frontiers in Electronic Testing), Kluwer academic pub 2004.
3. Pinaki Mazumder and Kanad Chakraborty, Fault –Tolerence and reliability techniques for High –Density Random-Acess Memories, Pearson India, 2002.

EV-530 Advanced Computer Architecture Cr. 3(3-0-0)

System Buses.

Memory systems and error detection and error correction coding.

Input/Output Modules & organization.

Operating System Support.

Instruction formats, instruction sets and their design, Pipelining.

CPU Structure & RISC Architectures.

Ref:

1. D. Patterson and J. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann Publishers, Inc., Second edition, 1998.
2. Computer Architecture: A Quantitative Approach, John L. Hennessy & David A Patterson, Morgan Kaufmann, 1996.
3. Structure Computer Organization, 4th Edition, Andrew S. Tanenbaum, Prentice Hall, 1999.
4. Computer Architecture and Organization, J. Hayes, McGraw Hill, 1988.
5. Computer Organization and Architecture, 5th Edition, William Stallings, Prentice Hall, 1996.

EV-532 Embedded Systems Cr. 3: (2-0-2)

Embedded computing- Microprocessors, embedded design process, system description formalisms. Instruction sets- CISC and RISC;
CPU fundamentals- programming I/Os, co-processors, supervisor mode, exceptions, memory management units and address translation, pipelining, super scalar execution, caching, CPU power consumption.
Embedded computing platform- CPU bus, memory devices, I/O devices, interfacing, designing with microprocessors, debugging techniques.
Program design and analysis- models of program, assembly and linking, compilation techniques, analysis and optimization of execution time, energy, power and size.
Processes and operating systems- multiple tasks and multiple processes, context switching, scheduling policies, inter-process communication mechanisms.
Hardware accelerators- CPUs and accelerators, accelerator system design.
Networks- distributed embedded architectures, networks for embedded systems, network-based design, Internet-enabled systems.
System design techniques- design methodologies, requirements analysis, system analysis and architecture design, quality assurance.

Ref:

1. Wolf, W. Computers as components- Principles of embedded computing system design. Academic Press (Indian edition available from Harcourt India Pvt. Ltd., 27M Block market, Greater Kailash II, New Delhi-110 048.)

EV-534 Micro Electro Mechanical System (MEMS) Cr. 3: (3-0-0)

Micro Electro Mechanical System (MEMS) Origins. MEMS Impetus / Motivation.
Material for MEMS. The toolbox: Processes for Micro machining.
MEMS Fabrication Technologies. Fundamental MEMS Device Physics: Actuation. Fundamental
MEMS Devices: The Cantilever Beam. Microwave MEMS Applications: MEM Switch Design Considerations. The Micromachined Transmission Line. MEMS-Based Microwave Circuit and System.

Books:

3. Micro-electromechanical (MEM) Microwave Systems by Hector J.De Los Santos, Artechhouse.
4. An Introduction to Micro-electromechanical System by Nadim Maluf, Artechhouse.

EV-538 Design of Asynchronous Sequential Circuits : Cr. 3: (3-0-0)

Introduction: Summary of synchronous techniques - disadvantages in today's technology. Advantages of asynchrononous techniques - low power, performance, modularity. Historic difficulties with asynchronous design. Flow Table Reduction, The state-assignment Problem, Delays, Hazards, and Analysis, Feedback, other Modes of operation, Counters.
Circuit Classification: Bounded Delay, speed independent, and delay independent. Data models (single-rail, dual-rail). Handshaking protocols (2 phase, 4 phase)
Micropipeline *Circuits*: Basic building blocks. Pipelines, with and without data processing elements. The design of the Amulet processors.
NCL Logic: The NULL convention logic approach. Preserving delay insensitivity, threshold gates with hysteresis.
Formal Aspects of Asynchronous: The Rainbow approach. Green descriptions of micro-pipelines. Overview of formal basis to asynchronous descriptions

Ref :

1. Asynchronous sequential circuits by Stephen H. Unger, John Wiley & Sons
2. Switching and Finite Automota Theory. Kohavi, Tata McGraw Hill

EV-540 Electronic manufacturing Technology Cr. 3: (2-1-0)

Overview of different technologies & future trends- (i) PCB, multilayer PCB, (ii) thin film, (iii) Thick film, (iv) Surface mount devices (v) monolithic- VLSI & MMIC (vi) packaging of semiconductor devices (vii) multichip modules & optoelectronic sub-system packaging (viii) system-on-package (ix) Micro-electro-mechanical systems & NEMS (x) Nanotechnology (xi) standards & procedures- MIL-M-38510F, MIL-STD-883B, ISO-9000 etc.

Ref:

EV-542 FPGAs Physical Design Cr. 3: (2-0-2)

Introduction to FPGA Architectures.
FPGA design flow, partitioning, placement and routing algorithms.
Technology mapping for FPGAs, case studies.

Ref:

1. Brown, S. D., Francis. R. J., Rose, J. and Vranesic, Z G. Field programmable Gate arrays. Kluwer, 1992.
2. Betz, V., Rose, J. and Marquardt, A. Architecture and CAD for Deep-submicron FPGAs. Kluwer, 1999.
3. Trimberger, S. M. FPGA Technology. Kluwer, 1992.
4. Oldfield, J. V. and Dorf, R. C. FPGAs: Reconfigurable logic for rapid prototyping and implementation of digital systems. John Wiley, 1995

EV-552 Special Topics in VLSI Design-2 Cr. 3: (2-0-2)

Low power and low energy synthesis for digital systems, power estimation and modeling, power issues at system, algorithm, architecture and OS level, power issues in memory. Low power applications.

Ref:

Relevant conference/journal papers.

Open elective II & III (some indicative choices)-

CP-5xx Security in Computing Cr. 3: (3-0-0)
CP-504 Parallel & Distributed Computing Cr. 3: (3-0-0)
From M. Tech. (Computer Engg.) of Dept. of Computer Engg.
CP-506 Selected Topics in Cryptography Cr. 3: (3-0-0)
From M. Tech. (Computer Engg.) of Dept. of Computer Engg.
EC-562 Digital Signal & Image Processing Cr. 3: (3-0-0)
EC-572 Wireless and Mobile Adhoc NetworkingCr. 3:(3-0-0)
From M. Tech. (ECE)