Hajee Mohammod Danesh Science & Technology University, Dinajpur

Department of Electronics and Communication Engineering

Masters Syllabus of

MS in Electronics and Communication Engineering (ECE)

Semester: July-December (Compulsory)

Course Code	Course Title	Credits
ECE 501	Electronics of Solids	2
ECE 503	VLSI Technology and Device Modeling	2
ECE 505	Advanced Digital Communication	2
ECE 507	Advanced Computer Networks	2
	Research (satisfactory/unsatisfactory)	(3)

Semester- July-December (Optional)

Choose One Course from each group

Course Code	Course Title	Group	Credits
ECE 511	Nanoelectronics	Electronics and Circuits	2.00
ECE 513	Compound Semiconductor Devices		
ECE 515	Digital Circuit Design		
ECE 517	Thin film Technologies		
ECE 519	Laser Processing of Materials		
ECE 531	Statistical Theory of Communication	Communications and Control Systems	2.00
ECE 533	Data Mining		
ECE 535	Telecommunication Networks		
ECE 537	Cellular Mobile Systems		
ECE 539	Microwave Theory and Techniques		
ECE 541	Advanced Microprocessors		
ECE 543	Advanced Digital Signal Processing		
ECE 545	Optical Networks		

Hajee Mohammod Danesh Science & Technology University, Dinajpur

Department of Electronics and Communication Engineering

Masters Syllabus of

MS in Electronics and Communication Engineering (ECE)

Semester: January-June (Compulsory)

Course Code	Course Title	Credits
ECE 551	Nanophotonics and Metamaterials	2
ECE 553	Microcontroller and Embedded System	2
ECE 555	Advanced Wireless Communication	2
ECE 557	Advanced Artificial Intelligence and Robotics	2
	Research (satisfactory/unsatisfactory)	(3)

Semester: January-June (Optional)

Choose One Course from each group

Course Code	Course Title	Group	Credits
ECE 561	Advanced Quantum Electronics	Electronics and Circuits	2
ECE 563	Power Semiconductor Circuits		
ECE 565	Advanced Electronic Engineering Materials		
ECE 567	Biomedical Signal Processing		
ECE 569	Renewable Power Generation Sources		
ECE 581	Free Space Optical Communication	Communications and Control Systems	2
ECE 583	Multicarrier Communication		
ECE 585	Network Management		
ECE 587	Wireless Sensor Networks		
ECE 589	Network Security		
ECE 591	Bioinformatics		
ECE 593	Advanced Multimedia Communications		
ECE 595	Teletraffic Engineering		

Semester: Research (Compulsory)

Course Title	Credit hours
Thesis Work	(2)
Thesis Evaluation	5
Thesis Defense	3
Sub-Total	10
Grand Total	40

Details of Courses

Semester: July-December (Compulsory)

Course Code	Course Title	Credit hours
ECE 501	Electronics of Solids	2
ECE 503	VLSI Technology and Device Modeling	2
ECE 505	Advanced Digital Communication	2
ECE 507	Advanced Computer Networks	2
	Research (satisfactory/unsatisfactory)	(3)

ECE 501: Electronics of Solids
Credit : 2.00
Contact Hours: 2hrs/week

Crystal Structure: Lattice types, basis, defects, reciprocal lattice, Miller indices. Free Electron Theory: Drude model, Sommerfield model, Application of Drude model. Electrons in a periodic potential, Bloch's theorem, The nearly free electron model, The tight binding method, Energy band structure of semiconductors and insulators, Band structure engineering, Measurement of band structure, Phones, Electron-Electron Scattering, Thermal properties of metals and semiconductors, Magnetoresistance and Superconductivity. Carrier Transport: Boltzmann transport theory, relaxation time approximation, high field transport and hot-carrier effects, Hall effect.

Recommended books:
[1] Walter A. Harrison, "Electronic Structure and the Properties of Solids", Dover Publications, 1989, ISBN: 978-0486660219.
[2] Sharon Ann Holgate, "Understanding Solid State Physics", Taylor & Francis, 2009, ISBN: 978-0750309721.

ECE 503: VLSI Technology and Device Modeling
Credit : 2.00
Contact Hours: 2hrs/week

VLSI process technology. Crystal growth and wafer preparation. Epitaxial growth on Si substrate. Oxidation of Si. Lithography, diffusion: methods and models. Ion implantation, metallization. Overview and process flow of a CMOS and a BICMOS process. VLSI si devices.

Isolation techniques. Second order effects in BJT devices: base width modulation. Emitter current crowding, kirk effect. Second order effects in MOS devices: short channel effects, narrow width effects. Device scaling rules. Device models. Compact models for bipolar devices. Ebers-Moll type model. Gummel-poon type model and their implementation in SPICE. BJT model in SPICE2. Compact models for MOS transistor and their implementation in SPICE. Level 1, 2 and 3 MOS model parameters in SPICE. Parameter extraction for bipolar and MOS device models. Geometry, process and temperature dependency of bipolar and MOS model parameters. Parameter optimization, statistics of parameters and statistical modeling.

Recommended books:

[1] Wai-Kai Chen, "VLSI Technology (Principles and Applications in Engineering)", CRC press, 2003, 1st edition, ISBN: 978-0849317385.
[2] Kwyro Lee, Michael shur, Tor A. Fjeldly and Tron Ytterdal, "Semiconductor Device Modeling For VLSI" , Prentice Hall, 1997, 1st edition, ISBN: 978-0138056568.

ECE 505: Advanced Digital Communication
Credit : 2.00
Contact Hours: 2hrs/week

Review of Probability and Stochastic Processes. Power Spectrum and Communication over Memoryless Channel: PSD of a synchronous data pulse stream, M-ary Markov source, Convolutionally-coded modulation, Continuous phase modulation, Scalar and vector communication over memoryless channel, Detection Criteria. Coherent and Non-Coherent Communication: Coherent receivers, Optimum receivers in WGN, IQ modulation & demodulation, Noncoherent receivers in random phase channels, M-FSK receivers, Rayleigh and Rician channels, Partially coherent receives – DPSK, M-PSK, M-DPSK, BER Performance Analysis. Band-limited Channels and Digital Modulations: Eye pattern, demodulation in the presence of ISI and AWGN, Equalization techniques, IQ modulations, QPSK, O/4-QPSK, QAM, QBOM, BER Performance Analysis, Continuous phase modulation, CPFM, CPFSK, MSK, OFDM. Block Coded Digital Communication: Architecture and performance, Binary block codes, Orthogonal, Biorthogonal, Transorthogonal- Shannon's channel coding theorem, Channel capacity, Matched filter, Concept of Spread Spectrum Communications, Coded BPSK and DPSK demodulators, Linear block codes, Hammning , Golay, Cyclic, BCH, Reed–Solomon codes. Convolutional-Coded Digital Communication: Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram, Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm.

Recommended books:

[1] John G. Proakis, "Digital Communications", McGraw-Hill Science/ Engineering/Math, 5th edition, 2007, ISBN: 978-0072957167.

[2] Kamilo Feher, "Advanced Digital Communications: Systems and Signal Processing Techniques", Scitech Pub Inc, 1997, ISBN: 978-1884932021.

ECE 507: Advanced Computer Networks
Credit : 2.00
Contact Hours: 2hrs/week

Modifications of TCP, TCP over ATM, ATM internetworking, ATM service categories and quality of services, ATM switch architectures and their performance, Digital switching, Traffic analysis, Fiber optics networks optical packet switching, Metropolitan networks, Wide area networking, Gigabit Ethernet, ADSL, HTTP, pHTTP and recent advances in internet protocols, Web server performance, proxy servers, load balancing in web servers, IP switching, Tag switching, Multiprotocol label switching, IP security; Queuing models for networks and protocols, Real time protocols- RTP, RTCP, RTSP, Voice over IP, Distributed object technology for networking, Networks agents, Active networks and protocol boosters, Multimedia Networking, Integrated Service, Differential Service, MPLS.

Recommended books:

[1] Andrew S. Tanenbum and David J. Wetherall, "Computer Networks", Prentice Hall, 5th edition, 2010, ISBN: 978-0132126953.

[2] Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann, 4th edition, 2007, ISBN: 978-0123705488.

Semester- July-December (Optional)
Choose one Course from each Group

Course Code	Course Title	Group	Credit hours
ECE 511	Nanoelectronics	Electronics and Circuits	2.00
ECE 513	Compound Semiconductor Devices		
ECE 515	Digital Circuit Design		
ECE 517	Thin film Technologies		
ECE 519	Laser Processing of Materials		
ECE 531	Statistical Theory of Communication	Communications and Control Systems	2.00
ECE 533	Data Mining		
ECE 535	Telecommunication Networks		
ECE 537	Cellular Mobile Systems		
ECE 539	Microwave Theory and Techniques		
ECE 541	Advanced Microprocessors		
ECE 543	Advanced Digital Signal Processing		
ECE 545	Optical Networks		

Electronics and Circuits

ECE 511: Nanoelectronics
Credit : 2.00
Contact Hours: 2hrs/week
Introduction to Nanoelectronics. Fabrication of nanoscale building blocks: E-beam, AFM, STM, dip-pen, nanoimprint, self-assembly. Single electron devices: Coulomb blockade, Fabrication issues for logic and memory applications, Device examples. Graphene and carbon nanotubes: Material structures and properties, Electric and mechanical properties, FET, Chemical sensors, Nanoelectromechanical systems (NEMS). Semiconductor nanowires: Growth, Heterostructures, Biosensors, Environmental sensors, Solar cells, Lasers. Molecular electronics: Single molecule devices, Memory devices, Spintronics: Spin-FET, spin valves and MRAM.

Recommended books:

[1] Vladimir V. Mitin, Viatchaslav A. Kochelap and Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press, 2012, ISBN: 978-1107403765.

[2] George W. Hanson, "Fundamentals of Nanoelectronics", Prentice Hall, 1st edition, 2007, ISBN: 978-0131957084.

[3] Mircea Dragoman and Daniela Dragoman, "Nanoelectronics: Principles and Devices", Artech House Publishers, 2nd edition, 2008, ISBN: 978-1596933682.

ECE 513: Compound Semiconductor Devices
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to GaAs device technology. GaAs metal-semiconductor field effect transistor (GaAs MESFET): introduction, structure, equivalent circuits, current saturation, effect of source and drain resistances, gate resistance and application of GaAs MESFET. High electron mobility transistor (HEMT): practical HEMT structure, energy band line-up, equivalent circuit, HEMT noise, pseudomorphic HEMT and applications. Opto-electronic integration of compound semiconductor devices: heterojunction phototransistor (HPT) and light amplifying optical switch (LAOS). Low temperature compound semiconductor electronics. Design consideration of MMICs and power MMICs using compound semiconductor devices.

Recommended books:

[1] S. Tiwari, "Compound Semiconductor Device Physics", Academic Press, 1991, ISBN: 978-0126917406.
[2] Osamu Oda, "Compound Semiconductor Bulk Materials and Characterization", World Scientific Publishing Company, 1st edition, 2007, ISBN: 978-9810217280.

ECE 515: Digital Circuit Design
Credit : 2.00
Contact Hours: 2hrs/week

Introduction: Digital Design, Analog versus Digital, Digital Devices, Electronic Aspects of Digital Design, Software Aspects of Digital Design, Printed-Circuit Boards, Digital-Design Levels. Digital Circuits: Logic Signals and Gates, Logic Families, CMOS Logic, Electrical Behavior of CMOS Circuits, CMOS Steady-State Electrical Behavior, CMOS Dynamic Electrical Behavior, CMOS Logic Families, Bipolar Logic, Transistor-Transistor Logic, TTL Families, CMOS/TTL Interfacing, Low Voltage CMOS Logic and Interfacing, Emitter-Coupled

Logic. Combinational Logic Design Principles: Switching Algebra, Combinational-Circuit Analysis, Combinational- Circuit Synthesis, Programmed Minimization Methods, Timing Hazards, The VHDL Hardware Description Language. Combinational Logic Design Practices: Documentation Standards, Circuit Timing, Combinational PLDs, Decoders, Encoders, Three-State Devices, Multiplexers, Exclusive- OR Gates and Parity Circuits, Comparators, Adders, Subtractors, ALUs, Combinational Multipliers. Sequential Logic Design Principles: Bistable Elements, Latches and Flip-Flops, Clocked Synchronous State-Machine Analysis, Clocked Synchronous State-Machine Design, Designing State Machines Using State Diagrams, State-Machine Synthesis Using Transition Lists, Decomposing State Machines, Feedback Sequential Circuits, Feedback Sequential-Circuit Design, VHDL Sequential-Circuit Design Features. Sequential Logic Design Practices: Sequential-Circuit Documentation Standards, Latches and Flip-Flops, Sequential PLDs, Counters, Shift Registers, Iterative versus Sequential Circuits, Synchronous Design Methodology. Combinational-Circuit and Sequential-Circuit Design Examples using VHDL.

Recommended books:

[1] John F. Wakerly, “Digital Design: Principles and Practices”, Prentice Hall, 4th edition , 2005, ISBN: 978-0131733497.

[2] Volnei A. Pedroni, “Circuit Design and Simulation with VHDL”, The MIT Press, 2nd edition, 2010, ISBN: 978-0262014335.

ECE 517: Thin film Technologies
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to thin films: Nucleation, growth, kinetics and thermodynamics of materials; Physical vapor deposition, Chemical vapor deposition, Plasma / Ion beam deposition, Epitaxial thin films: LPE, MBE, MOCVD; Film formation, Thin film characterization, Interdiffusion and reaction in thin films, Film formation, structural and physical properties: thickness, composition, morphology, mechanical properties, uniformity, grain size, Electrical, Optical and Magnetic properties of thin films, Electrical conduction in thin films- size effects, interface properties, electromigration. Applications and emerging technologies: Thin films for microelectronics, MEMS, optical coatings, photodetectors, smart sensors, xerographic devices, TFTs, switching devices, antiabrasive coatings, solar cells, superconducting and GMR devices, integrated optics, thin film superlattices, quantum and nano devices, bioelectronics devices.

Recommended books:

[1] Zexian Cao, "Thin Film Growth: Physics, materials science and applications", Woodhead Publishing, 2011, ISBN: 978-1845697365.

[2] Donald Smith, "Thin-Film Deposition: Principles and Practice", McGraw-Hill Professional, 1st edition, 1995, ISBN: 978-0070585027.

[3] R. W. berry, P. M. Hall and M. T. Harris, "Thin Film Technology", Van Nostrand Reinhold Inc., U.S., 1968, ISBN: 978-0442007171.

ECE 519: Laser Processing of Materials
Credit : 2.00
Contact Hours: 2hrs/week

Common industrial lasers and their output characteristics: Gas Lasers, Solid-state Lasers, Dye Lasers, Free-electron Lasers. Fundamentals of Laser-Material Interactions: Heat in Solids, Single Photon and Multi-Photon Processes, Laser Reflection & Absorption, Vaporization, Recondensation, Plasma Formation. Laser Plasma Interaction: Processes in Nanosecond LaserPlasma Interactions, Plasma Interactions with Femtosecond Laser Pulses. Overview of Laser Applications: Laser Application in Various Fields, Advantages & Disadvantages, Economics. Laser processing fundamentals: Beam characteristics, Optical Components and Design of Beam Delivery Systems, Absorption Characteristics of Materials, Heat Flow Theory and Metallurgical Considerations. Working principles of interferometers and elementary holography. Laser Cutting, Drilling, and Piercing: process characteristics, material removal modes, development of theoretical models and practical performances. Welding: process mechanisms like keyhole and plasma, development of theoretical models, operating characteristics and process variation. Laser Surface Treatment: Heat Treatment, Surface Melting, Surface Alloying & Cladding, Surface Texturing, development of theoretical models, LCVD and LPVD. Micro/Nano-Machining of Materials: Optical Waveguides, Photonic Devices & Circuits, Photonic Crystals, Metamaterials, Micro/NanoFluidic Channels. Laser Cleaning: Mechanisms of Laser Cleaning, Overview of Laser Cleaning Process. Biomedical Laser Processes and Equipment: Interaction of Laser Radiation with Biological Tissues, Medical Applications of Lasers, Medical Diagnostics, Laser Manufacture of Medical Devices. Laser Automation and In-process Sensing: Automation Principles, In-process Monitoring, In-process Control. Laser Safety.

Recommended books:

[1] Peter Schaaf, "Laser Processing of Materials: Fundamentals, Applications and Developments", Springer, 1st edition, 2010, ISBN: 978-3642132803.

[2] John C. Ion, "Laser Processing of Engineering Materials: Principles, Procedure and Industrial Application", Butterworth-Heinemann, 2005, ISBN: 978-0080971896.

[3] William M. Steen and Jyotirmoy Mazumder, "Laser Material Processing," Springer, 4th edition, 2010, ISBN: 978-1-84996-061-8.

[4] John Dowden, "The Theory of Laser Materials Processing," Springer, 1st edition, 2009, ISBN: 978-1-4020-9339-5.

Communications and Control Systems

ECE 531: Statistical Theory of Communication
Credit : 2.00
Contact Hours: 2hrs/week
An introduction to statistical communication theory. Statistical preliminaries: Probability distributions and distribution densities, Random Processes, time and ensemble averages, Ergodicity. Spectra, covariance and correlation functions. Sampling, interpolation and random pulse trains. Basics of information theory. Random noise processes. Signal detection and extraction. Binary detection systems minimizing average risk: The average risk, Optimum detection, The Neyman-Pearson detection system, The ideal observer detection system, Minimax detection rule, Threshold detection. Extraction systems minimizing average risk: Estimates, Estimators, Cramer-Rao Inequality, Maximum likelihood estimation, Bayes Extraction with cost functions, coherent and incoherent estimation of signal amplitudes, Waveform estimation. Information measures in reception: Information and sufficiency, Information-loss criterion for detection/extraction.

Recommended books:

[1] David Middleton, "Introduction to Statistical Communication Theory", Peninsula Pub, 1987, ISBN: 978-0932146151.

[2] Y. W. Lee, "Statistical Theory of Communication", Dover Publications, 2004, ISBN: 978-0486438900.

ECE 533: Data Mining
Credit : 2.00
Contact Hours: 2hrs/week

Data Warehouse: Definition, The compelling need for data warehouse, Data warehouse architecture, 2-tiere, 3-tiere data warehouse, OLAP and Multidimensional data analysis.
Data Mining: Introduction, scope, Types of data, Data processing, Measures of Similarity and dissimilarity, Summary statistics, Data visualization.
Classification: Basic concepts, Decision tree, Attribute Selection measure, Nearest-neighbor classifiers, Bayesian classifier, Naïve Bayes Classifier, Rule-based classifier, Classification by back propagation, ANN, Support vector machine.
Cluster Analysis: Introduction, Types of clusters, Partitioning Methods, Hierarchical Methods, Density based Methods, Grid-Based and Model-Based Methods, Clustering high dimensional data.
Association Analysis: Basic concept, frequently item-set generation: The Apriori principles, Candidate Generation, Support Count; Rule generation, Mining various kinds of association rules, Correlation analysis.
Complicated Data Mining: Graph-Based Clustering, Graph mining, Subgraph mining, mining sequential pattern,
Books Recommended:
1. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber.
2. Introduction to Data Mining, Pang-Ning Tan,Michael Steinbach,Vipin Kumar.

ECE 535: Telecommunication Networks
Credit : 2.00
Contact Hours: 2hrs/week

Telecommunications Fundamentals: History of Telecommunications, Telecommunications in AsiaPacific Region, Telecom Organizations and Standardization. Public Switched Telephone Network (PSTN): International, National and Local Networks topology, Transmission Media and systems: Twisted-Pair Copper Cable, Coaxial Cable, Microwave, Satellite, Fiber Optics, Microwave Radio Relay Lines, Satellite Communications Networks, Optical Fiber Communication Networks, Mobile Communication Systems, Wireless Local Loop Systems. Integrated Services Digital Network (ISDN): Principle of ISDN, ISDN Standardization. Mobile network: Ad Hoc network, Cellular network, capacity, Bluetooth. Local area network: Network sharing techniques, inter networking: TCP, IP congestion control. High speed network [ATM]: Architecture, Services; Protocol; Traffic Control; Adaptation layer.

Recommended books:

[1] Tarek N. Saadawi and Mostafa H. Ammar , " Fundamentals of Telecommunication Netowrks", Wiley-Interscience, 1st edition, 1994, ISBN: 978-0471515821.

[2] Roger L. Freeman, "Telecommunication System Engineering", Wiley-Interscience, 4th edition, 2004, ISBN: 978-0471451334.

ECE 537: Cellular Mobile Systems
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems. Mobile Radio Propagation: Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, statistical models for multipath fading channels. Modulation Techniques: Minimum Shift Keying, Gaussian MSK, M-ary QAM, M-ary FSK, Orthogonal Frequency Division Multiplexing, Performance of Digital Modulation in Slow-Flat Fading Channels and Frequency Selective Mobile Channels. Equalization: Survey of Equalization Techniques, Linear Equalization, Non-linear Equalization, Algorithms for Adaptive Equalization. Diversity Techniques, RAKE receiver. oding: Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, RS codes for CDPD. Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Capacity of Cellular CDMA and SDMA. Wireless Systems and Standards: Second Generation, Third Generation and fourth Generation Wireless Networks and Standards, WLL, Bluetooth, AMPS, GSM, IS-95, DECT.

Recommended books:

[1] Ian poole, "Cellular Communications Explained: From Basics to 3G", Newnes, 1st edition , 2006, ISBN: 978-0750664356.

[2] Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press 2005, ISBN: 978-0521843478.

ECE 539: Microwave Theory and Techniques
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to Microwaves: History of Microwaves, Microwave Frequency bands, Applications of Microwaves. Mathematical model of Microwave Transmission: Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission. Analysis of RF and Microwave Transmission Lines: Coaxial Line, Rectangular Waveguide, Circular waveguide, Stripline, Microstrip Line. Microwave Network Analysis: Equivalent Voltages and currents for non-TEM lines, Network parameters for microwave Circuits, Scattering Parameters. Microwave Design Principles: Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Modern Trends in Microwaves Engineering: Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC), Monolithic Microwave IC fabrication, RFMEMS for microwave components, Microwave Imaging.

Recommended books:

[1] Stephen F. Adam, “Microwave Theory and Applications”, Adam Microwave Consulting, 1992, ISBN: 978-0963428400.

[2] Robert E. Collin, “Foundations for Microwave Engineering”, Wiley-IEEE Press, 2nd edition, 2000, ISBN: 978-0780360310.

ECE 541: Advanced Microprocessors
Credit : 2.00
Contact Hours: 2hrs/week

Advanced Microprocessor Architecture: Internal Microprocessor Architecture, Real mode memory addressing, Protected Mode Memory addressing, Memory paging, Data addressing modes, Program memory addressing modes, Stack memory addressing modes, Data movement instructions, Program control instructions, Arithmetic and Logic Instructions. Pentium Processors: Introduction to Pentium Microprocessor, Special Pentium registers, Pentium memory management, New Pentium Instructions, Pentium Processor, Special Pentium pro features, Pentium 4 processor. 16-Bit Micro Controller: 8096/8097 architecture, CPU registers, RALU,

Internal Program and Data memory Timers, High speed Input and Output, Serial Interface, I/O ports, Interrupts, A/D converter, Watch dog timer, Power down feature, Instruction set, External memory Interfacing, External I/O interfacing. RISC Processors and ARM: The RISC revolution, Characteristics of RISC Architecture, The Berkeley RISC, Register Windows, Windows and parameter passing, Window overflow, RISC architecture and pipelining, Pipeline bubbles, Accessing external memory in RISC systems, Reducing the branch penalties, Branch prediction, The ARM processors, ARM registers, ARM instructions, The ARM built-in shift mechanism, ARM branch instructions, sequence control, Data movement and memory reference instructions.

Recommended books:

[1] Barry B. Brey, "Intel Microprocessors", Prentice Hall, 8th edition, 2008, ISBN: 978-0135026458.
[2] N. Senthil Kumar, M. Saravanan and S. Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, USA, 2011, ISBN: 978-0198066477.
[3] Alan Clements, "The principles of computer Hardware", Oxford University Press, 4th Edition, 2006, ISBN: 978-0199273133.
[4] John B. Peatman, "Design with Microcontrollers", Mcgraw-Hill College, 1988, ISBN: 978-0070492387.

ECE 543: Advanced Digital Signal Processing
Credit : 2.00
Contact Hours: 2hrs/week

Parametric Methods for Power Spectrum Estimation: Relationship between the auto correlation and the model parameters, The Yule-Walker method for the AR Model Parameters, The Burg Method for the AR Model parameters, unconstrained least-squares method for the AR Model parameters, sequential estimation methods for the AR Model parameters, selection of AR Model order. Adaptive Signal Processing: FIR adaptive filters, steepest descent adaptive filter, LMS algorithm convergence of LMS algorithms, Application- noise cancellation, channel equalization , adaptive recursive filters, recursive least squares. Multirate Signal Processing: Decimation by a factor D, Interpolation by a factor I, Filter Design and implementation for sampling rate conversion-Direct form FIR filter structures, Polyphase filter structure. Speech Signal Processing: Digital models for speech signal-Mechanism of speech production, model for vocal tract, radiation and excitation, complete model, time domain processing of speech signal- Pitch period estimation, Linear predictive Coding-Basic Principles, autocorrelation method, Durbin recursive solution. Introduction to Wavelet Transforms.

Recommended books:

[1] John G. Proakis and Dimitris K. Manolakis, "Digital Signal Processing", Prentice Hall, 4th edition, 2006, ISBN: 978-0131873742.

[2] Saeed V. Vaseghi, "Advance Digital Signal Processing and Noise Reduction", Wiley, 4th edition, 2009, ISBN: 978-0470754061.

ECE 545: Optical Networks

Credit : 2.00

Contact Hours: 2hrs/week

Optical networking: principles and challenges; evolution of optical networks, wavelength routed network, wavelength division multiplexing (WDM) network, sub-carrier multiplexing optical networks. Enabling technologies: optical transmitter, optical fiber, optical receivers, optical amplifiers, optical switching elements, optical cross-connects (OXC), multiplexers/demultiplexers, filters, wavelength routers, optical wavelength converters, WDM network test beds. Network architecture, IP over WDM. Broadcast optical networks: single and multiple hop networks, channel sharing and multi-casting, shared channel multicasting network-GEMNET, performance evaluation for unicast and multicast traffic, experimental WDM networks. Wavelength routed networks: virtual topology design, routing and wavelength assignment, circuit switched, and packet switched approaches, performance evaluation. Reconfiguration in WDM network, network control and management, network optimization, design considerations. Multi wavelength star and ring networks. Network Survivability. Passive optical networks (PONs). Photonic switching, ptical TDM (OTDM) and optical CDMA (O-CDMA) networks, next generation optical networks.

Recommended books:

[1] Leonid G. Kazovsky, Ning Cheng, Wei-Tao Shaw, David Gutierrez and Shing-Wa Wong, "Broadband Optical Access Networks", Wiley-Interscience, 1st edition, 2011, ISBN: 978-0470182352.

[2] Jane M. Simmons, "Optical Network Design and Planning", Springer, 2010, ISBN: 978-1441945556.

[3] Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks," Academic Press, 2nd edition, 2002, ISBN: 1-55860-655-6.

Semester: January-June (Compulsory)

Course Code	Course Title	Credit Hour
ECE 551	Nanophotonics and Metamaterials	2
ECE 553	Microcontroller and Embedded System	2
ECE 555	Advanced Wireless Communication	2
ECE 557	Advanced Artificial Intelligence and Robotics	2
	Research (satisfactory/unsatisfactory)	(3)

Details Course

ECE 551: Nanophotonics and Metamaterials
Credit : 2.00
Contact Hours: 2hrs/week

Introduction: Nanophotonics at a glance. Foundations for Nanophtonics: Maxwell Equations, Quantum Mechanics, Optics, Principles of Nanophotonics. Light generation by nanostructures: semiconductor quantum wells, wires, dots, nanocrystals, nanowires. Light propagation in nanostructures: nanowires, nano-waveguides. Nanolasers: laser basics, nanowire lasers. Photonic crystal: Theoretical modeling of photonic crystals, Features of photonic crystals, phase, group and energy velocity; defect mode. Near-field interaction and microscopy: Near-field optics and theoretical modeling of near-field nanoscopic interactions, Near-field interaction & microscopy. Plasmonics: Plasmonic fundamentals and sensors, Local field enhancement, Plasmonic waveguiding, Super-resolution imaging, Metamaterials, Nanolithography. Silicon Photonics: basic properties of Si materials and design guidelines in Si-photonics, silicon photonic waveguides, optical modulators in silicon photonics circuits, silicon lasers.
Recommended books:

[1] Sergey V. Gaponenko, “Introduction to Nanophotonics”, Cambridge University Press, 1st edition, 2010, ISBN: 978-0521763752.

[2] Paras N. Prasad, “Nanophotonics”, Wiley-Interscience, 1st edition, 2004, ISBN: 978-0471649885.

[3] Motoichi Ohtsu, Kiyoshi Kobayashi, Tadashi Kawazoe, Takashi Yatsui, and Makoto Naruse,” Principles of Nanophotonics,” CRC Press, 1st edition, 2008, ISBN : 978-1-58488-972-4.

[4] Dennis W. Prather, Shouyuan Shi, Ahmed Sharkawy, Janusz Murakowski, and Garrett J. Schneider, “Photonic Crystals,” John Willey & Sons, 1st edition, 2009, ISBN: 978-0-470-27803-1.

[5] Stephan A. Maier, "Plasmonics: Fundamentals and Applications," Springer, 1st edition, 2007, ISBN: 978-0387-33150-8.

[6] Graham T. Reed, "Silicon Photonics," John Willey & Sons, 1st edition, 2008, ISBN: 978-0-470-02579-6.

ECE 553: Microcontroller and Embedded System
Credit : 2.00
Contact Hours: 2hrs/week

Introductions, Concepts, Classifications, Characters, Requirements, Introduction to embedded systems design process, Unified modeling language (UML), Embedded micro-controller cores, Embedded memories, technological aspects, Interfacing between analog digital blocks, signal conditioning, Digital signal processing, Sub-system interfacing with external systems, user interfacing, Design trade-offs, Thermal considerations, Networked embedded systems, The 12C bus, CAN bus, Flex ray, Example of applications.

ECE 555: Advanced Wireless Communication
Credit : 2.00
Contact Hours: 2hrs/week

Wireless Medium: Air Interface Design, Radio propagation mechanism, Path-loss modeling and Signal Coverage, Effect of Multipath and Doppler, Channel Measurement and Modelling, Simulation of Radio Channel. Wireless Medium Access: Fixed Assignment Access for Voice Networks, Random Access for Data Networks, Integration of Voice and Data traffic. Wireless Network Operation: Wireless Network Topologies, Cellular Topology, Cell fundamentals, Signal to Interference Ratio, Capacity Expansion, Mobility Management, Resources and Power Management, Security in Wireless Networks. Wireless WAN: GSM and TDMA Technology, Mobile Environment, CDMA Technology, IS95, IMT2000, Mobile Data Networks, CDPD Networks, GPRS, Mobile Application Protocol. Wireless LANs and HiperLANs: Introduction to wireless LANs, IEEE 802.11,WPAN IEEE 802.15 –Mobile Ad Hoc Networks (MANET)-Principle and operation. IEEE 802.16: WiMAX, IEEE 802.21: MIH (Media Independent Handover (MIH), IEEE 802.15.7:Visible Light Communication, IEEE 802.15.3c: High rate WPAN, WiMedia. Wireless Home Networking, Concepts of Bluetooth Technology.

Recommended books:

[1] Andreas F. Molisch , " Wireless Communications", Wiley, 2nd edition , 2011, ISBN: 978-0470741863.

[2] Savo G. Glisic, "Advanced Wireless Communications: 4G Cognitive and Cooperative Broadband Technology", Wiley-Interscience, 2nd edition, 2007, ISBN: 978-0470059777.

ECE 557: Advanced Artificial Intelligence and Robotics
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to AI and intelligent agents, State space representation of problems, Advanced search techniques in AI, Problem solving as constraint satisfaction, Logical agents and automated inference, Problem solving as planning, Creating plans in complex and unknown environments, Representing uncertain knowledge, Probabilistic reasoning, Bayesian networks, Temporal reasoning, Utility theory for decision making with uncertain knowledge, Automated learning from examples, Knowledge-based learning, Probabilistic and reinforcement learning, Learning in neural belief networks, Practical natural language processing, Computer vision, Introduction to Robotics, Automation & autonomy architectures; Robot hardware: sensors, effectors; Robotic mapping: localization, Monte Carlo localization, multi-object localization; Robotic navigation and locomotion: motion planning, dynamics and control; Human-robot interaction.

Recommended books:

[1] M. Team Jones, "Artificial Intelligence: A Systems Approach", Jones and Bartlett Publishers, Inc, 1st edition, 2008, ISBN: 978-0763773373.

[2] Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, 3rd edition, 2009, ISBN: 978-0136042594.

[3] Patrick Henry Winston, "Artificial Intelligence", Addison Wesley, 3rd edition, 1992, ISBN: 978- 0201533774.

Semester: January-June (Optional)
Choose one Course from each Group

Course Code	Course Title	Group	Credit hour
ECE 561	Advanced Quantum Electronics	Electronics and Circuits	2
ECE 563	Power Semiconductor Circuits		
ECE 565	Advanced Electronic Engineering Materials		
ECE 567	Biomedical Signal Processing		
ECE 569	Renewable Power Generation Sources		
ECE 581	Free Space Optical Communication	Communications and Control Systems	2
ECE 583	Multicarrier Communication		
ECE 585	Network Management		
ECE 587	Wireless Sensor Networks		
ECE 589	Network Security		
ECE 591	Bioinformatics		
ECE 593	Advanced Multimedia Communications		
ECE 595	Teletraffic Engineering		

Electronics and Circuits

ECE 561: Advanced Quantum Electronics
Credit : 2.00
Contact Hours: 2hrs/week

Basic notions of quantum electronics: Stimulated emission, Population inversion, Feedback and the lasing condition, Saturation and relaxation. History of quantum electronics, Stimulated quantum transitions, Density matrix, Populations of levels, Evolution of the density matrix. Susceptibility of matter: general properties of susceptibility, dispersion theory, two-level model and saturation, Bloch equations. Non-stationary optics: stimulated non-stationary effects, emission of an atom, collective emission. Nonlinear optics, The Kirchhoff law of quantum amplifiers, basic concepts of the statistical optics, Hamiltonian form of Maxwell's equations, Quantization of the field, States of the fields and their properties, Statistics of photons and photoelectrons, Interaction of an atom with quantized field, Recent progress in quantum electronics.
Recommended books:

[1] Maria Chekhova and Sergey Kulik, "Physical Foundations of Quantum Electronics", World Scientific Publishing Company, 1st edition, 2011, ISBN: 978-9814324502.

[2] D. Marcuse, "Principles of Quantum Electronics", Academic press, 1980, ISBN: 978-0124710504.

ECE 563: Power Semiconductor Circuits
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to power electronics, Static switching devices, characteristics of SCR, BJT, MOSFET, IGBT, SIT, GTO, MCT. Classifications of static power converters and their applications, Control circuits for static power converters, PWM control of static power converters. Switch mode DC to DC converters, Resonant converters, Fourier analysis of static converter waveforms, HD, THD, pf, ZVS and ZCS of static converters. Hysteresis current of AC drives, Design of SCR communication circuits, Design of protection circuits for static power converters.

Recommended books:

[1] Shashi B. Dewan and Alan Straughen, "Power Semiconductor Circuits", John Wiley & Sons, 1975, ISBN: 978-0471211808.

[2] B. J. Baliga, "Fundamentals of Power Semiconductor Devices", Springer, 1st edition, 2008, ISBN: 978-0387473130.

ECE 565: Advanced Electronic Engineering Materials
Credit : 2.00
Contact Hours: 2hrs/week

Electric Properties: Polarization, electrical conductivity and dielectric losses. Pyroelectric phenomena. Piezoelectric effect and electrostriction. Domain structure and peculiarities, electric properties of ferroelectrics and anti-ferroelectrics. Structure and properties of some ferroelectrics and anti-ferroelectrics. Phase transition in ferroelectrics, fundamentals of spontaneous polarization theory. Magnetic Properties: Disordered magnetics, ordered magnetics. Domain structure of ferromagnetic crystals and magnetization processes. Anisotropy of ferroelectric crystals. Structure of some magnetically ordered crystals and reorientation transition. Piezomagnetic and magnetoelectric effect.

Recommended books:

[1] Philippe Robert, "Electrical and Magnetic Properties of Materials", Artech House Publishers, 1988, ISBN: 978-0890062623.

[2] W. Bolton, "Electrical and Magnetic Properties of Materials", Longman, 1991, ISBN: 978-0582070257.

ECE 567: Biomedical Signal Processing
Credit : 2.00
Contact Hours: 2hrs/week

Introduction to Human physiological system, Types of Biomedical signals: ECG, EEG, EMG, EOG, ERG etc. Introduction to short term Fourier transform (STFT), Design of filters using Hanning window, Hamming window, Kaiser window, Haar window. Introduction to Electrocardiograph and ECG signals, Types of interferences in ECG signals, ECG signal analysis and noise removal, Detection of ECG abnormalities, ANN-based ECG analysis system, Introduction to Electroencephalograph and EEG signals, EEG signal analysis, Kurtosis coefficients, Independent component analysis (ICA), Principle component analysis (PCA). Autoregressive (AR) Model, Fast Fourier Transform (FFT) and Inverse Fast Fourier Transform (IFFT), Data Compression methods: Arithmetic coding, Huffman coding, LZW coding, Bit-plane coding.

Recommended books:

[1] Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", CRC Press, 1st edition, 2005, ISBN: 978-0849320996.

[2] Geoff Dougherty, "Digital Image Processing for Medical Applications", Cambridge University Press, 1st edition, 2009, ISBN: 978-0521860857.

ECE 569: Renewable Power Generation Sources
Credit : 2.00
Contact Hours: 2hrs/week

Basic characteristics of sunlight, solar energy resource, photovoltaic cell-characteristics, equivalent circuit, photo voltaic for battery charging. Wind source, wind statistics, energy in the wind, aerodynamics, rotor types, forces developed by blades, Aerodynamic models, braking systems, Power control and monitoring system, power performance. Wind driven induction

generators, power circle diagram, steady state performance, impact on central generation, transmission and distribution systems, wind farm electrical design. Wind-diesel systems, fuel savings, permanent magnet alternators, modeling, steady state equivalent circuit, self-excited induction generators, integrated wind-solar systems. Micro-hydroelectric systems, power potential, scheme layout, generation efficiency and turbine part flow-isolated and parallel operation of generators, geothermal-tidal and Ocean Thermal Energy Conversion (OTEC) systems.

Recommended books:

[1] John F. Walker and Nick Jenkins, "Wind energy Technology", John Wiley and sons, 1st edition, 1997, ISBN: 978-0471960447.

[2] Van Overstraeton and R. P. Mertens, "Physics, Technology and use of Photovoltaics", Taylor & Francis, 1st edition, 1986, ISBN: 978-0852744871.

Communications and Control Systems

ECE 581: Free Space Optical Communication
Credit : 2.00
Contact Hours: 2hrs/week

Introduction: Technology Overview, System Configurations, Evolution of Infrared Communication Systems, The Optical Wireless Channel, Design Fundamentals, Power Budget Considerations. Atmospheric Transmission, Effect of Rain, Fog and Mist, Scintillation, Data Transmission Limitations, Eye Safety, Light-Emitting Diodes versus Laser Diodes, Fundamentals of Optical Concentration, Optical Concentrators, Optical Wireless Transmitter Design, Optical Source Characteristics, External Optical Modulators, Direct Digital Modulator, Driver Circuit Design Concepts, Transmitter Linearization Techniques, Optical Wireless Receiver Design, Photodetection in Reverse-Biased Diodes, Choosing the Photodetector, Bit Error Rate and Sensitivity, Bandwidth, Signal Amplification Techniques, Transceiver Circuit Implementation Technologies-Hybrid and Monolithic Integration. Optical Modulation, Coding, and Multiple Access techniques. Infrared Data Association (IrDA) Protocols. Wireless Infrared Networking: Network Architecture, Optical Wireless Network Specifications, The Ad Hoc Network, Quality of Service, Future Infrared Networking.

Recommended books:

[1] Roberto Ramirez-Iniquez, Sevia M. Idrus and Ziran Sun , "Optical Wireless Communications: IR for Wireless Connectivity", Wiley-Interscience, 1st edition , 2008, ISBN: 978-0849372094.

[2] Steve Hranilovic, "Wireless Optical Communication systems", Springer, 1st edition, 2010, ISBN: 978-1441919823.

ECE 583: Multicarrier Communications
Credit : 2.00
Contact Hours: 2hrs/week

Direct-Sequence Spread Spectrum, Multicarrier Spread-Spectrum Communications, Frequency Hopped Spread-Spectrum Communications, Time-Hopping Spread-Spectrum Communications, Principles of Single carrier and Multicarrier Communications, Orthogonal Frequency-Division Multiplexing (OFDM), Frequency-Domain Spread Multicarrier CDMA, Single-Carrier Frequency Division Multiple Access, Orthogonal Multicarrier DS-CDMA, Multi-tone DS-CDMA, Generalized Multicarrier DS-CDMA, Time-Hopping Multicarrier CDMA, Time-Frequency-Domain Spread Multicarrier DS-CDMA, Performance of Multicarrier Systems over Gaussian Channels, Performance of Multicarrier Systems over Frequency-Selective Fading Channels, Coherent Multiuser Detection, Non-coherent Multiuser Detection, Multiuser Transmitter Pre-processing, Multiple-Input Multiple-Output (MIMO) Communications, Spatial Diversity, Spatial-Division Multiple Access, Performance of Multicarrier CDMA Using Space–Time Coding, Time-Frequency Domain Space–Time Spread Multicarrier DS-CDMA, Space–Time MC DS-CDMA over Fast Time Varying Fading channels.

Recommended books:

[1] Lie-Liang Yang , "Multicarrier Communications", Wiley, 1st edition , 2009, ISBN: 978-0470722008.

[2] Carl R. Nassar, Bala Natarajan, Zhiqiang Wu, David A. Wiegandt, S. Alireza Zekavat and Steve Shattil, "Multi-Carrier Technologies for Wireless Communication", Springer, 1st edition, 2010, ISBN: 978-1441949370.

ECE 585: Network Management
Credit : 2.00
Contact Hours: 2hrs/week

Overview. Standards, Models, and Functions. A Framework for Network Management: TMN. SNMP v1 Network Management: Organization Models. SNMP v1 Network Management: Information Models. SNMP v1 Network Management: Communication and Functional Models. SNMPv2. SNMPv3. RMON. NM Applications – Configuration management. NM Applications – Fault and Performance Management. NM Applications – Security and Accounting Management. Web Based Management. NM Tools.

Recommended books:

[1] Mani Subramanian 'Network Management: Principals and Practice' Addison Wesley, 1st edition, 1999, ISBN: 978-0201357424.

[2] William Stallings, "SNMP, SNMPv2, SNMPv3, and RMON 1 and 2", Addison-Wesley Professional, 3rd edition, 1999, ISBN: 978-0201485349.

ECE 587: Wireless Sensor Networks
Credit : 2.00
Contact Hours: 2hrs/week

Introduction of Ad hoc/ Sensor networks: Key definitions of Ad hoc/ Sensor networks, Advantages of Ad hoc/ Sensor networks, Unique constraints and challenges, Driving applications. Wireless communications/Radio characteristics. Ad-hoc wireless networks. Media Access Control (MAC) Protocols: Issues in designing MAC protocols, Classification of MAC protocols, MAC protocols. Routing protocols: Issues in designing Routing protocols, Classification of Routing protocols, Routing protocols. Networking sensors: Unique features, Deployment of Ad hoc/ Sensor network, Sensor tasking and control, Transport layer and security protocol. Sensor network platform and tools: Berkley Motes, Sensor network programming challenges, Embedded operating systems, Simulators. Applications of Ad hoc/ Sensor network and future direction: Ultra wideband radio communication, Wireless fidelity systems.

Recommended books:

[1] Xiang-Yang Li, "Wireless Ad Hoc and Sensor Networks: Theory and Applications", Cambridge University Press, 2008, ISBN: 978-0521865234.

[2] Maggie Xiaoyan Cheng and Deying Li, "Advances in Wireless Ad Hoc and Sensor Networks", Springer, 2010, ISBN: 978-1441943286.

ECE 589: Network Security
Credit : 2.00
Contact Hours: 2hrs/week

Network Security Overview, Introduction to Critical Infrastructure Protection, Risk Analysis Theory and Practice, Eavesdropping and Wiretapping, Informants and Surveillance, Cyber Crime and Cyber Criminals, Privacy and Cyberspace Law, Privacy and Information Operations, The Modus Operandi of Hacking, Cyberterrorism and Cyber vigilantism, Cyberterrorism Threat Spectrum, Algorithm Security, Application Software Security Land-Based Networks, Application Software Security Wireless Networks, Systems Software Security, Intrusion Detection, Incident Response and Integrity Control, Malware, Spyware, Riskware and Spam, Identity Theft and Consumer Profiling, Disaster Data Recovery and Computer Forensics.

Recommended books:

[1] Robert Moore, "Cybercrime: Investigating High-Technology Computer Crime", Anderson, 2nd edition, 2010, ISBN: 978-1437755824.

[2] William Stallings, "Cryptography and Network Security: Principles and Practice", Prentice Hall, 5th edition, 2010, ISBN: 978-0136097044.

[3] Sean Convery, "Network Security Architectures", Cisco Press, 1st edition, 2011, ISBN: 978-1587142970.

ECE 591: Bioinformatics
Credit : 2.00
Contact Hours: 2hrs/week

Introduction. Molecular biology basics: DNA, RNA, genes, and proteins. Restriction mapping algorithm. Motif in DNA sequences, motif finding algorithms. Genome rearrangements, sorting by reversals and breakpoints. DNA sequence alignments. Gene prediction. Space-efficient sequence alignments, sub-quadratic alignment, DNA sequencing, genome sequencing, protein sequencing, spectrum graphs. Combinatorial pattern matching: Exact pattern matching, heuristic similarity search algorithms, approximate string matching, BLAST, FASTA. Clustering: Microarrays, hierarchical clustering, K-means clustering, corrupted Cliques problem, CAST clustering algorithm, Evolutionary trees. Feature extraction of different Biosignals.

Recommended books:

[1] Arthur Lesk, "Introduction to Bioinformatics", Oxford University Press, USA, 3rd edition, 2008, ISBN: 978-0199208043.

[2] Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", The MIT Press, 1st edition, 2004, ISBN: 978-0262101066.

[3] Marketa Zvelebil and Jeremy Baum, "Understanding Bioinformatics", Garland Science, 1st edition, 2007, ISBN: 978-0815340249.

ECE 593: Advanced Multimedia Communications
Credit : 2.00
Contact Hours: 2hrs/week

Multimedia information representation, Multimedia networks, Multimedia services and applications, Network QoS and application QoS, Transform coding, Motion compensated predictive coding; Information representation: text, image, audio and video; Text and image compression: compression principles, text compression, image compression; Audio and Video compression: Audio compression, Video compression, Video compression principles, Multimedia compression standards: JPEG, H.26x, MPEG 1/2/4/7, AVC, Scalable Video Coding, Other coding formats for text, speech, image and video, Multimedia communication across networks: Layered video coding, Error relevant video coding techniques, Multimedia transport across IP networks and relevant products such as RSVP, RTP, RTCP, DVMRP, Multimedia in

mobile networks, Multimedia broadcast networks, Content based retrieval in digital libraries, End-to-End QoS for video delivery, Wireless video, Error control in video streaming, Cross-layer video adaptation.

Recommended books:

[1] Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press, 1st edition, 2012, ISBN: 978-1439874844.

[2] Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards", Addison Wesley, 1st edition, 2000, ISBN: 978-0201398182.

ECE 595: Teletraffic Engineering

Credit : 2.00

Contact Hours: 2hrs/week

Teletraffic Theory Statistical characterization of telecommunications traffic. The Erlang C formula and its applications. Circuit efficiency, grade of service and measurement of congested circuits. Dimensioning of telephone circuits and switches. Switching Evolution of circuit switching systems. Space switching, time switching, and stored program control (SPC) switching. Blocking and non-blocking switches. Packet switching with comparison to circuit switching. Signaling Evolution of signaling systems. The CCITT no. 7 signaling system Transmission Multiplexing hierarchies – PCM and time division multiplexing, SONET, SDH and WDM techniques and networks. Data Transmission, Transmission in LANS. Transmission in WANS – X.25, Frame Relay. Asynchronous Transfer Mode (ATM). Congestion control in data transmission, Convergence of Technologies Voice and video over packet switching networks. Integrated networks. Applications in multimedia communications Introduction, Telecommunications transmission, Evaluation of switching systems, Telecommunications traffic, Switching networks, Time-division switching, Control of switching systems, Signaling, Packet switching, Networks, Signals and channels, Analogue modulation theory, Discrete signals, Noise in analogue communications systems, Noise in digital communications systems, High-frequency transmission lines, Antennas, Active microwave devices, Passive microwave devices, Telephony, Television systems, Optical fiber communications, Packet switched networks, Satellite communications, Mobile communication systems

Reference Books:

1) Telecommunications Switching, Traffic and Networks, J. E. Flood

2) Telecommunications Engineering, J. Dunlop, D.G. Smith