ELECTRONICS ENGINEERING DEPARTMENT
इलेक्ट्रानिक्स अभियांत्रिक विभाग

SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT
सरदार वल्लभभाई नेशनल इन्स्टीयुट ओफ टेक्नोलोजी, सुरत

क्रमांक: ECED/ / 2014-15 दिनांक: 08/01/2015

M.Tech. I (EC) Semester-I (Communication System)

Appendix - 1

M.Tech. I(EC), I Semester (Communication System) OLD

Sr. No.	Course Name	Code	Teaching Scheme			Credit	Examination Scheme			Total
			L	T	P		Theory	Tutorial	Practical	
1	RF CIRCUITS & SYSTEMS	EC 601	3	0	0	3	100	--	--	100
2	ADVANCE OPTICAL COMMUNICATION SYSTEMS	EC 603	3	0	0	3	100	--	--	100
3	ADVANCE DSP	EC 605	3	0	0	3	100	--	--	100
4	COMMUNICATION LABORATORY - I	EC 607	0	0	8	4	--	--	100	100
5	Elective I	EC 6XX	3	0	0	3	100	--	--	100
6	Elective II	EC 6XX	3	0	0	3	100	--	--	100
Total			15	0	8	19	500	--	100	600
Total Contact Hours per week: 23										

LIST OF SUBJECTS FOR ELECTIVE I & II:		
(01)	Digital VLSI Design	EC609
(02)	Embedded Systems	EC613
(03)	VLSI Technology	EC617
(04)	Information Theory & Coding	EC619
(05)	Digital Satellite Communication	EC621
(06)	Cellular Networks	EC627
(07)	Probability and Random Processes	EC629

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Appendix 2

PG PROGRAM in Communication Systems **M. Tech. I (EC) [CS/VLSI] Semester I**	**L**	**T**	**P**	**C**	
EC601:RF CIRCUITS & SYSTEMS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION	**(02 Hours)**
RF Behavior of Passive Components, Chip Components	
TRANSMISSION LINE ANALYSIS	**(03 Hours)**
Transmission Lines, Equivalent Circuit Representation, Theoretical Foundation, Circuit Parameters For A Parallel Plate Transmission Line, General Transmission Line Equation,Microstrip Transmission Lines, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced And Loaded Transmission Line, Problems	
SMITH CHART	**(03 Hours)**
From Reflection Coefficients to Load Impedance, Impedance Transformation, Admittance Transformation, Parallel and Series Connection, Problems	
SINGLE- AND MULTIPORT NETWORKS	**(02 Hours)**
Basic Definitions, Interconnecting Networks, Network Properties And Application,Scattering Parameters-Definition And Meaning Of S- Parameters, Problems	
RF FILTERS DESIGN	**(06 Hours)**
Basic Resonator And Filter Configurations, Special Filter Realizations, Filter Implementation	
MATCHING AND BIASING NETWORKS	**(04 Hours)**
Impedance Matching using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation & Biasing Networks, Problems solutions	
POWER DIVIDERS AND DIRECTIONAL COUPLERS	**(04 Hours)**
The T - Junction Power Divider, The Wilkinson Power Divider, The Quadrature (90°) Hybrid, Coupled Line Directional Couplers, Problems	
BASIC BLOCKS IN RF SYSTEMS	**(03 Hours)**
Receiver And transmitter Architectures, Low Noise Amplifier Design, Design And Implementation Of Various Mixers	
RF OSCILLATORS & SYNTHESIZERS	**(07 Hours)**
Basic Topologies, VCO And Definition of Phase Noise, Noise Power Trade-Off,Resonator Less VCO Design, Quadrature And Single-Sideband Generators, PLLS,Various RF Synthesizer Architectures And Frequency Dividers	
DESIGN ISSUES	**(04 Hours)**
Linearization Techniques, Power Amplifier Design, Integrated RF Filters	
MMIC	**(04 Hours)**
Materials, MMIC Growth, Thin Film Formation, Hybrid IC Formation	
	(Total Contact Time: 42 Hours)

फोन नं: संस्थान कार्यालय: २२२३३७१-७४, फेक्स नं: २२२८३९४, २२२७३३४ विभागीय प्रमुख: २२०१५५१, विभाग कार्यालय: २२०१५५२

ई-मेइल: director@svnit.ac.in, hod@eced.svnit.ac.in

BOOKS RECOMMENDED:
1. Ludwig Reinhold and Bretchko Powel, “RF Circuit Design”, Pearson Education, Reprint 2004
2. Pozar M. David, “Microwave Engineering”, John Wiley & Sons, Inc., 1999
3. Liao Samuel, “Microwave Devices And Circuits”. Pearson Education, Second Reprint, 2006
4. Bhat Bharathi and Koul Shibon,“Stripline-Like Transmission Lines For MIC”, New Age International, Reprint 2003
5. Razavi B., “RF Microelectronics”, Prentice-Hall PTR,1998

M. Tech. I (EC) [CS] Semester I	**L**	**T**	**P**	**C**	
EC603:ADVANCE OPTICAL COMMUNICATION SYSTEM(NEW)	**3**	**0**	**0**	**3**	

REVIEW OF FIBER OPTIC COMMUNICATION	**(05 Hours)**
Elements Of Fiber Optic Communication, Light Transmission Basics, Optical Spectrum, Wavelengths, Frequencies, Channel Spacing, Optical Power, Nature Of Light, Basic Optical Laws, Propagation Of Light In Fiber, Types of Optical Fiber, Degradation Of Signals In Optical Fiber, Attenuation, Absorption, Scattering Losses, Bending Losses, Dispersion	
PASSIVE AND ACTIVE OPTICAL COMPONENTS	**(10 Hours)**
Principle And Operation Of Optical Source, Detectors, Amplifiers, Modulators, Couplers, Isolators, Circulators, Fiber Gratings, Filters, Switches	
NONLINEAR EFFECTS IN FIBER	**(08 Hours)**
Distortion In Signal Due To Nonlinearities In Fibers, Self Phase Modulation, Cross Phase Modulation, Stimulated Raman Scattering, Stimulated Brillouin Scattering, Four Wave Mixing, Optical Solitons	
OPTICAL SYSTEM CONCEPT AND DESIGN	**(09 Hours)**
WDM System Configuration, Classification Of WDM System, CWDM, DWDM,Applications Of WDM Systems, WDM System Model, System Requirement, System Design Considerations, Link Power Budget, System Performance Measurement Parameters, Power Penalty In System, Optical Networks, SONET/SDH	
SIMULATION AND MODELING OF SYSTEM	**(05 Hours)**
Need of Simulation, Advantages Of Simulation, System Modeling, Introduction to Photonics CAD 1.6, Study Of Different Features And Tools Of Photonics CAD	
FIBER OPTIC SENSORS	**(05 Hours)**
Concept And Components, Classification And Operation Of Fiber Optic Sensors,Applications Of Fiber Optic Sensors	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Vivekanand Mishra, Sunita Ugle, "Optic Communication: Systems And Component", Wiley India Pvt Ltd , 1st edition 2012

2. Ramaswami and Sivarajan,“Optical Networks - A Practical Perspective”, Elsevier, Morgan Kaufmann Publishers, 2nd Edition, 2002

3. Mynbave and Scheiner,“Fiber Optics Communications Technology”, Pearson Education Editions, 1st Indian Reprint, 2001

4. Agrawal G., “Fiber Optic Communication Systems”, John Wiley & Sons, New York, 1992

5. Photonics CAD 1.6, “User’s Manual”, All Optical Technology, Korea, 2002

6. Shizhuo Yin,“Fiber Optic Sensors”,Taylor & Francis Group, CRC Press, 2nd Edition, 2008

M. Tech. I (EC) [CS/VLSI] Semester I	**L**	**T**	**P**	**C**	
EC605:ADVANCE DSP(NEW)	**3**	**0**	**0**	**3**	

REVIEW OF DISCRETE SIGNAL REPRESENTATION AND ANALYSIS	**(06 Hours)**

TIME AND FREQUENCY-DOMAIN DESIGN TECHNIQUES FOR IIR AND FIR FILTERS	**(10 Hours)**

FIR And IIR Filter Specifications And Structure, FIR Filter Design- Window Method, Park- s Method, Frequency Sampling Method; Design Of IIR Digital Filters:Butterworth, Chebyshev And Elliptic Approximations. Low Pass, Band Pass, Band Stop And High Pass Filters, Bilinear Transformation Method, Adaptive Signal Processing

EFFECT OF FINITE REGISTERS LENGTH	**(05 Hours)**

Number Representation, Quantization Error, Round-Off Error, Overflow Error, Limit Cycle, System Noise Behavior, Noise Filtering By LSI System, Noise In A Cascade Of 2nd Order Filter, Stability Of Linear Filter

MULTIRATE TECHNIQUES	**(09 Hours)**

General Rate-Changing System, Integer-Factor Interpolation And Decimation And Rational-Factor Rate Changing, Efficient Multirate Filter Structures, Optimal Filter Design For Multirate Systems, Multi-Stage Multirate Systems, Over sampling D/As, Perfect-Reconstruction Filter Banks And Quadrature Mirror Filters

APPLICATIONS OF DSP	**(12 Hours)**

Speech And Radar Signal Processing; Signal Detection, Spectral Analysis Using DFT,Active Noise Control, Musical Sound Processing, Digital FM Stereo Generation, Speech Processing, Discrete Multi-Tone Transmission Of Digital Data, Digital Audio Sampling Rate Conversion

(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Salivahanapriya S,“Digital Signal Processing”, Tata McGraw-Hill,2003

2. Rabiner L. R. and Gold B.,“Theory And Applications Of Digital Signal Processing”, Prentice Hall,1992

3. Oppenheim A. V. and Schafer,“Discrete Time Signal Processing”, Prentice Hall,1989

4. Proakis John G. and Manolakis D.G.,“Digital Signal Processing: Principle, Algorithms And Applications”, Prentice Hall,1997

5. Mitra Sanjit K.,“Digital Signal Processing - A computer Based Approach”, McGraw-Hill,2005

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M. Tech. I (EC) [CS] Semester I	**L**	**T**	**P**	**C**	
EC607:COMMUNICATION LABORATORY - I(NEW)	**0**	**0**	**8**	**4**	

RF CIRCUITS & SYSTEMS	**(02 Hours)**
01) Study Of Microwave Bench	
02) Plot Of Standing Wave Pattern And Finding VSWR For Different Loads	
03) Characteristics Of Waveguide Directional Coupler	
04) Solving Problems Using Z – Match Software For Smith Chart	
05) Measurement Of Insertion Loss And VSWR Of Bandstop Filter Using Simulated Network Analyzer	
06) Measurement Of Transmission Loss And Reflection Loss For 50 Ohms Microstrip Line	
07) Determination Of Resonance Frequency Of Microstrip Ring Resonator And Calculation Of Relative Dielectric Constant Of Substrate	
08) Measurement Of Power Division, Isolation And Return Loss Of A 3 dB Power Divider	
09) Measurement Of Coupling And Isolation Loss Of A Backward Wave Microstrip Direction Coupler	
10) Measurement Of Gain Of Microstrip LNA Amplifier	
11) Study Of Microwave Communication Link	

ADVANCE DSP	**(03 Hours)**
01) Write A MATLAB Program To Get Fourth Order Butterworth Filter	
02) Write A MATLAB Program For Interpolation And Decimation	
03) Write A MATLAB Program To Decimate By Factor Of Eight In Two Stages	
04) Write A MATLAB Program For Power Spectral Density Of Signal With Random Noise And Draw Spectrum Of Chirped Signal	
05) Write A MATLAB Program To Plot The Zeros And Poles Of System And Comment On Stability	
06) Write A MATLAB Program To Pass Various Sinusoids Of Freq. 50 Hz, 200 Hz And 300 Hz Through Band Pass Filter Having Cutoff Freq. Wn = [0.125, 0.275]; Generated Through Kaiser Window. Draw Its Freq. Spectrum And Output In Time Domain	
07) Write A MATLAB Program For Generation Of Moving Average Filter Which Is Basic Low Pass Filter	
08) Write A MATLAB Program For Haar Wavelet Signal Decomposition And Reconstruction	
09) Write A MATLAB Program For DFT Filter Bank Realization	
10) Mini Projects	

ADVANCE OCS	**(03 Hours)**
01) Setting-Up A Fiber Optic Analog Link Using OFT Kit	
02) Setting-Up A Fiber Optic Digital Link Using OFT Kit	
03) Finding The Losses And NA For Given Optical Fiber Using OFT Kit	
04) Study Of The Splicing Kit, Light Source And Power Meter	
05) Dispersion Comparison Using FOTX-RX Using FOT Kit	

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06) TDM Frame Generation And Transmission-Reception Using FOT Kit
07) Performance Analysis Of Single Channel Fiber Optic Communication Link Using Photonics CAD 1.6
08) Performance Analysis Of Fiber Optic Communication Link With FEC Coder And Decoder Using Photonics CAD 1.6
09) Performance Analysis Of Multichannel WDM Link Using Photonics CAD 1.6
10) Performance Analysis Of Bidirectional DWDM Link Using Photonics CAD 1.6
11) Performance Analysis Of Analog And CATV Transmission Using Photonics CAD 1.6
12) Mini Project

LIST OF SUBJECTS FOR ELECTIVE I & II:

M. Tech. I (EC) [VLSI/CS] Semester I	**L**	**T**	**P**	**C**	
EC609:DIGITAL VLSI DESIGN(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO VLSI DESIGN	**(05 Hours)**
Historical Perspective, Design Hierarchy, Concepts Of Regularity, Modularity And Locality, VLSI Design Styles, VLSI Design Flow,Computer-Aided Design Technology	
MOS INVERTER	**(06 Hours)**
Static Characteristics: Introduction, Resistive Load Inverter, Inverters With N Type MOSFET Load, CMOS Inverter, Switching Characteristics And Interconnect Effects, Introduction, Definitions And Calculations Of Delay Times, Inverter Design With Delal Constraints, Estimation Of Interconnect Parasites, Calculation Of Interconnect Delay, Switching Power Dissipation Of CMOS Inverter	
CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION	**(06 Hours)**
Delay Estimation, Logical Efforts And Transistor Sizing, Power Dissipation, Interconnect, Design Margin, Reliability	
COMBINATIONAL AND MOS SEQUENTIAL LOGIC CIRCUITS	**(06 Hours)**
CMOS Logic Circuits, Complex Logic Circuits, Behavior Of MOS Logic Elements, SR Latch Circuit, Clocked Latch And Flip-Flop Circuits, CMOS D-Latch And Edge-Triggered Flip-Flop	
DYNAMIC LOGIC CIRCUIT	**(06 Hours)**
Pass Transistor Circuits, Voltage Bootstrapping, Synchronous Dynamic Circuit Techniques, Dynamic And High Performance Dynamic CMOS Circuit	
DIGITAL SUBSYSTEM DESIGN	**(13 Hours)**
Semiconductor Memory Design, Schmitt Trigger, Multivibrator Circuit, Digital Phase Locked Loop, Adders, Multipliers And Shifters	
	(Total Contact Time:42 Hours)
BOOKS RECOMMENDED	
1. Kang and Leblebici,"CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, 3rd Edition, 2003	
2. Baker R. Jacob, Li H. W. & Boyce D. E.,"CMOS Circuit Design, Layout And Simulation", Prentice-Hall Of India, 2nd Edition, 1998	
3. Jan M. Rabey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuit",Pearson Education, 2nd Edition, 3rd Indian Reprint, 2004	
4. Weste and Harris,"CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, 3rd Edition, 2002	
5. Pucknell and Eshraghian: "Basic VLSI Design", Prentice Hall of India, 3rd Edition, 2003	

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M. Tech. I (EC) [VLSI/CS] Semester I	**L**	**T**	**P**	**C**	
EC613:EMBEDDED SYSTEMS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO EMBEDDED SYSTEMS	**(04 Hours)**
Overview, Categories, Characteristics, Application Areas, Process of Embedded System Development, RICS Vs SICS Architecture, RTOS Overview of 8 Bit Microcontrollers Family	
OVERVIEW OF 8 BIT MICROCONTROLLER	**(06 Hours)**
Brief Review Of 8 Bit Microcontroller, Programming, CPU Block Diagram, Memory Organization, Ports And Interfacing, High Speed Output, Interrupts, ADC, PWM, Timers, Watch Dog Timer, Serial Port, I/O Port	
ARM ARCHITECTURE	**(13 Hours)**
Resisters, Current Program Status Resister, Pipeline, Exception, Interrupt And Vector Table, Memory Map, Arm And Thumb Mode Memory Management Unit, Arm Architecture, Arm Architecture Revision, Cortex Processor Architecture	
ARM SOFTWARE DEVELOPMENT	**(05 Hours)**
Arm & Thumb Instruction Set: Data Processing Instruction, Branch Instruction, Load Store Instruction, Program Status Resister Instruction, Loading Constant, Stack Instruction, Conditional Execution	
'C' Programming ARM	**(05 Hours)**
Overview Of C Compiler, Basic 'C' Compiler, C Looping Structure, Resistor Allocation, Function Calls, Pointer Aliasing, Structure Arrangement, Bit Fields, Unaligned Data And Endianness, Division, Floating Point, Inline Function And Inline Assembly	
COMMUNICATION INTERFACE	**(09 Hours)**
RS 232, UART, USB, RS485, Infrared, Ethernet, IEEE802.11, Bluetooth, SPI, I2C, CAN	
	(Total Contact Time:42 Hours)

BOOKS RECOMMENDED

1. Kenneth Ayala J., "8051 Microcontroller: Architecture, Programming & Applications", Thomson, 1st Edition, 2006

2. Sloss and System, "ARM System Developer's Guide: Designing and Optimacy System Software",Elsevier, 2004

3. Rajkama, "Embedded System Architecture, Programming and Design", Tata McGraw- Hill,2004

4. Mazidi and Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", PHI, 3rd Edition, 2004

5. Prasad K. V. K. K., "Embedded / Real-Time Systems: Concepts, Design And Programming", Dreamtech Press, 2005

M. Tech. I (EC) [VLSI/CS] Semester I	**L**	**T**	**P**	**C**	
EC617:VLSI TECHNOLOGY(NEW)	**3**	**0**	**0**	**3**	

ENVIRONMENT FOR VLSI TECHNOLOGY	**(03 Hours)**
Clean Room And Safety Requirements, Wafer Cleaning Processes And Wet Chemical Etching Techniques	
IMPURITY INCORPORATION	**(05 Hours)**
Solid State Diffusion Modeling And Technology, Ion Implantation Modeling, Technology And Damage Annealing, Characterization Of Impurity Profiles	
OXIDATION	**(08 Hours)**
Kinetics of Silicon Dioxide Growth Both for Thick, Thin And Ultra thin Films. Oxidation Technologies In VLSI And ULSI, Characterization Of Oxide Films, High K And Low K Dielectrics For ULSI	
LITHOGRAPHY	**(04 Hours)**
Photolithography, E-Beam Lithography And Newer Lithography Techniques For VLSI/ULSI, Mask Generation	
CHEMICAL VAPOUR DEPOSITION TECHNIQUES	**(07 Hours)**
CVD Techniques For Deposition Of Polysilicon, Silicon Dioxide, Silicon Nitride And Metal Films, Epitaxial Growth Of Silicon, Modeling And Technology	
METAL FILM DEPOSITION	**(05 Hours)**
Evaporation And Sputtering Techniques, Failure Mechanisms In Metal Interconnects, Multi-Level Metallization Schemes	
PLASMA AND RAPID THERMAL PROCESSING	**(06 Hours)**
PECVD, Plasma Etching And RIE Techniques, RTP Techniques For Annealing, Growth And Deposition Of Various Films For Use In ULSI	
PROCESS INTEGRATION	**(04 Hours)**
NMOS, CMOS And Bipolar Circuits, Advanced MOS Technologies	
	(Total Contact Time:42 Hours)

BOOKS RECOMMENDED

1. Chang C.Y. and Sze S. M.,“VLSI Technology”,McGraw Hill,1996

2. Ghandhi S. K.,“VLSI Fabrication Principles”,John Wiley Inc.,New York,1983

3. Sze S. M.,“VLSI Technology”,McGraw Hill,2nd Edition,1988

4. Stephen A. Campbell,“The Science & Engineering of Microelectronics Fabrication”, Oxford University Press,2nd Edition,2001

5. Peter Van Zant,“Microchip Fabrication: A Practical Guide To Semiconductor Processing”, McGraw-Hill,4th Edition,2000

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M. Tech. I (EC) [CS/VLSI] Semester I	**L**	**T**	**P**	**C**	
EC619:INFORMATION THEORY AND CODING(NEW)	**3**	**0**	**0**	**3**	

INFORMATION THEORY	**(09 Hours)**
Review Of Probability Theory, Introduction, Measure Of Information, Average Information Content Of Symbols In Long Independent Sequences, Average Information Content Of Symbols In Long Dependent Sequences, Properties Of Entropy, Extension Of Zero Memory Source	
SOURCE CODING	**(07 Hours)**
Properties Of Codes, Uniquely Decodable Codes, Kraft's Inequality, Average Length Of A Code, Shannon's First Theorem, Shannon's Encoding Algorithm, Shanon-Fano Codes, Huffman's Codes, Arithmetic Codes, Code Efficiency And Redundancy	
COMMUNICATION CHANNELS	**(06 Hours)**
Introduction, Discrete Communication Channels, Continuous Channels, Entropy Functions And Equivocation, Mutual Information, Channel Capacity, Channel Efficiency And Redundancy, Special Channels, Shannon-Hartley Law And Its Implications	
BLOCK CODES AND LINEAR CODES	**(08 Hours)**
Single Parity Check Codes, Product Codes, Hamming Codes, Hamming Codes,Minimum Distance Of Block Codes, Linear Block Codes, Generator Matrices, Parity Check Matrices, Encoder, Syndrome And Error Detection, Minimum Distance, Error Correction And Error Detection Capabilities, Performance Of Small Signal Constellations,Hard-Decision And Soft Decision Decoding	
CYCLIC, BCH & CONVOLUTION CODES	**(12 Hours)**
Definition Of Cyclic Codes, Polynomials, Generator Polynomial, Encoding And Decoding Of Cyclic Codes, Generator And Parity-Check Matrices Of Cyclic Codes, Linear Algebra And Galois Field, Introduction To BCH Codes, Introduction To Convolution Codes,Introduction To Turbo Coding	
	(Total Contact Time:42 Hours)

BOOKS RECOMMENDED

1. Abrahamson N.,"Information Theory and coding", McGraw-Hill Book Co.,1963
2. Ranjan Bose,"Information theory, coding and cryptography",Tata McGraw-Hill,2nd Edition,2008
3. Salvatore Gravano,"Introduction to Error Control Codes",Oxford University Press,1st Edition,2007
4. Proakis J.J.,"Digital Communications", McGraw Hill,2nd Edition,1989
5. Todd K.Moon,"Error Correcting Coding", Wiley India Edition,2006

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M. Tech. I (EC) [CS] Semester I	**L**	**T**	**P**	**C**	
EC621:DIGITAL SATELLITE COMMUNICATION(NEW)	**3**	**0**	**0**	**3**	

COMMUNICATION SATELLITE: ORBIT AND DESCRIPTION	**(04 Hours)**
Orbit Period & Velocity, Effects Of Orbital Inclination, Azimuth & Elevation, Coverage Angle & Slant Range, Eclipse, Placement Of A Satellite In A Geostationary Orbit, Satellite Description	
EARTH STATION	**(06 Hours)**
Earth Station Antenna, High Power Amplifier, Low Noise Amplifier, Upconverter, Down Converter, Monitoring & Control, Reliability, Space Qualification	
SATELLITE LINK	**(06 Hours)**
Basic Link Analysis, Interference Analysis, Rain-Induced Attenuation, Rain-Induced Cross Polarization Interference, System Availability, Satellite Links Design, Satellite-Satellite Link Using Lasers	
FREQUENCY DIVISION MULTIPLE ACCESS	**(04 Hours)**
FDM-FM-FDMA, SCPC, FM-FDMA TV, Companded FDM-FM-FDMA And SSB-AM-FDMA, Intermodulation Products, Resulting From Amplitude Nonlinearity And From Both Amplitude & Phase Nonlinearities, Optimized C/I Plus Noise Ratio	
TIME DIVISION MULTIPLE ACCESS	**(08 Hours)**
TDMA Frame Structure, TDMA Burst Structure, TDMA Frame Efficiency, TDMA Superframe Structure, Frame Acquisition & Synchronization, Satellite Position Determination, Burst Time Plan, Control & Coordination By The Reference Station, TDMA Timing, TDMA Equipment, Advanced TDMA Satellite Systems	
EFFICIENT TECHNIQUES: DEMAND ASSIGNMENT MULTIPLE ACCESS & DIGITAL SPEECH INTERPOLATION	**(06 Hours)**
The Erlang B Formula, Types Of Demand Assignments, DAMA Characteristics, Real–Time Frame Reconfiguration, DAMA Interfaces, SCPC–DAMA, SPADE, Digital Speech Interpolation	
SATELLITE SPREAD SPECTRUM COMMUNICATIONS	**(04 Hours)**
Direct Sequence Spread Spectrum System, Direct Sequence Code Division Multiple Access, Frequency Hop Spread Spectrum Systems, Frequency Hop Code Division Multiple Access, Satellite On-Board Processing	
MOBILE SATELLITE NETWORKS	**(02 Hours)**
Operating Environment, MSAT Network Concept, CDMA MSAT Network, Statistics of Mobile Propagation	
SATELLITE SERVICES	**(02 Hours)**
VSAT, Radarsat, GPS, DTH, Satellite Phones	
	(Total Contact Time:42 Hours)

BOOKS RECOMMENDED

1. Ha Tri T.,“Digital Satellite Communications”,McGraw-Hill,2nd Edition.,1990
2. Roddy Dennis,“Satellite Communications”,McGraw-Hill,3rd Edition,2001
3. Tomasi Wayne,“Advanced Electronic Communication Systems”, PHI, 5th Edition,2001
4. Nagaraja N.S.,“Elements Of Electronic Navigation”, TMH, 2nd Edition, 1990
5. Pratt T. and Bostian C. W.,“Satellite Communications”, John Wiley & Sons, 1st Edition, 19866

M. Tech. I (EC) [CS] Semester I	**L**	**T**	**P**	**C**	
EC627:CELLULAR NETWORKS(NEW)	**3**	**0**	**0**	**3**	

CELLULAR TECHNOLOGY	**(07 Hours)**
Introduction To Cellular Mobile Systems, Elements Of Cellular Radio System Design, Frequency Reuse, Cell Coverage And Traffic, Frequency Management And Channel Assignment, Interferences, Location Management	
GSM	**(09 Hours)**
Introduction To GSM, GSM Architecture, Components Of GSM System, Call Handling In GSM, Multiple Access In GSM, GSM Channels, Handover Mechanisms, Mobility Management	
GPRS	**(05 Hours)**
Introduction To GPRS, Coding Schemes In GPRS, GPRS Layers And Functions, Channels In GPRS, GPRS Functioning And Modes	
EDGS TECHNOLOGY	**(02 Hours)**
EVOLUTION OF CDMA BASED STANDARDS	**(02 Hours)**
Evolution Of CDMA Based Standards: IS-95 To CDMA - 2000	
UMTS	**(11 Hours)**
WCDMA, UMTS Architecture, UMTS Radio/ Air Interface, UMTS Modes: TDD & FDD,UMTS Channel, UMTS Packet Handling, Power Saving & Handover	
WLL	**(04 Hours)**
Introduction To WLL Systems, WLL Architecture, Capacity Of CDMA WLL, WCDMA–WLL	
CONVERGANCE IN WIRELESS SYSTEMS	**(04 Hours)**
	(Total Contact Time:42 Hours)

BOOKS RECOMMENDED

1.William C.Y. Lee,“Wireless & Cellular Telecommunication”,McGraw-Hill,3rd Edition,2005

2. Upena Dalal,“Wireless Communication”,Oxford University,1st Edition,2009

3. Vijay K. Garg,“Wireless Network Evolution 2G to 3G”,Pearson Education,2nd Edition,2004

4. T. G. Palanievelu, R. Nakkeeran,“Wireless & Mobile Communication”,PHI, 1st Edition,2009

5. Schiller Jochen,“Mobile Communications”, Addison Wesley, LPE,Pearson Education,4th Indian Reprint,2000

M. Tech. I (EC) [CS/VLSI] Semester I	**L**	**T**	**P**	**C**	
EC629:PROBABILITY AND RANDOM PROCESSES(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO PROBABILITY THEORY	**(05 Hours)**
Sets, fields, sample space and events, axiomatic definition of probability. Combinatorics,Joint and conditional probabilities, Independence, total probability, Bayes' rule	
RANDOM VARIABLES	**(12 Hours)**
Cumulative Distribution Function, Probability Density Function. Relation Between Probability And Probability Density, Joint Cumulative Distribution And Probability Density, Characteristic functions and moment generating functions, Average Value And Variance Of A Random Variable, Gaussian Probability Density, Error Function, Rayleigh Probability Density,Mean And Variance Of The Sum Of Random Variables, Correlation Between Random Variables, Central Limit Theorem, liner minimum mean square error and orthogonality principle, Chebysev inequality Sequences Of Random Variables, Convergence Of Sequences Of Random Variables. Weak law of large number.	
STOCHASTIC PROCESSES	**(10 Hours)**
Stationary, Nonstationary, Strict-Sense and Wide-Sense Stationary Processes, Gaussian Processes, Poisson Process and the Markov Process	
EXPECTED VALUES OF A RANDOM PROCESS	**10 Hours)**
The Mean Value, Autocorrelation, Autocovariance, Power Spectral Density, Joint Statistical Averages of Two Random Processes, Crosscorrelation And Crosscovariance, Ergodicity, Mean Square Continuity, Mean Square Derivative And Mean Square Integral Of Stochastic Processes, Ergodic Processes	
STOCHASTIC MODELING	**(08 Hours)**
Example of random processes: White noise process and white noise sequence, Gaussian process, Poisson process, Markov Process	
	(Total Contact Time:42 Hours)
BOOKS RECOMMENDED	

1. Papoulis,"Probability, Random Variables And Stochastic Processes", McGraw-Hill,4th Ed., 10th Reprint,2006

2. Larson H. J. and Shubert B. O."Probabilistic Models In Engineering Science – Vol I, Random Variable And Stochastic Process, Vol II Random Noise Signals And Dynamic Systems",Wiley Publication,1st Ed.,1982

3. Gardener W.,"Stochastic Processes", McGraw-Hill,1st Ed.,1986

4. Montgomeri and Ruger,"Applied Statistics And Probability For Engineers",John Wiley, 1st Ed.,2006

5. Hayes Monson H.,"Statistical Digital Signal Processing", John Wiley,1st Ed.,1996

6. Alberto leon Gracia, Probability and Random processes for electrincal engineer,: 2nd Ed, PE india

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M.Tech. I (EC), II Semester (Communication System)

Appendix 1

M.Tech. I(EC), II Semester (Communication System)OLD

Sr. No.	Course Name	Code	Teaching Scheme			Credit	Examination Scheme			Total
			L	T	P		Theory	Tutorial	Practical	
1	IMAGE PROCESSING	EC 602	3	0	0	3	100	--	--	100
2	WIRELESS COMMUNICATION	EC 604	3	0	0	3	100	--	--	100
3	COMMUNICATION LABORATORY - II	EC 606	0	0	8	4	--	--	100	100
4	Elective III	EC 6XX	3	0	0	3	100	--	--	100
5	Elective IV	EC 6XX	3	0	0	3	100	--	--	100
6	Elective V	EC 6XX	3	0	0	3	100	--	--	100
Total			15	0	8	19	500	--	100	600
Total Contact Hours per week: 23										

LIST OF SUBJECTS FOR ELECTIVE III , IV & V	
Optical Networks	EC608
Analog VLSI Design [Pre-requisite:EC609]	EC612
Real Time Systems	EC614
Reconfigurable Computing	EC618
Low Power VLSI Design	EC622
Nanoelectronics	EC624
DSP Structures for VLSI	EC626
Estimation & Detection Theory	EC628
Microwave Integrated Circuits	EC632
Optical Signal Processing	EC634
Ad-Hoc Networks	EC636
MIMO Technology	EC638

Appendix 2

M. Tech. I (EC) [CS/VLSI] Semester II	**L**	**T**	**P**	**C**	
EC602:IMAGE PROCESSING(NEW)	**3**	**0**	**0**	**3**	
IMAGING SYSTEM					**(04 Hours)**
Camera Model, Image Representation, Human Visual Perception And Color, High-Dynamic-Range Imaging					
IMAGE ANALYSIS					**(08 Hours)**
Spatial Filters, 2D Convolution, Discrete Fourier Transform, DCT, Walsh Transform, KLT And DWT, Concept Of Filtering, Smoothing And Sharpening, Edge Detection					
LOW-LEVEL IMAGE PROCESSING					**(15 Hours)**
Point Operators, Histogram Processing, Image Restoration, Image Enhancement, Image Compression, Morphological Processing, Image Segmentation					
HIGH-LEVEL IMAGE PROCESSING					**(07 Hours)**
Image Representation, Hough Transform For Feature Extraction, Shape Extraction, Boundary Description, Texture Description, Object Recognition And Tracking					
ADVANCED PHOTOGRAPHY					**(08 Hours)**
Introduction To Image Cloning, Warping, Morphing, Imprinting, Watermarking, Super Resolution Image, Image Rendering					
					(Total Contact Time: 42 Hours)
BOOKS RECOMMENDED:					
1. Gonzalez Rafel C. and Woods Richard C.,"Digital Image Processing", Pearson Education, Prentice Hall of India, 2nd Edition,2002					
2. Jain A.K.,"Fundamentals Of Digital Image Processing", Prentice Hall of India, 1st Edition,1989					
3. Jain R., Kasturi R. and Schunck B.G:"Machine Vision", McGraw-Hill 2nd Edition,1995					
4. Pratt W. K,"Digital Image Processing", Prentice Hall, 1st Edition,1989					
5. Rosenfold and Kak A.C,"Digital Image Processing", Vol. 1 and 2, Prentice Hall, 1st Edition,1986					
6. Milan Sonka, Vaclav Hlavac and Roger Boyle,"Image processing, Analysis, And machine Design", Thomson Publishing, India, 2nd Edition,2007					

M. Tech. I (EC) [CS/VLSI] Semester II	**L**	**T**	**P**	**C**	
EC604:WIRELESS COMMUNICATION(NEW)	**3**	**0**	**0**	**3**	

GENERAL CONSIDERATIONS	**(12 Hours)**
General Considerations About Radio Waves Over Wireless Channel, Radio Propagation And The Atmosphere, Basic Propagation Mechanisms In General, Radio Propagation Categories For Long Distance Case, Short Distance NLOS Mobile Communication Case, AWGN Model Showing Reflection, Scattering And Diffraction Of Radio Waves For Mobile Systems/Multipath Effect, Large Scale Fading, Small Scale Fading, Delay Spread Effect, ISI, Doppler Shift/Spread, Doppler Power Spectrum, Flat And Frequency Selective Fading	
CHANNEL MODELS	**(05 Hours)**
Channel Models, Equalization Techniques And Diversity Techniques	
SPREAD SPECTRUM MODULATION	**(13 Hours)**
Basic Principle Of Orthogonality, Subcarrier Setting In The Spectrum, FDM Vs Orthogonal FDM, OFDM Block Diagram And Explanation, Pulse Shaping And Windowing In OFDM, Synchronization In OFDM, Pilot Insertion In OFDM Transmission And Channel Estimation, Amplitude Limitations, FFT Points Selection Constraints, CDMA Vs OFDM, Hybrid OFDM, MIMO	
OFDM	**(13 Hours)**
Spread Spectrum Modulation Concepts, ML, Walsh-Hadamard, Gold Sequences, Code Properties, Auto And Cross Correlation, Partial Correlation, DSSS Transmitter, Rake Receiver Block Diagram, PN Signal Characteristics, Spectral Density, Bandwidth And Processing Gain, Interference Rejection, Antijam Characteristics, Energy And Bandwidth Efficiency, Near Far Problem And Power Control, Frequency Hopping Spread Spectrum,Time Hopping, Comparison Of Spread Spectrum Modulation Methods, Hybrid Spread Spectrum System, Chirp Spread Spectrum	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Upena Dalal, “Wireless Communication”,Oxford University Press, 1st Edition,2008

2. Molisch Andreas F.,“Wideband Wireless Digital Communication”, Pearson Education, 3rd Indian Reprint,2003

3. Sharma Sanjay, “Wireless Communications”,Katsons Books,2006

4. Rappaport,T. “Wireless Communications”, Pearson Education,5th Indian Reprint,2003

5. Schulze Henrik and Luders Christian,“Theory And Applications Of OFDM And CDMA - Wideband Wireless Communications”,Wiley, 2005

6. Goldsmith Andrea, “Wireless Communications”,Cambridge University Press,2002

7. Feher Kemilo,“Wireless Digital Communication”,PHI, 1995

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M. Tech. I (EC) [CS] Semester II	**L**	**T**	**P**	**C**	
EC606:COMMUNICATION LABORATORY - II(NEW)	**0**	**0**	**8**	**4**	
IMAGE PROCESSING				**(04 Hours)**	
01) Spatial Gray Level Resolution And Zooming, Shrinking, Bilinear Interpolation					
02) Creation Of Negative Image And Gamma Correction					
03) Thresholding Applied To Image					
04) Bit Plane Slicing Of An Image					
05) Histogram Equalization And Matching For B/W And Color Images, Finding Mean And Variance					
06) Noise Generation In The image Using Gaussian Noise And Salt & Pepper Noise, Finding Mean And Variance					
07) Noise Reduction Using Median Filter					
08) Periodic Noise Reduction Using Notch Filter					
09) High Pass And Low Pass Filter Applied To Image					
10) Function Implementation For Reading, Writing & Rotating Images					
11) Point Detection And Edge Detection Of The Image					
12) Correlation Between Two Images					
13) Pseudo Color Processing					
WIRELESS COMMUNICATION				**(04 Hours)**	
01) Design And Implementation Of Wireless Link Using Various Modulation Techniques: i) MPSK & ii) MQAM					
02) Matched Filter - Correlator Equalization					
03) Adaptive Filters Used For Equalization					
04) Decision Feedback Equalizer					
05) AR Estimator And BER Performance Comparison – Burg Method, Covariance Method, Modified Covariance Method, Yule – Walker Method					
06) RLS, LMS And MMSE Methods For Estimation					
07) Spread Spectrum Modulation Techniques.					
08) OFDM Link					
09) Channel Models Incorporated With Various Modulation Techniques.n					

फोन नं: संस्थान कार्यालय: २२२३३७१-७४, फेक्स नं: २२२८३९४, २२२७३३४ विभागीय प्रमुख: २२०१५५१, विभाग कार्यालय: २२०१५५२

ई-मेइल: director@svnit.ac.in, hod@eced.svnit.ac.in

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LIST OF SUBJECTS FOR ELECTIVE III , IV & V

M. Tech. I (EC) [CS] Semester II	**L**	**T**	**P**	**C**	
EC608:OPTICAL NETWORKS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO OPTICAL NETWORKS	**(07 Hours)**
Principles and challenges, WDM Networking Evolution, Point-to-point WDM systems, Fiber and Wavelength Cross connects, WDM Network Constructions, Broadcast-and-Select (Local) WDMNetwork, Wavelength-Routed (Wide-Area) Optical Network.	
FIRST AND SECOND GENERATION OPTICAL NETWORKS	**(07 Hours)**
SONET/SDH: Multiplexing, Elements of a SONET/SDH Infrastructure, SONET/SDH Physical Layer, Fiber Channel, Metropolitan-Area Networks: FDDI, ATM, IP.	
WAVELENGTH ROUNTING NETWORKS	**(07 Hours)**
Elements of Virtual Topology Design: System Architecture, Algorithms, Multiple, Point-to-Point Links, Arbitrary Virtual Topology. Routing and Wavelength, Assignment: Problem formulation and solution approach. Static Lightpath Establishment (SLE), Dynamic Lightpath Establishment (DLE). Reconfiguration in WDM Networks: Passive star based LAN and WAN Algorithm	
CONTROL And MANAGEMENT	**(07 Hours)**
Network Management Functions, Equipment Management, Connection Management,Performance Management. Fault Management: Protection Concepts, Ring Networks, Mesh Networks, Handling Node Failures. Interworking between layers.	
WAVELENGTH ROUNTING APPROACHES	**(07 Hours)**
Circuit-Switched Approaches: LDC-Based Approach, Lightpath-Based Approach, Least-Congested-Path (LCP) Routing, Wavelength-Conversion-Based Routing. Packet-Switched Approaches: Logical Topologies for Electronic Packet-Switched Networks, Deflection Routing Networks. Optical packet switch design. Wavelength Converters and switches. Optical access network architectures.	
Future Optical Network	**(07 Hours)**
Optical TDM Networks: Basics of TDM, Optical TDM, Optical Sources, Modulation and Multiplexing, Transmission of Ultrafast OTDM Signal Using Soliton. Optical TDM Network Architectures and Proposals. Optical CDMA Networks: Basics of CDMA, Optical CDMA .	
	(Total Contact Time: 42 Hours)

Books Recommended:

1. R. Ramaswami, Kumar N. Sivarajan,“Optical Networks: A Practical Perspective”,Morgan Kaufmann, 3rd Ed.,2009.

2. Biswanath Mukerjee,“Optical WDM Networks”,Springer Science Business Media,Inc 2006

3. T. E. Stern, K. Bala and Georgios Elinos,“Multiwavelength Optical Networks: Architecture, Design and Control”,Cambridge University Press, 2nd Ed.,2009

4. D. W. Faulkner, “WDM and Photonic Networks”, IOS Press, 1st Ed. 2000.

5. Peng-Jun Wan, “ Multichannel Optical Networks”,Kluwer Academic,1st Ed. 2000.

M. Tech. I (EC) [VLSI/CS] Semester II	**L**	**T**	**P**	**C**	
EC612:ANALOG VLSI DESIGN(NEW)	**3**	**0**	**0**	**3**	

ANALOG CMOS SUB-CIRCUITS	**(09 Hours)**
Small Signal Model For MOS, MOS Switch, MOS Resistors, Current Sink/Source, High Input Impedance Current Mirrors, Differential, Cascode And Current Amplifiers Output Amplifiers, High Gain Amplifier Architectures	
CMOS OPERATIONAL AMPLIFIERS	**(09 Hours)**
Design Of CMOS Operational Amplifiers, Compensation, Comparators, Design Of Two Stage Op-Amps, Cascode Op-Amps, Simulation And Measurement Techniques	
HIGH PERFORMACE CMOS OP-AMPS	**(06 Hours)**
Buffered Op-Amps, High Speed/Frequency Op-Amps, Differential Output Op-Amps, Micro Power Op-Amps, Low Noise And Low Voltage Op-Amps	
SWITCHED CAPACITOR FILTERS	**(09 Hours)**
Switched Capacitor Circuits: Design And Analysis, Switched Capacitor Amplifiers, Switched, Capacitor Integrators, Z Domain Models, 1st And 2nd Order Switch Capacitor Filters, Higher Order Filters.	
D/A AND A/D CONVERTERS	**(09 Hours)**
Sample And Hold Circuits. Characterization Of DAC, Nyquist Rate, Parallel DAC, Extending Resolution Of Parallel DAC, Serial DAC, Characterization Of ADC, Serial ADC, High Speed ADC, Over Sampling Techniques	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. John D.A. and Martin K.,“Analog Integrated Circuit Design”,Wiley,1997

2. Razavi Behzad,“Design of Analog CMOS Integrated Circuit”,Tata McGraw-Hill,2002

3. Allen Philip and Holberg Douglas,“CMOS Analog Circuit Design”,Oxford University Press,2002

4. Gregorian R. and Temes G.C.,"Analog MOS ICs for Signal Processing", Wiley 1986

5. Baker Jacob R., Harry W. Li and Boyce David E.,“CMOS: Circuit Design, Layout and Simulation”,Wiley Interscience, 2003

M. Tech. I (EC) [VLSI/CS] Semester II	**L**	**T**	**P**	**C**	
EC614:REAL TIME SYSTEMS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO REAL TIME SYSTEMS	**(10 Hours)**
Hard Versus Soft Real Time Systems, Reference Models Of Real Time Systems, Operating System Services, I/O Subsystems, Network Operations Systems, Real Time Embedded Systems, Operating Systems Interrupt Routines In RTOS Environments, RTOS Task Scheduling Models, Interrupt Latency And Response Time, Standardization Of RTOS	
REAL-TIME SCHEDULING AND SCHEDULABILITY ANALYSIS	**(09 Hours)**
Task, Process And Threads, Commonly Used Approaches To Real Time Scheduling, Clock-Driven Scheduling, Priority Driven Scheduling Of Periodic Tasks, Hybrid Schedules, Event Driven Schedules, Earliest Dead Line First (EDF) Scheduling, Rate Monitoring Alog (RMA), Real Time Embedded Operating Systems: Standard & Perspective, Real Time Operating Systems: Scheduling Resource Management Aspects,Quasi-Static Determining Bounds On Execution Times	
INTER-PROCESS COMMUNICATION AND SYNCHRONIZATION OF PROCESSES,TASKS AND THREADS	**(05 Hours)**
Multiple Process in An Application, Data Sharing By Multiple Tasks And Routines Inter Process Communication	
REAL TIME OPERATING SYSTEMS	**(09 Hours)**
Handling Resources Sharing and Dependencies Among Real Time Tasks, Resource Sharing Among real Time tasks, Priority Inversion, Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP), Priority Ceiling Protocol (PCP), Different Types of Priority Inversion Under PCP, Important Features of PCP, Handling Task Dependencies	
COMMERCIAL REAL TIME OPERATING SYSTEMS	**(09 Hours)**
Time Services, Unix As Real Time OS, Non-Primitive Kernel, Dynamic Priority Levels, Unix Based Real Time OS, Extension to the Traditional Unix Kernal, Host Target Approach, Preemption Point Approach, RT Linux, Windows CE As Real Time OS, Rea Time POSIX Standard, MC/OS-II	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Rajib Mall,“Real Time Systems Theory And Practice”,Pearson Education,2007

2. Wayne Wolf,“Computers as Components: Principles of Embedded Computing System Design”,Morgan Kaufman,2001

3. Liu Jane,“Real-time Systems”,PHI,2000

4. Laplante Phillip A,“Real-Time Systems Design and Analysis: An Engineer's Handbook”,2005

5. Albert M. K. Cheng, “REAL-TIME SYSTEMS Scheduling, Analysis, and Verification”,Wiley Interscience,2002

6. Richard Zurawski, “Embedded Systems Handbook”,CRC Taylor Francis,2006

M. Tech. I (EC) [CS / VLSI] Semester II	**L**	**T**	**P**	**C**	
EC618:Reconfigurable Computing(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION	**(06 Hours)**
General overview, Goals and motivations, History, state of the art, future trends, Basic concepts and related fields of study, Performance, power, and other metrics, Algorithm analysis and speedup projections, VHDL tutorial, RC Architectures, Device characteristics, Fine-grained architectures, Coarse-grained architectures	
FPGA Physical Design Tools	**(08 Hours)**
Technology mapping, Placement & routing, Register Transfer (RT)/Logic Synthesis, Controller/Datapath synthesis, Logic minimization	
RC Application Design	**(10 Hours)**
Parallelism, Systolic arrays, Pipelining, Optimizations, Bottlenecks, High-level Design,High-level synthesis, High-level languages, Design tools	
System architectures:	**(10 Hours)**
Hybrid architectures, Communication, Hw/sw partitioning, Soft-core microprocessors, System design strategies, System services, Small-scale architectures, HPC architectures, HPEC architectures, System synthesis, Architectural design space explorations.	
Case Studies & Special Topics:	**(08 Hours)**
Signal and image processing, Bioinformatics, Security, Partial Reconfiguration, Numerical Analysis, Performance Analysis/Prediction, Fault Tolerance	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. C. Maxfield,“The Design Warrior's Guide to FPGAs”,Newnes,2004

2. M. Gokhale and P. Graham,“Reconfigurable Computing: Accelerating Computation with Field-Programmable Gate Arrays”,Springer,2005

3. C. Bobda,“Introduction to Reconfigurable Computing: Architectures, Algorithms and Applications”,Springer,2007

4. P. Lysaght and W. Rosenstiel (eds.),“New Algorithms, Architectures and Applications for Reconfigurable Computing”,Springer,2005

5. D. Pellerin and S. Thibault,“Practical FPGA Programming in C” Prentice-Hall,2005

6. W. Wolf,“FPGA-based System Design”,Prentice-Hall, 2004

7. R. Cofer and B. Harding,“Rapid System Prototyping with FPGAs: Accelerating the Design Process”,Newnes,2005

8. N. Voros and K. Masselos (eds.),“System-Level Design of Reconfigurable Systems-on-Chip”,Springer,2005

9. G. De Micheli,“Synthesis and Optimization of Digital Circuits”,McGraw-Hill,1994

M. Tech. I (EC) [VLSI/CS] Semester II	**L**	**T**	**P**	**C**	
EC622:LOW POWER VLSI DESIGN(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION	**(09 Hours)**
Low Power VLSI, Modeling And Sources Of Power Consumption, Power Estimation At Different Design Levels	
POWER OPTIMIZATION	**(14 Hours)**
Combinational Circuits And Sequential Circuits Voltage Scaling Approaches, Low Energy Computing Using Energy Recovery Techniques, Low Power SRAM Architectures	
SOFTWARE DESIGN	**(08 Hours)**
Software Design For Low Power VLSI Design, Computer Aided Design Tools	
CASE STUDIES	**(11 Hours)**
Recent Trends in Low-Power Design for Mobile And Embedded Application	
	(Total Contact Time: 42 Hours)
BOOKS RECOMMENDED:>	
1. Roy Kaushik and Prasad Sharat,"Low-Power CMOS VLSI Design",John Wiley & Sons Inc,2000	
2. Chandrakasan Anantha P. and Brodersen Robert W.,"Low Power Digital CMOS Design",Kluwer Academic,1995	
3. Yeap Gary K.,"Practical Low Power Digital VLSI Design", Kluwer Academic,1998	
4. Kiat-Seng Yeo and Kaushi Roy,"Low Voltage Low Power VLSI Subsystems",McGraw- Hill, 1st Edition,2004	
5. Kang S. M.,"CMOS Digital Integrated Circuits",Tata McGraw Hill, 3rd Edition,2003	

M. Tech. I (EC) [VLSI/CS] Semester II	**L**	**T**	**P**	**C**	
EC624:NANOELECTRONICS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION TO MINIATURIZATION AND NANOSCALE PHYSICS	**(02 Hours)**
Scaling Laws In Mechanics, Electricity, Electromagnetism And Optics The Basics Of Quantum Mechanics: Atomic Orbitals, Electromagnetic Waves, The Quantization Of Energy, Atomic Spectra And Discreetness, The Photoelectric Effect, Wave-Particle Duality, The Uncertainty Principle, Particle In A Well	
INTRODUCTION TO NANOSTRUCTURES AND MEMS	**(15 Hours)**
Nanostructures Like Particles, Wires, Films, Layers And Coatings, Porous Materials, Small Grained Materials And Molecules, Historical Background Of MEMS, Silicon Pressure Sensors, Micro-Electro-Mechanical Systems, Micro-fabrication And Micromachining: Integrated Circuit Processes, Bulk Micromachining, Isotropic Etching And Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes	
APPLICATONS AREAS	**(15 Hours)**
a) Nanomechanics: Nanomechanical Memory Elements And Mass Sensors b) Nanoelectronics: Electrons In Solids, Fermi Energy, Density Of States For Solids, Changing The Behavior Of The Solids, Quantum Confinement, Tunneling, Single Electron Phenomenon, Molecular Electronics c) Nanophotonics: Photonic Properties Of Nanomaterials, Near-Field Light, Optical Tweezers, Photonic Crystals	
NANOELECTRONIC DEVICES AND SYSTEMS	**(10 Hours)**
Resonant Tunneling Diode, Quantum Cascade Laser, Single Electron Transistor, Carbon Nanotube Devices, Sensors And Actuators, Physical Microsensors And Actuators, Their Principles, Design Issues And Examples	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Rogers, Pennathur and Adams,“Nanotechnology: Understanding Small Systems”,CRC Press, Tayler And Francis Group,2008

2. Fahrner W. R. (Ed),“Nanotechnology And Nanoelectronics: Materials, Devices, Measurement Techniques”,Springer Publications,2005

3. Kumar Vijay,“Nanosilicon”,Elsevier Ltd., 1st Edition,2008

4. Kohler and Fritzsche,“Nanotechnology: An Introduction To Nanostructuring Techniques”, Wiley-VCH, 1st Edition, 1st Reprint,2004

5. Mahalik N. P.,“Micromanufacturing and Nanotechnology”,Springer,2006

M. Tech. I (EC) [VLSI/CS] Semester II	**L**	**T**	**P**	**C**	
EC626:DSP STRUCTURES FOR VLSI(NEW)	**3**	**0**	**0**	**3**	

VLSI ARCHITECTURES	**(09 Hours)**
VLSI Architectures for DSP Algorithms, Data Flow Representations, Pipelining And Parallel Processing, Retiming, Unfolding, Register Minimization Techniques, Systolic Architectures	
ALGORITHMS	**(11 Hours)**
Algorithm For Fast Implementation Of Convolution, FIR, IIR And Adaptive Filters, DCT,Analysis Of Finite Word Length Effects	
LOW POWER DESIGN STRATEGIES	**(11 Hours)**
Architecture And Applications Of General Purpose Digital Signal Processors, Architecture and Programming Of TMS 320c55x/ Black Finn High Performance Design Strategies, Case Study Of TMS320C6x/ SHARC	
APPLICATION CASE STUDIES	**(11 Hours)**
Speech Coding, Image Compression, Vitterbi Decoding, Wireless Communication	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Wanhammar Lars,“DSP Integrated Circuits”, Academic Press,1999

2. Kuo S. M. and Lee B. H.,“Real-Time Digital Signal Processing: Implementations, Applications & Experiments With The TMS320C55X”,Wiley,2001

3. Parhi K. K.,“VLSI Digital Signal Processing Systems:Design And Implementation”,John Wiley 1999

4. Parhi K. K. and Nishitani T.,“DSP For Multimedia Systems”, Marcel Dekker,1999

5. Higgins Richard J.,“DSP in VLSI”, PHI, 1990

M. Tech. I (EC) [CS] Semester II	**L**	**T**	**P**	**C**	
EC628:ESTIMATION & DETECTION THEORY(NEW)	**3**	**0**	**0**	**3**	

LINEAR PREDICTION	**(19 Hours)**
Linear Prediction And Optimum Linear Filters, Forward And Backward Linear Prediction, Solution Of The Normal Equations-Levinson-Durbin And Schur Algo, Pede's Approximation, AR Lattice And ARMA Process And Lattice Ladder Filter, Wiener Filter, Kalman Filter, Adaptive Filter, Linear Mean Square Estimation, Estimation Error, Least Square Errors, Minimum Mean Square Error	
ESTIMATION	**(07 Hours)**
Estimation Based On Statistical Analysis, Bayesian Estimation, MAP And ML Detection Rules, Cramer-Rao Inequality	
SPECTRUM ESTIMATION	**(03 Hours)**
APPLICATIONS OF ESTIMATION THEORY	**(13 Hours)**
Wireless Channel Estimation, Pilot Based And Training Sequence Based Estimation And Blind Estimation, Estimation Theory Applied For Speech, Image And Video Compression Coding, Time Delay Estimation, Velocity Estimation, Detection of Signal In Gaussian Noise	
(Total Contact Time: 42Hours)	

BOOKS RECOMMENDED:

1. Anderson B. D. O and Moore J. B.,"Optimal Filtering",Prentice-Hall,1981

2. Ljung L.,"System Identification Theory For The User",Prentice-Hall,1987

3. Maybeck P. S.,"Stochastic Models, Estimation And Control, Vol. 1, 2, 3",Academic Press,1982

4. Saeed V. Vaseghi,"Advanced Digital Signal Processing And Noise Reduction", Wiley, 2nd Edition,2000

5. Monson Hayes,"Statistical Digital Signal Processing And Modeling", John Wiley & Sons Inc., 1st Edition,1996

6. Proakis John and Manolakis,"Digital Signal Processing",Prentice-Hall, 3rd Edition, 1996

M. Tech. I (EC) [CS/VLSI] Semester II	**L**	**T**	**P**	**C**	
EC632:MICROWAVE INTEGRATED CIRCUITS(NEW)	**3**	**0**	**0**	**3**	

ACTIVE RF COMPONENTS	**(12 Hours)**
RF Diodes, Bipolar-Junction Transistor, RF FET	
ACTIVE RF COMPONENT MODELING	**(10 Hours)**
Diode Models, Transistor Models, Measurement Of Active Devices, Scattering Parameter Device Characterization	
RF TRANSISTOR AMPLIFIER DESIGNS	**(10 Hours)**
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	**(10 Hours)**
Basic Oscillator Model, HF Oscillator Configuration, Basic Characteristics Of Mixers	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Ludwig Reinhold and Bretchko Pavel,“RF Circuit Design: Theory And Applications”,Pearson Education,3rd Indian Reprint,2004

2. Massobrio G. and Antognetti P.,“Semiconductor Device Modelling With SPICE”,McGraw- Hill,1993

3. Gonzalez G.,“Microwave Transistor Amplifiers- Analysis And Design”,Prentice Hall,1997

4. Gentili Christian,“Microwave Amplifiers And Oscillators”, North Oxford Academic,Revised Edition,1986

5. Vendelin G., Pavio A and Rhode U. L.,“Microwave Circuit Design Using Linear And Nonlinear Techniques”,John Wiley,1990

M. Tech. I (EC) [CS/VLSI] Semester II	**L**	**T**	**P**	**C**	
EC634:OPTICAL SIGNAL PROCESSING(NEW)	**3**	**0**	**0**	**3**	

DIFFRACTION THEORY	**(09 Hours)**
Huygen's Principle, Fraunhofer Diffraction, Fresnel Diffraction, Kirchhoff's Diffraction Theory, Boundary Diffraction Waves, Diffraction Grating	
COHERENCY	**(05 Hours)**
Interference, Visibility, Coherence Function, Spatial Coherence, Temporal Coherence	
FOURIER OPTICS	**(08 Hours)**
Optical Fourier Transform, Linear System, Convolution, Correlation, Fourier Methods In Diffraction Theory, Optical Transfer Function	
INFORMATION OPTICS	**(08 Hours)**
Spatial Frequencies, Abbe's Theory, Spatial Filtering, Phase Contrast, Imaging Enhancement, Optical Filters, Spatial Light Modulator	
APPLICATION OF OPTICAL SIGNAL PROCESSING	**(06 Hours)**
Holography, Information Processing, Optical Pattern Recognition	
ADVANCED OPTICAL SIGNAL PROCESSING	**(06 Hours)**
Digital Optics, Optical Computing, Optical Neural Network	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Goodman J.,"Introduction to Fourier Optics", McGraw Hill, 2nd Edition,2000
2. Hecht E.,"Optics",Addison Wesley, 4th Edition,2001
3. Anthony Vanderlugt,"Optical Signal Processing",John Wiley & Sons,2005
4. Okan K. Ersoy,"Diffraction, Fourier Optics and Imaging",Wiley-Inter Science,2006
5. W.T. Rhodes,"Fourier Optics and Optical Signal Processing",Wiley-Blackwell,2009

M. Tech. I (EC) [CS/VLSI] Semester II	**L**	**T**	**P**	**C**	
EC636:AD-HOC NETWORKS(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION	**(04 Hours)**
Introduction To Generations In Wireless Systems, Introduction To Mobile Ad-Hoc Networks (MANETS), Classification Of Mobile Data Networks	
BLUETOOTH	**(08 Hours)**
Bluetooth Network Structure: Piconet & Scatternet, Bluetooth Specifications, Bluetooth Protocol Stack, Bluetooth Media Access Control Consideration, Asynchronous Connectionless And Synchronous Connection Oriented Communication Link, Modified Bluetooth	
WIFI - IEEE802.11 STANDARDS	**(08 Hours)**
Various 802.11 Protocols (a to s), WiFi Architecture, Security Enhancement, QoS Enhancement, Physical & MAC Layer Aspects Of 802.11 a,b,g,e,n; WiFi MAC: Point Coordinate Function, Distributed Coordinate Function, Hybrid Coordinate Function	
WiMAX - IEEE802.16 STANDARDS	**(08 Hours)**
Various 802.16 (a to e) Protocols, WiMAX Air Interface / Physical Layer, WiMAX Architecture, WiMAX Protocol Architecture, WiMAX And WiFi Interworking, WiMAX Mode: TDD And FDD, QoS In WiMAX	
WIRELESS SENSOR NETWORK	**(07 Hours)**
Zigbee IEEE 802.15.4, Mobile Computing Aspects	
UWB	**(02 Hours)**
UWB Air Interface	
IEEE802.20 AND BEYOND	**(02 Hours)**
LONG TERM EVOLUTION	**(03 Hours)**
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Toh C. K.,“Ad-hoc Mobile Wireless Networks”,LPE, Pearson Education,2nd Edition,2009
2. William C.Y. Lee,“Wireless & Cellular Telecommunication”, McGraw-Hill,3rd Edition,2005
3. Upena Dalal,“Wireless Communication”,Oxford University,1st Edition,2009
4. Vijay K. Garg,“Wireless Network Evolution 2G to 3G”,Pearson Education,2nd Edition,2004
5. T. G. Palanievelu, R. Nakkeeran,“Wireless & Mobile Communication”,PHI,1st Edition,2009
6. Schiller Jochen, “Mobile Communications”, Addison Wesley, LPE, Pearson Education,4th indian Reprint,2000

ELECTRONICS ENGINEERING DEPARTMENT
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M. Tech. I (EC) [CS] Semester II	**L**	**T**	**P**	**C**	
EC638:MIMO TECHNOLOGY(NEW)	**3**	**0**	**0**	**3**	

INTRODUCTION	**(09 Hours)**
Introduction Of Channel, Channel Models, SISO, SIMO, MISO, MIMO System Model, MIMO Channel Measurement	
EFFECT OF ANTENNA	**(07 Hours)**
The Effect Of Antenna On MIMO Performance, Micro And Macro Spatial Diversity, Pattern Diversity, Mutual Coupling And Receiver Network Modeling	
MIMO CHANNEL	**(07 Hours)**
MIMO Channel In Micro And Pico Environment, Wireless MIMO Channel Capacity MIMO LAN Environment	
ORTHOGONAL SPACE TIME CODING	**(08 Hours)**
Orthogonal Space Time Coding, Space Time Block Code Alamouti Scheme	
ANTENNA SUBSET SELECTION	**(11 Hours)**
Antenna Subset Selection In MIMO Communication System, Diversity And Multiplexing With MIMO Antenna Selection, Diversity Versus Multiplexing, Transmit/Receive Antenna Selection, Antenna Selection In MIMO Wireless LAN System	
	(Total Contact Time: 42 Hours)

BOOKS RECOMMENDED:

1. Gershman A. G. and Sidiropoulos N. D.,“Space Time Processing For MIMO Communication”,John Wiley & Sons,2005

2. Paulraj A., Nabar R. and Gore D., “Introduction To Space-Time Wireless Communications”,Cambridge University Press,2003

3. Larsson Erik G., Stoica Petre and Ganesan Girish,“Space Time Block Coding For Wireless Communication”,Cambridge University Press,2003

4. Durgin Gregory D.,“Space Time Wireless Channels”,Pearson Higher Education,2002

5. Branka Vucetic, Jinhong Yuan and Branka Vuceric,“Space Time Coding”,John Wiley & Sons,2003

6. Xiaodong Wang and H. Vincent Poor,“Wireless Communication Systems: Advance Techniques For Signal Reception”,Pearson Education,2003

7. Glisic Savo G.,“Advanced Wireless Network, 4G Technology”,John Wiley & Sons,2006

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M.Tech. I (EC), III Semester (Communication System)NEW

Appendix – 1

M.Tech. II (EC), III Semester (Communication System)OLD										
Sr. No.	**Course Name**	**Code**	**Teaching Scheme**			**Credit**	**Examination Scheme**			**Total**
			L	**T**	**P**		**Theory**	**Tutorial**	**Practical**	
1	Dissertation Preliminaries	EC 801	0	0	16	8	0	--	400	400
2	Seminar	EC 803	0	0	4	2	0	--	100	100
Total			0	0	20	10	0	--	500	500
Total Contact Hours per week: 20										

M.Tech. II (EC), IV Semester (Communication System)

M.Tech. II(EC), IV Semester (Communication System) OLD										
Sr. No.	**Course Name**	**Code**	**Teaching Scheme**			**Credit**	**Examination Scheme**			**Total**
			L	**T**	**P**		**Theory**	**Tutorial**	**Practical**	
1	Dissertation	EC 802	0	0	24	12	0	0	400	400
Total			0	0	24	12	0	0	400	400
Total Contact Hours per week: 24										

फोन नं: संस्थान कार्यालय: २२२३३७१-७४, फेक्स नं: २२२८३९४, २२२७३३४ विभागीय प्रमुख: २२०१५५१, विभाग कार्यालय: २२०१५५२

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