Master of Technology in ECE
Department of Electronics & Communication Engineering

Subject Code	Course Title	Credit Total(L T P)
Semester 1 (Core Courses)		
ECT661	Advanced Digital Communication Systems	3 (3-0-0)
ECT663	Advanced Error Control Codes	3 (3-0-0)
ECT665	Advanced Microwave Engg.	3 (3-0-0)
ECT679	Advanced Optical Communication Systems	3 (3-0-0)
ECT693	Computer Communication	3 (3-0-0)
ECP667	Comm. Lab-I	3 (0-0-6)
ECT990	Mathematical Methods & Techniques for ECE technologists-I*	3 (3-0-0)
ECT992	Mathematical Methods & Techniques for ECE technologists-II*	3 (3-0-0)
	Total Semester Credits	21
Semester 2 (2 + 5 electives)		
ECP668	Comm. Lab-II	3(0-0-6)
ECD666	Minor Project	4(0-0-8)
	(Elective Courses)#	
ECT662	Advanced Digital Signal & Image Processing	3 (3-0-0)
ECT664	Estimation and Detection	3 (3-0-0)
ECT670	Satellite Communication and Radar Engg.	3 (3-0-0)
ECT672	Wireless and Mobile Adhoc Networking	3 (3-0-0)
ECT674	Cryptography	3 (3-0-0)
ECT676	Design of Microstrip Antennas	3 (3-0-0)
ECT678	Design of MIC's & MMIC's	3 (3-0-0)
ECT680	Advanced Mobile Systems	3 (3-0-0)
ECT682	Smart and Phased Array Antenna Design	3 (3-0-0)
ECT684	Advance topics in Communication	3 (2-0-2)
ECT686	Photonic Integrated Devices and Systems	3 (3-0-0)
ECT688	EMI/EMC	3 (3-0-0)
ECT690	Wireless Sensor Networks	3 (3-0-0)
ECT692	Computational Electromagnetics	3 (3-0-0)
ECT694	Advanced Photonic Devices and Components	3 (3-0-0)
ECT696	Telecomm. Technology & management	3 (3-0-0)
ECT698	Advanced Networking analysis	3 (3-0-0)
ECT656	Adaptive Signal Processing	3 (3-0-0)
ECT657	VLSI signal processing architectures	3 (3-0-0)
ECT655	Optical Codes and Applications	3 (3-0-0)
	Total Semester Credits	22
Semester 3		
ECD699	Dissertation	16(0 0 32)
	Total Semester Credits	16
Semester 4		
ECD700	Dissertation	16(0 0 32)
	Total Semester Credits	16
	Total Credits of all semesters	75

#These courses will be offered by the faculty of Department.
#The students may opt for any of the elective course offered in the Institute on recommendation of supervisor
* only one course out of ECT990 or ECT992 shall be offered

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I SEMESTER

PG Course Details

Program: M.Tech. ECE	Department: ECE
Course Code: ECT661	Course Name: Advance Digital Communication System
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Baseband modulation and demodulation: Detection of binary signals in Gaussian 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

Books:

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

Program: *M. Tech. (VLSI Design)*	Department: *Electronics & Comm. Engg.*
Course Code: ECT 990	**Course Name: Mathematical Methods and techniques for Electronics & Communication Technologists-I**
Credit: 3	**L-T-P: 2-1-0**
Pre-requisite course:	
Co-requisite course:	

Syllabus:

[The following contents have implicit application to and exemplification through ECE problems such as communication over unreliable channel, processing of random signals, amplitude modulation by random signals, reliability of a electronic/communication systems, resource sharing in a system, and networks of queues]

A. Applied Probability and probability models: one- and two-dimensional random variables (RVs); discrete RVs- Poisson, geometric, binomial, hyper-geometric & multi-model; continuous RVs- normal, exponential, Gamma, chi-square, bivariate normal; moment generating function & Laplace of RV distribution; Random processes; Markov chain- continuous, discrete; Poisson process; renewal theory; queuing theory; reliability theory; 16 Hrs.

B. Brownian motion & stationery processes; Computer methods for generating RVs; Simulation- general & special techniques for continuous and discrete distributions, multi-variate distributions; variance reduction techniques; Monte-Carlo techniques 05 Hrs.

C. Transforms & systems analysis- Fourier Series, Fourier transform, z-transform, discre cosine (sine) transform, Wavelet transform, fractional transforms. 07 Hrs.

Suggested references (not limited to)-

1. Probability, random variables and stochastic processes, A. Papoulis and U. S. Pillai, Mc Graw Hill.
2. Probability & random processes for Electrical Engineers- Alberto Leon Garcia, Pearson (I)Applied Probability models for optimization- Sheldon M. Ross, Elsevier, 2009
3. Mathematical methods in Electrical engineering, Thomas B. A. Senior, Cambridge University Press

Further references

1. Discrete Wavelet transforms, Patrick J. Van Fleet, Wiley Interscience, 2007
2. Probability & statistics for engineers & scientists- Sheldon M. Ross, Elsevier, 2009
3. PROBABILITY AND STATISTICS IN ENGINEERING, William W. Hines, Douglas C. Montgomery, David M. Goldman. Connie M. Borror, John Wiley & Sons, 2008
4. Laplace and Fourier transforms for electrical engineers, Edward J. Craig, Holt, Rinehart and Winston, 1964
5. Computational Probability- Winfried K. Grassman, Kluwer

Program: *M. Tech. (VLSI Design)*	**Department:** *Electronics & Comm. Engg.*
Course Code: ECT992	**Course Name: Mathematical Methods and techniques for Electronics & Communication Technologists-II**
Credit: 3	**L-T-P: 2-1-0**
Pre-requisite course:	
Co-requisite course:	

Syllabus:

[The following contents implicit application to and exemplification through ECE problems such as reduced order polynomials, order reduction of a transfer function, sparse matrix based solution of large systems, implementation of search algorithms for design space exploration]

A. Linear algebra and Matrix analysis – Groups, fields and rings; vector spaces; basis & dimensions; canonical forms; inner product spaces- orthogonalization, Gram-Schmidt orthogonalization, unitary operators, change of orthonormal basis, diagonalization; eigenvalues & eigen vectors- Gerschgorin theorem, iterative method, Sturm sequence, QR method, introduction to large eigen value problems. 10 Hrs.

B. Function approximation & reduced order modelling of systems- Taylor's polynomial, least square approximation, Chebyshev series/polynomial, splines, Pade & rational approximation, Krylov subspaces, Lanczos process, Arnoldi method; Symbolic analysis and reduced order modelling of interconnects, linear and weakly non-linear analog/digital systems
12 Hrs.

C. Combinatorial optimization- counting methods, algorithms for optimization 06 Hrs.

Suggested references (not limited to)-

1. Topics in Algebra, I. N. Herstein, Wiley. Theory and Applications of Numerical Analysis, G. M. Phillips, Peter J. Taylor, Academic press
2. Advanced Model Order Reduction Techniques in VLSI Design, Sheldon Tan, Lei He, Cambridge Univ. Press, 2007.
3. Model Order Reduction: Theory, Research Aspects and Applications edited by W. H. A. Schilders, Henk A. Van Der Vorst, Joost Rommes, Springer.
4. Combinatorial optimization, Papadimitriou and Steiglitz, PHI (I)

Further references

1. MODEL ORDER REDUCTION TECHNIQUES WITH APPLICATIONS IN ELECTRICAL ENGINEERING, Luigi FORTUNA, Guiseppe NUNNARI, Antonio GALLO, Springer, 1992.
2. Y. Saad, Numerical methods for large Eigenvalue problems, www.umn.edu
3. Matrix Analysis & linear algebra, Meyer, SIAM
4. Schaum's outline on Linear Algebra, McGraw Hill
5. H. A. van der Vorst, Iterative methods for large linear systems, citeseerx.ist.psu.edu
6. Cheng et al, Symbolic analysis and reductions of VLSI circuits, Springer, 2005

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT663	Course Name: Advanced Error Control Codes
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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, Convolution codes: Coding and Decoding , Distance bounds, Performance bounds Turbo codes: Coding, Decoding Algorithms, Performance comparison , Interleaver design Trellis coded Modulation, TCM Decoders, TCM for AWGN and Fading Wireless Channels, Performance comparison.

Books:

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 practice of error control codes, AWL1983.
4. J.G.Proakis; Digital Communication

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT670	Course Name: Satellite Communication and Radar Engg
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Orbital parameters launching systems, Subsystem of satellite, 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.

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT674	Course Name: Cryptography
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Cryptography: Basic Terms and Concepts, Brief History of Cryptography and Cryptanalysis. Uses and misuses. Basic Number Theory - Divisibility, Primarily, Bases, Congruence's, Modular Arithmetic, GCD'S, Euclidian algorithm, Fermat and Euler Theorems, 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

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT676	Course Name: Design of Micro strip Antennas
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Fundamental Properties of Single layer Micro strip Patch Antenna. Micro strip Radiators Analytical Models for Micro strip Patch Antennas. Full wave Analysis of Micro strip Patch Antennas.

Rectangular Micro strip Patch Antennas. Circular Dish and Ring Patch Antennas. Circularly Polarized Micro strip Patch Antennas. Enhancing the Bandwidth of Micro strip Patch Antennas.

Improving the Efficiency of Micro strip Patch Antennas.

Books:

1. Micro strip 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 Micro strip Antenna for Wireless Applications by Robert A. Sainati, Artech House.
4. Compact and Broadband Micro strip Antenna by Kin-Lu Wong, John Wiley & Sons.
5. Micro strip Patch Antennas by Robert B. Waterhouse, Kluwer academic Publishers.
6. Handbook of Micro strip Antennas by J.R. James and P.S. Hall, Peter Peregrinus Ltd.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT664	Course Name: Estimation and Detection
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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).

Books:

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.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT679	Course Name: Advance Optical Communication system
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Review of optical fiber wave guiding 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 solution based communication. Transmitter design, Receiver PIN and APD diodes design, noise sensitivity 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 compression, solution 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.

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT686	Course Name: Photonic Integrated Devices and Systems
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Planar waveguides: Step-index and graded-index waveguides, guided and radiation modes. Strip and channel waveguides, anisotropic waveguides, segmented waveguide; electro-optic and acousto-optic waveguide devices. Directional couplers, optical switch; phase and amplitude modulators, filters, etc. Y-junction, power splitters, Arrayed waveguide devices, fiber pig tailing, Fabrication of integrated optical waveguides and devices. Waveguide characterization, 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

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT693	Course Name: Computer Communication
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Modeling 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. Queuing 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.

Books:

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

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]PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT605	Course Name: Digital System Design
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

Sequential Logic Design- Introduction, Basic Bi-stable Memory Devices, additional bi-stable devices, reduced characteristics and excitation table for bi-stable 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 o 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.

Books:

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.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT601	Course Name: Digital CMOS ICs
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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
PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code:ECT662	Course Name: Advance Digital Signal & Image Processing
Credit:3	L-T-P:3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code:ECT665	Course Name: Advanced Microwave Engineering
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT672	Course Name: Wireless and Mobile Adhoc Networking
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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

PG Course Details

Program: M.Tech ECE	**Department: ECE**
Course Code: ECT634	**Course Name:** Micro& Nano Electro Mechanical System (MEMS & NEMS)
Credit:3	**L-T-P: 3-0-0**
Pre-requisite course:	

Syllabus:-

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:

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

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PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT678	Course Name: Design of MICs & MMICs
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

1. 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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT680	Course Name:Advance Mobile Systems
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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,

Books:

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
4. Press

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT682	Course Name: Smart and Phased array antenna design
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

1. Microstrip Antenna design Handbook by R. Garg, P. Bharhia, I. Bahl, and A. Ittipiboo Pub. ArtechHouse
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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT631	Course Name: Analog and mixed signal ICs
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT688	Course Name:EMI/EMC
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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.

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT692	Course Name:Computational Electromagnetics
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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

Books:

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

DPGC Convener *Head, ECE* *SPGB Chairman*

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT694	Course Name: Advance Photonic Devices and Components
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT696	Course Name: Telecom Technology & Management
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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.

Books:

1. W. Stalling, Data Comm. & Networking

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT690	Course Name: Wireless Sensor Networks
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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

Books:

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

PG Course Details

Program: M.Tech ECE	Department: ECE
Course Code: ECT698	Course Name: Advanced Networking Analysis
Credit:3	L-T-P: 3-0-0
Pre-requisite course:	

Syllabus:-

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

Books:

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

DPGC Convener *Head, ECE* *SPGB Chairman*

Program: *M. Tech. (VLSI Design) M. Tech. (ECE)*	Department: *Electronics & Comm. Engg.*
Course Code: ECT 656 UG Code : ECT 467	Course Name: **Adaptive Signal Processing**
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	
Co-requisite course:	

Syllabus:

Adaptive Filter Structures and Algorithms :
Introduction to Adaptive systems, Adaptive Linear combiner, Minimum Mean-Square Error, Wiener-Hopf Equation, Error Performance Surface, LMS algorithm, Convergence of weight vector, Learning Curve, FX-LMS algorithm (Filtered X-LMS) and its application to ANC, Types of LMS, RLS algorithm, Matrix Inverse Lemma for RLS, Computational complexity of LMS and RLS, Convergence Analysis.

Advancements in Transforms :
Short time Fourier Transform (STFT), Multi Resolution Analysis, Wavelet Transform, Continuous Wavelet Transform (CWT), Inverse CWT, Discrete Wavelet Transform, Sub-band coding and implementation of DWT, Applications (signal and image compression, de-noising, detection of discontinuous and breakdown points in signals), S-transform, Frequency selective filtering with wavelet and S-transform.

Applications:
Direct Modelling or System Identification, Inverse Adaptive Modelling (Equalization), Adaptive Noise Cancellation, Adaptive filters for time series and stock market prediction, Biomedical Applications (Cancellation of 50-Hz interference in Electro-Cardiography, Cancelling donor heart interference in heart-transplant electrocardiography, Cancelling Maternal ECG in Fetal Electrocardiography), Echo Cancellation in Long distance Telephone Circuits, Adaptive self tuning filter, Adaptive line enhancer, Adaptive filters for classification and data mining.

Suggested references (not limited to)-

[1] B. Widrow and S. D. Stearns : Adaptive Signal Processing, Prentice Hall.
[2] D. G. Manolakis, V. K. Ingle, S. M. Kogon : Statistical and Adaptive Signal Processing, McGraw Hill.
[3] S. S. Haykin : Adaptive Filter Theory, 4th Edition, Prentice Hall.
[4] A. H. Sayed : Fundamentals of Adaptive Filtering, John Wiley & Sons.
[5] H. G. Stark : Wavelets and Signal Processing, Springer.
[6] S. Mallat, A Wavelet tour of Signal Processing, Academic Press.
[7] Rabi Polikar, The wavelet Tutorial, Part I-IV, Online available by Rowan University, Glassboro, NJ 08028.
[8] R. G. Stockwell, L. Mansinha, and R. P. Lowe, Localization of the Complex Spectrum : The *S* Transform, IEEE Transactions On Signal Processing, Vol. 44, No. 4, April 1996.

Program: *M. Tech. (ECE)*	Department: *Electronics & Comm. Engg.*
Course Code: ECT 655 UG Code : ECT 466	Course Name: **Optical Codes and Applications**
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	
Co-requisite course:	

Syllabus:

Introduction: Historical Perspective of Optical Communications, Optical Transmission and Optical Networking, Optical Communications Trends, Migration to 100 Gb/s Ethernet and Beyond, Dynamically Reconfigurable Optical Networks.

Optical Coding Schemes: Unipolar and Bipolar codes, 1D time spread codes, phase encoding, 2D phase-wavelength, wavelength-time and space-time codes and 3D space-wavelength-time, polarization-wavelength-time and space-wavelength-phase codes, Metrics for comparison of codes: Cardinality, Code dimension, Correlation functions, BER due to multiple access interference, received power & noise.

Enabling Hardware Technologies: Optical encoders/decoders using fiber optic components & integrated optics, Optical AND gate as a decoder, Optical AND gate using semiconductor optical amplifiers & ring resonator, Potential Applications.

Hybrid Multiplexing Techniques: Hybrid Multiplexing Transmission System, Photonic Gateway - Multiplexing Format Conversion, OCDMA/WDM Virtual Optical Path Cross Connect. Integration Technologies: Integration Strategies, Encoding/Decoding for FOCDMA Systems, Integrated Modules.

Suggested references (not limited to)-

1. Coding for optical channels - Ivan **Djordjevic**, William **Ryan**, Bane **Vasic (Springer)**
2. Optical code division multiple access: Fundamentals and Applications - Paul R. Prucnal (CRC Press)
3. Optical coding theory with prime - Wing C. Kwong; Guu-Chang Yang (CRC Press)
4. Spreading codes for all-optical code division multiple access communication systems – M. Ravi Kumar (Ph.D. Thesis, IIT Kharagpur)
5. Design and Performance Analysis of a New Family of Wavelength/Time Codes for Fiber-Optic CDMA Networks - E. S. Shivaleela (Ph.D. Thesis, IISc Bangalore)

Program: *M. Tech. (VLSI Design)*	Department: *Electronics & Comm. Engg.*
Course Code: ECT 657 UG Code : ECT 468	Course Name: **VLSI Signal Processing Architectures**
Credit: 3	L-T-P: 3-0-0
Pre-requisite course:	
Co-requisite course:	

Syllabus:

Introduction for DSP algorithms : VLSI Design flow, Mapping algorithms into Architectures: Graphical representation of DSP algorithms – signal flow graph (SFG), data flow graph (DFG), critical path, dependence graph (DG). Data path synthesis, control structures, Optimization at Logic Level and architectural Design, Loop bound and iteration bound, Algorithms for computing iteration bound, Iteration bound of Multirate data-flow graphs.

Parallel and pipeline of signal processing application : Architecture for real time systems, latency and throughput related issues, clocking strategy, power conscious structures, array architectures; Pipelining processing of Digital filter**,** Parallel processing**,** Parallel and pipelining for Low power design**,** Optimization with regard to speed, area and power, asynchronous and low power system design, ASIC (application specific integrated circuits) and ASISP application specific instruction set processors) design;

Systolic Array Architecture: Methodology of systolic array architecture**,** FIR based Systolic Array**,** Selection of Scheduling Vector**,** Matrix multiplication of systolic array

Architecture of different signal processing modules : Convolution technique, Retiming concept, Folding /Unfolding Transformation, CORDIC architecture

Low power Design : Theoretical background , Scaling v/s power consumption, power analysis, Power reduction techniques, Power estimation approach

Application in communication and signal processing system: Transformation architectures**,** source and channel coding structures**,** Motion Estimation and motion compensation for video**,** Speech processing algorithm

Suggested references (not limited to)-

1) **VLSI Digital Signal Processing Systems: Design and Implementation**
By K.K. Parhi , John Wiley & Sons, 1999 (ISBN Number: 0-471-24186-5)

2) **Richard J, Higgins, Digital Signal Processing in VLSI, Prentice** Hall, ISBN-10: 013212887X, ISBN-13: 9780132128872

3) M.A. Bayoumi, VLSI Design Methodology for DSP Architectures, Kluwer, 1994

4) U. Meyer – Baese , Digital Signal Processing with FPGAs, Springer, 2004