Graduate Courses Descriptions for students of Electrical Engineering

1712511 Analog Integrated Circuit Design   3 Cr.

CMOS Fabrication Technology, Basic Operation of MOS Transistors, CMOS Amplifiers, Common Source Amplifier, Common Drain Amplifier, Common Gate Amplifier, Folded Cascode Amplifier, Current Sources, Differential Amplifiers, Large Signal Characteristic, Differential Pair with Active Load, Common-Mode properties, Frequency Response of CMOS Amplifiers, Noise in CMOS Amplifiers.

1712513 Semiconductor Device Fabrication   3 Cr.

Review of semiconductor physics, Crystal growth, thermal oxidation, diffusion, ion implantation , epitaxy and chemical vapor deposition, lithography, etching, layout, a sample integrated circuit fabrication process.

1712518 Semiconductor Devices   3 Cr.

Review of the quantum physics, Introduction to the physics of semiconductors, Fermi level, PN Junction, Bipolar Junction Transistor , Physics, Models: Ebers-Moll and Gummel-Poon, MOS physics, MOS capacitor structure, MOSFET physics , Advanced theory of MOSFET, Short and narrow channel effects, Sub-threshold region, Level-3 and BSIM SPICE models, Scaling, Microwave semiconductor Devices (in case of enough time), Transferred Electron Devices- Gunn Diode, IMPact Avalanche and Transit Time – IMPATT, BARrier Injection Transit Time – BARITT

1712522 VLSI Circuit Design   3 Cr.

Introduction to MOS and BICMOS technologies, MOS transistors characteristics, design and process parameters, DC analysis of CMOS logic structures, ratio and ratio less logic structures, circuit elements and delay models, static and dynamic logic families, subsystem circuits, scaling, I/O circuits, CMOS test methods.

1712528 CMOS Integrated Circuits Design   3 Cr.

CMOS Operational Amplifiers, General Specification of the Operational Amplifiers, Different Operational Amplifier Structures, Two-Stage Operational Amplifier, Telescopic Cascode Operational Amplifier, Folded-Cascode Operational Amplifier, Current Mirror Operational Amplifier, Rail to Rail input swing Operational Amplifier, Fully Differential Operational Amplifiers, Common Mode Feedback (CMFB) Concept, Different CMFB circuits, continuous time and switched capacitor CMFB , Analysis of some different fully differential Op-Amp Architectures , CMOS Output Stages, CMOS Voltage and Current References Circuits, Switch-Capacitor Filters (in case of enough time)

1732539 VHDL   3Cr.

General review of integrated circuits fabrication, Y-chart and different description domains and levels of design abstraction, VHDL syntax, timing in VHDL, VHDL modeling techniques, algorithmic level design, gate level design, design of micro programmed control units, algorithmic level synthesis, scheduling techniques, allocation techniques, optimization.

1714511 Power Electronics   3 Cr.

Special topics in phase-controlled rectifiers (Transformers specifications, Twelve-pulse rectifiers, Sequential control, Effects on supply), Load commutated inverters (series and parallel resonant inverters), Voltage source inverters, Modulation techniques (Sinusoidal, Space vector, Selective harmonic elimination, random PWM), Current source converters, Multi-level inverters, PWM rectifiers, Introduction to dc-dc converters and switching power supplies, Modeling of switching power supplies, Single phase power factor correction (PFC), Introduction to dc drives

1714516 Control of Electrical Drives – 1   3 Cr.

Introduction (to fixed and variable speed drives), Dynamic of Electric Drives, Control of Electric Drives, DC Motor Drives, PM (Permanent Magnet) Synchronous motor drives, Induction motor drives, Fundamentals, V/f methods, Vector control method

1712524 High Frequency Power Conversion   3 Cr.

Introduction to soft switching, Resonant Converters : Series, Parallel, Series-Parallel in CCM and DCM modes, PWM control techniques in resonant converters, QRC and QSC converters : ZCS-QRC, ZVS-QRC, ZCS and ZVS QSC, ZVS Phase-shift PWM converters, ZVS-FB-PWM: Regular type, with saturating inductor, with

magnetizing inductance, ZVS-ML-Converters, Interleaved Converters, ZVZCS Phase-shift PWM Converters : ZCZVS-FB-PWM: With simple snubber, with auxiliary transformer, with active snubber, ZVT, ZCT and ZCZVT Converters : Basic converters, Isolated converters Active Clamp technique in DC-DC converters Application of this technique for current fed and voltage fed converters, Special DC-DC converters : Single soft switched PWM converters, Switched capacitor converter, Switched resonant capacitor converter, Switched resonator converter, Expansion of soft switching techniques to inverters

1714537 Vector Control of AC Drives   3 Cr.

Introduction to torque – controller drives, The space – phasor model of AC machines, Vector control of synchrous machines, Permanent – magnet machines, Reluctance machines, Electrically excited rotor, Speed and position estimator, Vector control of induction machines, Rotor, Stator or magnetizing – flux – oriented control, Direct and indirect vector control, Squirrel – cage, double – cage and doubly fed, Sensorless control techniques estimation, Rotor and stator resistances estimation, Direct torque control of induction machines

1714691 Power System Harmonics   3 Cr.

Fundamentals of harmonic, Power quality indices under harmonic distortion, Harmonic standards, Power under nonsinusoidal situations, Harmonic sources, Effects of harmonic on power system, Effects of harmonic on components, Harmonic measurement, Harmonic mitigation techniques, Methodology of passive filter design, Harmonic analysis, Harmonic load flow.

1714692 Electric Traction Systems   3 Cr.

Traction Forces & Mechanical equations, Power supply system for Electric Traction, Overhead equipment (OCS), Current Collection system, Traction motors & control, Power electronics of Traction (Rectifies, …), Traction system control & scheduling, EV & HEV, Vehicle Fundamentals, Electric vehicle & Hybrid electric vehicle configurations, Electric propulsion system, Hybrid propulsion system, EV & HEV Design & calculations

1714693 Application of Power Electronics in Power Systems   3 Cr.

Course content: Power electronics in transmission and distribution systems (FACTS and Custom Power devices), high power converters, parallel compensation in transmission systems (SVC, TCSC, STATCOM, series compensation in transmission systems, phase shifters, Unified Power Flow Controllers (UPFC), Interline Power Flow Controllers (IPFC), concept of instantaneous power, concepts of load compensation, Static Transfer Switches (STS), Distribution STATCOM, Dynamic Voltage restorer

1716511 Advanced Engineering Mathematics   3 Cr.

Advanced Linear Algebra, Linear space and mappings (rank and nullity, matrix representation of linear mapping), Matrices (characteristic value and vectors, invariant subspaces, minimal polynomial, nilpotent transformations, Jordan canonical form), Functions of matrices, Complex Analysis, Analytic functions, maximum modulus, entire and meromorphic functions, Laurent and Taylor series, radius of convergence, Cauchy integral formula and its applications, Goursat theorem, Liouville theorem, Morera theorem, Classification of singularities, Argument principle, Rouche theorem, winding number, Multivalued functions branch points and branch cuts, Riemann surfaces, Evaluation of various types of improper integrals, summation of infinite series, Analytic continuation, Schwarz reflection principle, Gamma and Bata functions, Conformal Mapping, Harmonic functions, Conformal mapping and its applications in electrostatics, Mapping by elementary functions, Bilinear mapping, Schwarz-Christoffel transformation and its applications, Solving Dirichlet and Neumann problems using complex functions, Integral Transforms and Their Applications, Fourier transform in complex plane, Laplace transform, inverse Laplace transform, Fourier-Bessel transform, Mellin transform, Hilbert transform, principal value integrals, Applications in solving differential equations and summation of infinite series, Wiener-Hopf method, Integral Equations, Classification of integral equations, Volterra and Fredholm equations, Converting differential equations to integral equations, Green·s function method, Solution by integral transform techniques, Neumann series, Fredholm series, Separable kernel, Hilbert-Schmidt theory, Wiener-Hopf technique,Calculus of Variations, Review of maximum and minimum of multivariable functions, Basic concepts of calculus of variations, Euler equation, conditions for maximum, Lagrangian mechanics, principle of least action, Hamiltonian mechanics, Constraints and Lagrange multipliers, Isoperimetric problems, Rayleigh-Ritz procedure

1716517 Optimal Control Theory   3 Cr.

Describing the system and evaluating its performance, Introduction, The performance Measure, Dynamic programming, The optimal control law, The principle of optimality, The calculus of variations and pontryagin`s minimum principle, The calculus of variations, The variational approach to optimal control problems

1716528 Fuzzy Control Systems   3 Cr.

An Introduction to Computational Intelligent Fuzzy Logic, Neural Network and Evolutionary Computing. Fuzzy Sets, Linguistic Variables, Rectangular Norms, Fuzzy Logic and Fuzzy Inference Systems, Fuzzy Models (mamdani model –Takagi Sugeno model…), Design of Fuzzy Controllers and Fuzzy PID Controllers, Evolutionary Computing, Genetic Algorithms, PSO Algorithms, Design of Controllers with Genetic Algorithms, Neural Networks, Neuron and Perceptron, Multi Layer Perceptron, Back Propagation.

1716540 Nero Fuzzy Networks and Soft Computing   3 Cr.

Fuzzy Set Theory, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Neuro-Fuzzy networks, Neuro-Fuzzy networks, Equivalence between RBF and Fuzzy Models, ANFIS: Adaptive Neuro-Fuzzy Inference Systems, Hybrid Learning Algorithm, ANFIS as a Universal Approximator, Neuro-Fuzzy Control, Neural Networks, Single- layer Perceptron, Multi -layer Perceptron , Back propagation for Feed forward Networks, Radial Basis Function Networks, RBF Training, Neural Network Control, Wavelet neural network, Wavelet Theory, Wavelet Neural Networks, WNN Training, Wavelet Network Control

1716532 Adaptive Control   3 Cr.

Adaptive control principles, Self Tuning controller, pole placement technique, Minimum Variance controller, Generalized Minimum Variance controller, Self optimizing systems, self tuning systems, ODE Methods, Adaptive control with Biz Method, Model Reference controller, The MIT rule, Lyapanov`s Stability Approach, Popov`s Hyper stability Approach, Monopoli`s Augmented Error Approach, Narendras Error Model Approach, Egardts Unifed Approach, Self – tuning control, Model – Reference Approach, Scheduling Gain, Use of Adaptive control in: Paoer Plants Examples, Industrial Process Examples, Flight control systems Examples, Biomedical systems Examples

1716534 Robust Control   3 Cr.

H_2 and H_∞ Spaces, internal stability, coprime factorization, model uncertainly, robust stability, robust performance, linear fractional transformation, controller parameterization, H_2 and H_∞ control, miscellaneous topics.

1716536 Advanced Industrial Control   3 Cr.

Model predictive control and its application in Industrial process control, MPC algorithms , Model Algorithmic control Dynamic, Matrix control and Generalized predictive control, Multi Input Multi Output MPC, Constrained MPC, Nonlinear MPC, Application in sample industrial processor, Reliability of control systems, Reliability in Basic process control systems and safety Instrumented systems, Safety Instrumented systems standards: IEC 61508 and IEC 61511, Discrete event systems, Petri Nets and its application in modeling and controls, Design for Discreet event systems.

1716536 Intelligent Instrumentation   3 Cr.

Intelligent (Smart) sensing systems: Basic concepts, Technologies, and applications, Digital signal processing for intelligent sensors, Multi-sensor data fusion, Distributed sensor networks

1716521 Nonlinear Control Systems

Review of control systems and the concept of feedback, Nonlinear differential equations, Nonlinear state-space models, Types of nonlinearity, Simulation of nonlinear systems, Equilibrium points, Phase trajectories and phase planes, Phase portraits, Plotting phase portraits, Phase portrait of linear systems, Concepts of Lyapunov, asymptotic and exponential stability, Linearization of nonlinear systems, Lyapunov's indirect (linearization) stability theorem, Lyapunov's direct stability theorem, Invariant sets, Stability of invariant sets, Building Lyapunov functions, Lyapunov's method for linear systems, Instability theorems, Review of discrete-time nonlinear systems, Stability of discrete-time nonlinear systems, Lyapunov's theorems for discrete-time nonlinear and linear systems, Review of linear controllers for nonlinear systems, Nonlinear controllers for linear systems, Circle and Popov criteria, Linear controllers for nonlinear systems, LTI equivalent of nonlinear systems, Nonlinear controllers for linear systems, Feedback linearization

1716692 Advanced Nonlinear Dynamics and Control   3 Cr.

Mathematical Preliminaries, Basic of Differential Geometry, Linearization by State Feedback: Theory and Applications, SISO systems: Input Output Linearization, SISO systems: Full State Linearization, Zero Dynamics

Inversion, tracking, stabilization, MIMO systems: linearization by static state feedback, Full state linearization of MIMO systems, Dynamic Extension, Sliding Mode Control and Robust Linearization, Nonlinear Observers, Design Examples: Ball and Beam, Nonlinear Flight Control, Input –Output Analysis and Stability, Definitions of Input - Output Stability, Small Gain Theorems, Passivity and passivity theorems, Connections between Input - Output and State Space Stability, Geometric Nonlinear Control (If time allows), Drift-Free Control Systems

Steering of Drift-Free Nonholonomic Systems, Steering Model Control Systems Using Sinusoid, Zero Dynamic Algorithm

1718511 **Digital Signal Processing**   3 Cr.
Introduction to digital and analog signal processing: advantages and disadvantages, Discrete-time signals and systems, The Z-transform, Sampling of continuous-time signals, Transform analysis of linear time-invariant systems, Structures for implementation of discrete-time systems, Digital filter design techniques, The discrete Fourier transform (DFT), Efficient computation of discrete Fourier transform (FFT Algorithms), Fourier analysis of signals using the discrete Fourier transform, An overview to digital signal processors

1718513 **Stochastic Processes**   3 Cr.
Review of probability, Scalar and Vector random variables, concepts of random signals, Important discrete and continuous – time stochastic processes. Markovity , second and higher and higher order statistics of random processes. Stationarity and Ergodicity properties. Series and orthogonal expansions. Frequency domain analysis , filtering. Power spectral density. Applications of randomness concepts and tools in fields such as estimation and communication.

1718515 **Information Theory and Coding**   3 Cr.
Entropy, Kullback-Leibler Distance, Mutual Information, Basic Information Inequalities, Data Processing Inequality, Asymptotic Equipartition Property, Markov Sources, Entropy Rate, Prefix-Free Codes, Huffman Code, Shannon Code, Capacity of Discrete Memoryless Channel, Channel Coding Theorem, Differential Entropy, Capacity of Gaussian Channels, Band-Limited Channels, Parallel Gaussian Channels

1718518 **Advanced Communications Theory**   3 Cr.
Review of Band pass Systems and Stochastic Signals descriptions in time and frequency domains, Temporal and spectral representation of digitally modulated signals, Optimal decision rules, receiver structures , robabilities of error of various binary and Mary signaling schemes in AWGN channel, Band limited channels, ISI & Equalization with AWGN, Receiver structures in Linear time – invariant channels with random gain or phase, Diversity in fading channels, Receiver structures of error probability analysis in fading channels.

1718520 **Adaptive Filters**   3 Cr.
Concepts of filtering and adaptation, review of relevant mathematical results from linear Algebra and stochastic signals, wiener filters, search methods, LMS algorithm and its variants (Normalized, variable step – size, constrained), Transform domain adaptive filters, subband adaptive filters, Least squares method, recursive Least squares.

1718522 **Channel Coding**   3 Cr.
Introduction to Channel Coding, Introduction to Algebra, Linear Block codes, Some important Linear Block codes

Cyclic Codes, Binary BHC codes, Nonbinary BHC codes (Reed- Solomom Codes), Convolutional Codes, Viterbi Algorithm (optimum Decoding of Convolutional Codes), Turbo Coding and BCJR Algorithm , LDPC (Low Density Parity Check) codes, TCM (Trellis – coded Modulation)

1718525 **Cryptography**   3 Cr.
Introduction: history of cryptography and introduction to security architecture, basic information security concepts and protection mechanisms, Confidentiality, Integrity and Authenticity (CIA), Mathematics: basic material on information theory, Shanoon criteria, Symmetric-key encryption, one-time-pad, complexity theory, number theory and background on functions, abstract algebra, and finite fields, Block Ciphers: DES (Data Encryption Standard), AES (Advanced Encryption Standard), encryption modes, linear and differential attacks on block ciphers,Hash functions: Basic constructions, Unkeyed hash functions (MDCs) Keyed hash functions (MACs), Data integrity and message authentication, Public-key cryptography: RSA , ElGamal , McEliece and

Knapsack public-key encryption, Digital signatures: security of public-key cryptography, RSA encryption and digital signature, ElGamal digital signature, DSS (Digital Signature Standard), Key management: Protocols and mechanisms, key establishment and key management, and certification, Stream Ciphers: Stream ciphers based on LFSRs , filtering generators, combinatorial function generators, clock-control generators, shrinking generators, and correlation attack.

1718532 Radar Systems   3 Cr.

Introduction to Radar, Radar Equation, CW (Continuous Wave) Radar, MTI (Moving Target Indicator) Radar, Tracking Radar, Radar signal processing (Detection of Radar signals), Radar Data processing (Information from Radar signals), Imaging Radars (SAR & ISAR), Electronic Warfare in Radar

1718534 Satellite Communications   3 Cr.

Orbital mechanics, locating the satellite, look angel determination, satellite subsystems, satellite link design, modulation and multiplexing techniques for satellite links, multiple access (FDMA, TDMA, CDMA), propagation effects on link, VSAT systems, low earth orbit and non – geostationary systems, direct broadcast satellite television and radio, satellite navigation, and global positioning system.

1734529 Artificial Neural Network   3 Cr.

Introduction, Perception Learning Rule, Linear Algebra, Linear Transformations for Neural Networks, Supervised Hebbian Learning, Performance Surfaces and Optimum Points, Performance Optimization, Widrow-Hoff Learning, Backpropagation, Associative Learning, Competitive Networks, Grossberg Network, Adaptive Resonance Theory, Hopfield Network, RBF Network

1718561 Advanced Electromagnetics Theory   3 Cr.

Comprehensive review of fundamental equations and fundamental theorems in electromagnetic theory, classical models for dielectrics and conductors, equivalence principles, principle of reciprocity – transmission line equivalent network and transverse resonance technique - comprehensive coverage of radiation, scattering and guided-wave problems in rectangular, cylindrical, and spherical coordinate systems - Green's functions in electromagnetics, function theoretic methods

1718567 Network Management   3 Cr.

Introduction: Goals of Network Management, Network Management Environment, Network Management Systems Architecture, Network Management Standard and Functional Model, Network Design Concepts, Overview of Network Design: Design Process, Access Network Design, Backbone Network Design, Addressing and Routing, Network Management – Standards, Models and Language, Network Management Standards, Network Management Models, Organization Model, Information Model, Communication Model, Functional Model, SNMPv1 Network Management: SNMP History, SNMP Model, Organization Model, System Overview, Information Model, Communication Model, Functional Model, SNMPv2 & SNMPv3 Network Management: SNMPv2 System Architecture, SNMPv2 Structure of Management Information, SNMPv2 MIB, SNMPv2 Protocol 36, SNMPv3 , Compatibility with SNMPv1, Remote Monitoring (RMON) : RMON SMI and MIB, RMON1, RMON2 , ATM Remote Monitoring, RMON Over Internet, Network Management Applications: Configuration Management, Fault Management, Performance Management, Event Correlation Techniques, Security Management, Accounting Management, Reports Management, Policy Based Management, Cost Management, Design and Management Tools: Design Tools, Classes of Design Tools, Management Tools, Classes of Management Tools , Open Issues

1718571 Network Programming   3 Cr.

Introductions, Socket Programming, Network Programming Protocols, Web Application Development, Programming Techniques, Security Issues, New Issues in Network Programming

1718573 Switching Systems   3 Cr.

Introduction : Circuit Switching: Time, Space, Time and Space Switching, Pocket Switching: Routing, Forwarding, Switching, SONET/SDH: Framing, Multiplexing, ADM, Cross Connect, Signaling, Switching Fabric Architectures: Interconnection Networks, Single Stage Switches, Multiple Stage Switches, Self Routing and Sorting Networks, Scalability, Packet Switching: Layer 3 Switching (IP), Layer 2 Switching (ATM, MPLS), Layer 4-7 Switching, Performance Issues: Buffering and Contentions, Input Queuing, Output Queuing, Input/Output Queuing, Speedup, Fabric Scheduling, Buffer Management , Queue Management, Shaping and policing, Router/ Switch Architectures: Sample Switch and Router Architectures, Switch Management, Design Issues, Multicasting: Multicasting Issues in Multistage Networks, Optical Switching: Optical Circuit Switching, Optical Packet Switching, Wavelength Switching, Switching and Signaling in Circuit – Switched Systems, Special Topics

1718574 Optical Communication Systems   3 Cr.

Introduction to Optics and Photonics (2 Lectures): The nature of Light, Overview of advantages, perspectives and challenges of optics and photonics, Why Optical Communication?, Optical Fibers (6 Lectures): Optical fiber structure and characteristics as a waveguide, Light propagation in optical fibers, Geometrical and Wave approaches, Rays and Modes, Signal degradation in Optical Fibers (Loss and Dispersion), Bandwidth, Nonlinear Effects, Types of Optical Fibers, Optical Sources (3 Lectures): Light Generation and Lasers, Laser Diodes and Light Emitting Diodes, Optical Amplifiers (3 Lectures): Semiconductor Optical Amplifier (SOA), Erbium Doped Fiber Amplifier (EDFA), Amplifier Noise, Optical Detectors (3Lectures): Light Detection and Photo detectors, PIN and APD photodiodes, Quantum Efficiency and Responsibility, Noise in Light Detection,Optical Fiber Communication Systems (4 Lectures): Optical Link Design, Loss Limited Optical Link Design, Loss and Dispersion Limited Optical Link Design, Non coherent Optical Communication Systems (4 Lectures): Intensity Modulation/Direct Detection, Optical Transmitter Circuit, Optical Receiver Circuit, Noise and System Design Considerations, Multiplexing strategies (TDM, SCM, WDM, DWDM), Coherent Optical Communication Systems (3 Lectures): Basic System, Heterodyne Detection Principles, Modulation Formats, Demodulation Schemes, Noise and System Design Considerations, Free Space Optical Communication Systems (2 Lectures): History, Applications, Advantages, Limitations and Disadvantages

1718576 Optical Networks   3 Cr.

Introduction : overview of principles, perspectives and challenges of optical networks covered in the course, Optical Technology overview : overview of optical fiber and optical Free – Space Communication System, optical fiber principles, light propagation and signal degradation in optical fibers, Coherent and Noncoherent optical Communication Systems, Multiple Access in Optical Networks :   TDMA, WDMA, SCMA, CDMA, SONET/SDH, CWDM/DWDM, (Broadcast & select, Wavelength- routed networks), Hybrid WDMA, TDMA, Hybrid

WDMA/CDMA, Enabling Technologies and Devices : couplers, Isolators, Circulators, optical filters and Multiplexers/ Demultiplexers , Add/Drop Multiplexers, optical cross connects, optical amplifiers, optical sources and detectors, optical switches, wavelength converters,…, Transmission System Engineering : system modeling, power penalty, loss, dispersion , nonlinear effects in optical fibers, crosstalk, noise, wavelength stability, Packet (IP) over optics : IP over SONET/SDH, IP over ATM over SONET/SDH, IP over DWDM, MPLS, GMPLS, Optical Switching : optical switch architectures, optical burst switching, photonic packet switching, Optical Network Architectures : passive optical networks (PON) , local area optical networks, optical access networks, optical transport networks (OTN) , all optical networks, Network Control ,Management, and Survivability : network Management and control Issues and Resilience, protection Mechanisms (UPSR, BLSR, Mesh), Open Issues

1718584 Active Microwave Circuits Design   3 Cr.

Review of microstrip lines and CPW, Design of microwave amplifiers (small signal), Stability and nonlinear distortion, Noise sources and noise analysis, Multi-stage amplifiers, Broadband and ultra-broadband amplifiers, High power amplifiers, Power combining, Microwave oscillators, and Microwave mixers.

1718585 Electromagnetic Compatibility   3 Cr.

Introduction to EMC, Natural and nuclear sources of EM Interferences, Man-made EMI, OATS, Radiated and conducted interference measurements, Transient interference immunity, Noise reduction techniques (grounding, shielding, bonding, filtering, partitioning, cables, connectors, and components) EMC Computer modeling and simulation, Signal integrity, EMC standards.

1718586 Advanced Antenna   3 Cr.

Linear planer and circular arrays. Integral equations, moment method, self and mutual impedances. Microstrip, lens and reflector antennas. Waveguide slot antenna, design of Linear and planar slot arrays. Ultra wideband antennas.

1718587 Advanced Microwave   3 Cr.

Introduction, Microwave circuit analysis, Microstrip and stripline transmission lines, Microwave resonators, Microwave filters, Numerical techniques in microwave engineering, Meta materials

1718592 Scattering of Electromagnetic Waves Theory   3 Cr.

Plane wave scattering by conducting planer surfaces, wedge and circular cylinders (normal and oblique incidence, TE and TM polarizations), and sphere. Geometrical optics, geometrical and uniform theory of diffraction, edge diffraction (straight and curved with normal and oblique incidence) applications of the theory (in reflector and horn antennas, radar cross section and so on).

1718595 Numerical Techniques in Electromagnetics   3 Cr.

Finite difference method for partial differential equations, Finite Difference Time Domain technique (Yee algorithm, stability analysis, numerical dispersion, modeling sources, absorbing boundary conditions, perfectly matched layers) – variation techniques (construction of variation formulas, Rayleigh-Ritz method, method of weighted residuals) – Integral equations and method of moments (construction of integral equations, MPIE and PMCHW formulations, choice of basis and testing functions) – Finite Elements Method (Galerkin and Ritz formulations, shape functions, matrix assembly, waveguide and resonator problems, absorbing boundary conditions and PML)

1732513 Advanced Computer Architecture   3 Cr.

Introduction: Fundamentals of Computer Design, Other Topics Including: Instruction Level Parallelism, Advanced Pipeline and Superscalar Systems, Memory Hierarchy Design, Multiprocessors and Multi-Computers, Interconnection Networks, Multi-vector and SIMD, Thread-Level Parallelism

1734545 Data Mining   3 Cr.

Data doubles about every year, but useful information seems to be decreasing. The area of Data Mining has arisen to address this problem. It has become not only an important research area, but also one with large potential in the real world.This course is divided into two major parts: Core and Advanced Topics.
The core topics covered are classification, clustering, and association rules which are main data mining functions. The advanced topics covered mining techniques for temporal data , spatial data and Web mining. In addition text mining is discussed in this course. Research in data mining techniques including classification, predication, and

cluster analysis. Relationships with fields which data mining draws from like database technology, artificial intelligence, machine learning, and neural networks will also be emphasized.

1734517 Expert Systems   3 Cr.

Introduction to Expert Systems; Basic Concepts, Applications, Knowledge Acquisition   Knowledge Representation and Knowledge-base organization (Knowledge Engineering). Expert Systems' special programming languages (Lisp, PROLOG,…). Logic and automated reasoning systems, Inference in rule-base systems (forward and backward chaining), Nonmonotonic reasoning and dealing with uncertainty. Design and implementation steps of an expert system, and development of a prototype of an expert system.

1734523 Statistical Pattern Classification   3 Cr.

Introduction, Bayesian Decision Theory, Maximum Likelihood and Bayesian Estimation, Nonparametric Techniques, Linear Discriminant Functions, Stochastic Methods, Nonmetric Methods, Unsupervised Learning and Clustering

1734533 Advanced Data Bases   3 Cr.

Transaction Management, Concurrency Control, Database Recovery, Database Security, Optimization, Missing Information, Uncertainly In Database, Overview of Query Evaluation, Temporal Database Systems, Object – Oriented Database Systems, Multimedia Database Systems, Active Database Systems

1734535 Network Security   3 Cr.

Introduction : Motivation, Perspective, Concepts, Definitions, Security Models & Architecture, Review of Cryptographic Algorithms : Basic Definitions, Block & Stream Cipher, Modes of Operation, Asymmetric Cryptography, Digital Signature , Hash Functions & MACs, Basic Cryptographic Protocols : Definitions & Principles, Classification & Assumptions, Security & Efficiency Goals, Attacks & Adversaries, Types of Key Establishment Protocols (including TTP-based vs. non TTP-based and Symmetric vs. Asymmetric Crypto-Algo-based), Advanced Cryptographic Protocols, Electronic Cash & Payment, Election, …, Authentication Mechanisms : Types of Authentication tools, Passwords, Dictionary Attack, One Time Passwords, Strong Authentication, Kerberos, Password-based Remote Authentication, Public Key Infrastructure, IP Security : TCP/IP Model, IP Packets, Packet Sniffing, Address Spoofing, SYN floods, DoS Attacks, Virtual Private Networks, PPTP, IPsec, IKE, Web Security :Weaknesses in HTTP, Cookies , Session Hijacking, Input Validation, Mobile Code Security, SSH, SSL, TLS, Firewalls : Philosophy, Benefits, Packet filter, Application Proxy, Stateful Inspection, Architecture, Performance, Scalability, Assurance, Intrusion Detection :Philosophy, Benefits , Rule-based vs. Profile-based detection , Network-based vs. Host-based IDS, Honey Pot, Intrusion Prevention Systems, Vulnerability Scanning, Malicious Codes :Viruses , Worms, Trojan Horses, Logic Bombs, Spy ware, Spam, Counter-Measures.

1734519 Machine Learning   3 Cr.

Introduction, Reinforcement Learning, Instance – booed techniques, Concept – Learning, Neural Network Learning, Genetic Algorithms, Decision Tree Learning,   Inductive Logic Programming

1734532 Advanced Algorithms   3Cr.

This course is intended for first-year graduate students of Software Engineering. It covers more advanced techniques for designing and analyzing algorithms compared to the undergraduate Design and Analysis of Algorithms course. In particular, it introduces amortized and average case analyses, Maximum Flow, (integer) Linear Programming, string matching, selected problems in computational geometry, and the basics of NP-completeness and approximation algorithms.

1734531 Evolutionary Computing   3Cr.

An introduction to the field of evolutionary computation, Comparing evolutionary algorithms with traditional search algorithms, Genetic algorithm, Evolutionary strategies, Evolutionary programming, Genetic programming, Classifiers systems. Schema theory, Parameter setting, Multiobjective problems, Constraint Handling, Memetic algorithms.

1718570 Network Performance Evaluation and Modeling   3 Cr.

The purpose of this course is to study the key issues in performance evaluation and modeling techniques of the discrete event systems. The course covers important subjects including discrete event simulation of

computer and telecommunication networks, random number generation, theory of traffic source modeling and output analysis.

1718575 Network Design   3 Cr.

This course covers the principles of network architecture, and design for wired and wireless networks. The course covers the principles and steps that are required to follow for planning the implementation of network systems including introduction to network planning and design, switching network design, computer network design (top-down design), Cisco reference network designs, wireless and mobile cellular network design (2G, 2.5G, 3G)

1718591 Networks Traffic Engineering   3 Cr.

This course intends to introduce the theory of traffic engineering of the networks including, classical analysis, advanced queuing theory, computational algorithms, asymptotic methods, and large deviation theory. The course will be applied in the subjects including fluid flow analysis, admission and access control, mixed services analysis, performance analysis of MAC layer protocols in multi-access networks, problems in wireless and mobile cellular networks, traffic engineering in broadband networks, traffic engineering in IP/MPLS

1734547 Computer Systems Performance Modeling and Evaluations   3 Cr.

This course covers a rich set of techniques that are central to the modeling and performance evaluation of modern computer systems. These techniques are from the areas of experimental design, statistics (both parametric and non-parametric), random number generation, simulation, queuing theory and queuing networks.

1718568 Traffic Control in Computer Networks   3 Cr.

Develop the analytical tools to provide an in-depth understanding of random access, routing, congestion control, scheduling and traffic shaping algorithms.