NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
Electronics & Communication Engineering Department

M. Tech. (Communication & Signal Processing)

Scheme of Courses

A student has to complete a minimum of 60 credits for the award of M. Tech Degree. The credit structure is as follows:

Core Course:	26 credits
Project/Seminar:	16 credits
Electives:	18 credits (Minimum)

Core Courses:

Course Code	Course Name	Credits
1st year Autumn Session		
ECEM-101	Digital Communications	3
ECEM-169	Computer and Network Security	3
ECEM- xxx	Machine Learning	3
ECEM- xxx	Coding Techniques	2
1st year Spring Session		
ECEM-103	Wireless Communications	3
ECEM-109	Image Processing	3
ECEM-110	Laboratory II (Image Processing)	1
ECEM-107	Advanced Design Techniques (Laboratory Course based on simulation tools)	2
ECEM-201	Seminar	1
2nd year Autumn Session		
ECEM-104	Advanced Computer Architecture	3
ECEM-108	Computer Networks	3
ECEM-202	Project (Dissertation) – I	3
2nd year Spring Session		
ECEM-203	Project (Dissertation) – II	12

Electives

ECEM-102	Software Engineering	
ECEM-151	DSP Processors and Architecture	3
ECEM-152	Multimedia Information System	3
ECEM-153	Advanced microprocessors	3
ECEM-154	Advanced TV Technology and Cable TV	3
ECEM-155	VLSI Design	3
CSEM- 208	Advanced JAVA	3
ECEM-157	System Software	3
ECEM-158	Special Topics in Applied Mathematics	3
ECEM-159	Embedded Systems	3
ECEM-160	Real Time Operating Systems	3
ECEM-161	Optical Communications	3
ECEM-162	Telemedicine	3
ECEM-163	Random Processes and Queuing Theory	3
ECEM-164	VLSI Technology	3
ECEM-165	Management Information System	3
ECEM-166	Special Topics in Communications	3
ECEM-167	Switching and Statistical Multiplexing in Telecommunications networks	3
ECEM-168	Analog CMOS Design	3
ECEM-170	ESD reliability	3
ECEM-171	RF IC Design	3
ECEM-172	System Design	3
ECEM-173	Special Topics in Information Technology (IT)	3
ECEM-174	Object Oriented Database	3
ECEM-175	Dataware Housing	3
ECEM-176	E-commerce	3
ECEM-177	Software Project Management	3
ECEM-178	Computer Vision and Artificial Intelligence	3
ECEM-187	Physical Electronics I	3
ECEM-206	Programming and Programming Methodology	3
ECEM-207	Artificial neural Networks	4
ECEM-208	Pattern Classification	4
ECEM-209	Advanced Image Processing	4
ECEM-210	Network Security Laboratory	2
ECEM-211	Network Security Assessment and Monitoring	4
ECEM-212	Research Methodologies and Techniques	3
ECEM-213	Operating Systems	3
ECEM-214	Theory of Computation	3
ECEM-215	High Speed Networks	3
ECEM-216	Logic Programming	3
ECEM-217	Biometrics	3
ECEM-218	Simulation and Modeling Techniques	3
ECEM-219	Next Generation Networks	3

ECEM-220	Distributed Computing	3
ECEM-221	Fault Tolerant Computing	3
ECEM-222	Advanced Network Security	4
MTHM-103	Function spaces and Wavelet Analysis	3
MTHM-104	Operations Research	3
MTHM-105	Advanced Engineering Mathematics	3
ECEM-112	(Communication skills & Research Techniques)	
ECEM-xxx	Current Mode Analog Circuits	3
ECEM-xxx	Multirate filter banks and wavelets	3
ECEM-XXX	Solar Photovoltaics	3
ECEM-XXX	Advanced Signal Processing	3
ECEM-xxx	(Detection and estimation theory)	3
ECEM-xxx	(Next generation Communication systems)	3
ECEM-xxx	(Quantum Computing)	3

The students can also take the course of the PG programmes from the sister Departments (only EE at present) of the Institute as Electives. Apart from above elective courses all core courses of ME will be elective courses for CIT.

Syllabus

CORE

1. Course code: ECEM 101 (Digital Communications)

Advantages of Digital communication over analog communication, General block diagram of digital communication system, signal and its characteristic features, sampling and quantization of signals, quantization noise and SNR due to quantization. Signal encoding; Signal encoding techniques: PCM, signal companding, μ-law, A-Law, Differential encoding, Delta modulation, Adaptive Delta modulation and ADPCM Techniques, sub-band encoding, vector encoding.; Waveform encoding techniques: Need, required features, NRZ, RZ, Manchester, AMI and other encoding techniques; Digital modulation techniques and their features, QPSK and QAM techniques, signal constellation; Error coding techniques: parity bit, polynomial error detection, Hamming code, convolution coding and decoding.; Performance evaluation of digital systems, BER, eye diagram, performance of BPSK, QPSK and QAM system and comparison; Spread spectrum techniques: FHSS, chip rate, DSSS, PN sequence, generation of PN sequence through feedback shift register, gold sequences

Books recommended:

1. John G. Proakis, Digital Communications
2. John R. Barry, Edward A.Lee, Digital Communication
3. J. S. Chitode, Digital Communication

2. Course Code: ECEM-169 (Computer and Network Security)

Introduction to computer networks and network security, Authentication and authorization overview, vulnerabilities, risk assessment, incidents, forensics. UNIX vulnerabilities and safeguards, Hash functions (MD5, SHA, RIPEM),Network security (BSDisms, sniffers, wrappers, vpns, firewalls, intrusion detection).Kerberos, DCE. Cryptography, steganography, number theory, random numbers. Secret key encryption (DES, IDEA, RC5, CAST, AES (Rijndael)).Public key encryption (Diffie-Hellman, RSA, ECC, DSA).key management, PKIs .Crypto API's. Secure applications: PGP, S/MIME, CFS, ssh, Netscape/SSL, IPsec. Issues: legal/political/ethical. Operating system security, Operating system security model, Secure security issues, Firewalls, Java security

Books recommended

1. Peterson &Davie Computer networks, A system Approach
2. William Stallings, Data and Computer Communications
3. Matt Bischop, Computer Security

3. Course code: ECEM-104 (Advanced Computer Architecture)

Different types of Architectures
Performance of Computers and Significance of bench marks
Pipelining and pipeline hazards, Hazard removal, State diagrams, etc.
Types of Parallel Architectures SISD, SIMD, and MIMD architectures
Interconnection Networks
Latest trends in Computer Architecture

Books recommended

1. Computer Architecture, David Patterson and John Hennessy

2. Computer Organization and Design, J. Hennessy and D. Patterson
3. Modern Processor Design, Shen and Lipasti, McGraw Hill

4. Course code: ECEM-108 (Computer Networks)

Review of data communication techniques. Data transmission, line coding, error control coding. Data switching, circuit switching message and packet switching. Network model ISO-OSI model, primitives and services. Local Area Network. LAN topologies and protocols. Elements of queuing. Data link control Simplex, pipelined and sliding window protocols, simplex performance analysis. X.25 data link layer. Random accesses techniques. Pure, slotted and finite population ALOHAs. Stability in ALOHAs. Routing and congestion control Static, adaptive, centralized and distributed routing procedures, congestion control. IEEE 802x protocols, implementation and performance issues. High speed LAN's. Transport layer. Quality of service, transport classes. Design issues, buffer management, synchronization. Session and presentation layer synchronization issues. Formatting data, compression, and data security. Broadband services, Admission and access control in broadband networks, ATM reference model

Books recommended

1. Computer Networks,Andrew Tanenbaum
2. Computer Networking and Internet, Fred Halsel , Addison Wesley
3. TCP/IP Protocol Suite, Behrouz Forouzan

5. Course code: ECEM-xxx (Machine Leaning)

6. Course code: ECEM-xxx (Coding Techniques):

7. Course Code: ECEM-103 (Wireless Communication)

Cellular concepts, frequency reuse, co channel interference, Cell splitting. Radio propagation characteristics; models for path loss, shadowing and multipath fading (delay spread, coherence bandwidth coherence time. Doppler spread). Jakes' channel model. Digital modulation for mobile radio; analysis under fading channels; diversity techniques and Rake demodulator. Introduction to spread spectrum communication. Multiple access techniques used in mobile wireless communications: FDMA/TDMA, CDMA. The cellular concept: Frequency reuse; the basic theory of hexagonal cell layout; spectrum efficiency. FDM/TDM Cellular systems; channel allocation schemes. Handover analysis. Cellular CDMA; soft capacity. Erring capacity comparison of FDM/TDM systems and cellular CDMA. Discussion of GSM standards; signaling and call control; mobility management; location tracing. Wireless data networking; packet error modeling on fading channels, performance analysis of link and transport layer protocols over wireless channels; mobile data networking (mobile IP); wireless data in GSM, IS-95, and GPRS.

Books Recommended

1.Wireless Communications, Andread, F.Molish
2.Wireless Communications, T.L.Singal
3.Fundamentals of Wireless Communications, David and Pramod

8. Course code: ECEM-109 (Image Processing)

Introduction: imaging and imaging devices. Image sampling and quantization, relationship between pixels and imaging geometry. Image enhancement techniques: Frequency domain, spatial domain, and fuzzy logic based. Image Segmentation: using edge detection and edge linking techniques, Image threshold and region oriented segmentations. Image representation schemes: Chain codes, polygonal approximation, and signatures. Shape descriptors: Fourier descriptors. Descriptor using moments. Descriptor using AR and CAR modeling. Texture: Introduction to texture, different techniques of texture analysis and their comparison

Books Recommended

1.Digital Image Processing, R. C. Gonzalez and R. E. Woods
2.Network Analysis and Synthesis, F. F. Kuo
3.Network Analysis and Synthesis, K.M.Soni

9. Course code: ECEM-110 Laboratory II (Image Processing)

1 Image acquisition, digitization and display
2 Application of edge detection techniques on Images
3 Enhancement of images using histogram equalization, histogram modification, and fuzzy Logic
4 Segmentation of images using thresholding and region growing

10. Course code: ECEM-107 (Advanced Design Techniques)

Installation of Scilab with the basic information of Scilab workspace and working directory, Creating matrices and some simple matrix operations , Statistics and working with polynomials , Scilab Programming language-looping and branching, Script files and function files, Writing Scilab functions , Graphics and Plotting- 2D graphs, 3D graphs, Creating Histogram, animations, Working with Applications-XCOS with examples in signal processing Matlab to Scilab convertor Working with Atoms- Image processing module (SIVP), METANET. Any other

simulator on which the student will be working, for M. Tech Thesis.

Elective Courses
(Minimum of 18 credits to be chosen in entire programme)

Course Code: ECEM 102 (Software Engineering)

Introduction, System analysis, User interface design, Debugging, Profiling and testing methods, Operating system interface, Support tools and scripting language, Project management, User and system documentation

Books Recommended

1. Software Engineering Ivan Marsac
2. Software Engineering Roger S.Pressman
3. Software Engineering James F. Peters

Course code: ECEM-151 (DSP Processors and Architecture)

Introduction, A Digital signal-processing system, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB

Computational Accuracy in DSP Implementations:

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

Architectures for Programmable DSP Devices:

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

Execution Control and Pipelining:

Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

Programmable Digital Signal Processors:

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

Implementations of Basic DSP Algorithms:

The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

Implementation of FFT Algorithms:

An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

Interfacing Memory And I/O Peripherals to Programmable DSP Devices:

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP),McBSP Programming, a CODEC intinterface circuit, CODEC programming, A CODEC-DSP interface example.

Books Recommended

1. Digital signal processing- Avtar Singh and S. Srinivasan

2. VLSI Digital Signal Processing Systems -Design & Implementation, K.K Parhi
3. Digital Processor Fundamentals, Architectures & Features – Lapsley et al.

Course code: ECEM-152 (Multimedia Information System)

Introduction to Multimedia, Multimedia Objects, Multimedia in business and work. Multimedia hardware, Memory & Storage devices, Communication devices, Multimedia software's, presentation tools, tools for object generations, video, sound, image capturing, authoring tools, card and page based authoring tools. Multimedia information, Delay-sensitive and time based Media data modeling, Multimedia storage and retrieval techniques, Multimedia communications: Synchronization, delay compensation, QOS negotiation protocols, Architectures and issues for distributed multimedia systems, Prototype multimedia systems: Video-on-Demand, Video conferencing.

Books Recommended

1.Fundamentals of Multimedia, Ze-Nian Li, Mark S.Drew
2.MULTI MEDIA, Tony Feldnan

Course Code: ECEM-153 (Advanced Microprocessors)

Pin configuration, Architecture, Memory and I/O space of 8086 microprocessor. Addressing modes and Instruction set. Introduction to assembly language of 8086 microprocessor and example programs. Input/output processor, interfacing of memories, I/O operations. Programmable interrupt controller, Programmable communication interface, Programmable Keyboard/Display interface. Floppy disk controller, DMA controller, USART controller, Pointer Controllers, etc. Introduction to 8088 and Pentium series.

Books Recommended

1.Computer Architecture, John L. Hennessy & David A. Patterson
2.Computer Architecture and organization, John P Hayes
3.The Pentium Microprocessor, James L. Antonakos

Course code: ECEM-154 (Advanced TV Technology and Cable TV)

Basic Color TV fundamentals: Optics of the color TV, Luminance and color signal generation, color TV cameras, CCD camera, Color Picture tubes, Chrominance signal generation, complete composite transmitter signal, Different color TV systems-NTSC, SECAM, PAL, Coders and decoders, PAL color TV receiver block diagram. Color TV receivers: Tuner section, IF section, Sound section, Sync section, chroma processing subsystem, EHT generation, SMPOS system, remote control techniques. Alignment and servicing of color TV receiver. Teletext, View data, video games and video recording systems, Advances in video technology and new video TV systems: Projection TV, stereo sound system, 3D Pictures, Digital TV, HDTV, Extended definition TV system, video compression. Direct to home TV broadcasting: Satellite TV system, antenna system, mixers and satellite receivers. Basic community TV system and cable TV system, mixers, modulators, amplifiers, signal splitters, cables for TV distribution.

Books Recommended

1.Television and Video Enginering, M.Dhake
2.Modern Television Practice, R.R Gulati

Course code: ECEM-155 (VLSI Design)

MOSFET

Basics of MOSFET: structure, operations under different regions, MOSFET current-voltage characteristics, MOSFET scaling: constant field and constant voltage scaling, small geometry concepts, MOSFET capacitance

MOS Inverter

Voltage transfer characteristics of MOS inverter, Noise margins: definition and calculation, Operation and noise margin calculation of resistive load inverter, CMOS inverter and Pseudo NMOS inverter, Static and dynamic power calculation for different inverter configurations, Delay time definition and calculations, propagation delay calculations for different inverter configurations.

MOS Fabrication and Layout

Basic fabrication process flow: MOS process and CMOS n-well process, Layout design rules: Micron and Lambda rules

MOS logic Circuits

Combinational circuits: MOS logic circuits with depletion nMOS loads, CMOS logic circuits, Complex logic circuits, CMOS transmission gates; Sequential circuits: Different latches and flip flop circuits; Dynamic circuits: Pass transistor circuits, Voltage bootstrapping, synchronous dynamic circuit techniques, High performance dynamic CMOS circuits

Semiconductor memories

Different types of memories, Memory organization, Different types of ROM, Different types of RAM: SRAM, DRAM and FRAM, Flash memory

References:

1. S-M. Kang and Y. Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, Third Edition.
2. N. Weste and K. Eshraghian, Principles of CMOS VLSI Design, Addison Wesley.
3. J. M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits: A Design Perspective, Pearson/PH.
4. R. J. Baker, CMOS: Circuit Design, Layout and Simulation, Second Edition, Wiley.

Course code: CSEM- 208 Advanced JAVA

Object-oriented programming with Java Classes and Objects: Fields and Methods, Constructors, Overloading methods, Garbage collection, Nested classes. Inheritance: Overriding methods, Polymorphism, Making methods and classes final, abstract classes and methods, Interfaces

Exception handling with try-throw-catch-finally construct: The Exception class ,The Object class: Cloning objects, The JDK LinkedList class, Strings, String conversions.Working with types: Wrapper classes, Enumeration interface. Packages: Package access, Documentation comments. Applets: Configuring applets, Applet capabilities and restrictions

Basics of AWT and Swing: Layout Managers, Event Handling , The Action Listener interface , Panels ,Classes for various controls, such as label, choice, list, Checkbox, etc.

Dialogs and frames, using menus, Using the adapter classes, Graphics. Threads: Synchronisation, The I/O Package : InputStream and OutputStream classes , Reader and Writer classes . Basic concepts of networking : Working with URLs , Concepts of URLs , Sockets. Database connectivity with JDBC , Java security Collections, Multithreading , Networking , Enterprise Java Bean, Java Database Connectivity (JDBC), Servlets, JavaServer Pages (JSP), Remote Method Invocation, Common Object Request Broker Architecture (CORBA), Introduction Smart Phone Application Development. Android Architecture, USer Interface Architecture, UI Widgets, Notification and Toast, Menus, Dialogs, Lists, Locations and Maps. Working with Data Storage. Animation and Content Providers. Network Communication, Services, Publishing your App.

Books Recommended:

1. Programming with Java A Primer, E.Balaguruswamy Tata McGraw Hill Companies
2. Java Programming John P. Flynt Thomson 2nd
3. Java Programming Language Ken Arnold Pearson
4. The complete reference JAVA2, Herbert schildt. TMH
5. Big Java, Cay Horstmann 2nd edition, Wiley India Edition
6. Core Java, Dietel and Dietel

Course code: ECEM-157 (System Software)

Functional overview of system software: macro-processors, assemblers, loaders, linkers, compilation and interpretation. Operating systems: introduction concurrency and threads process management, memory management, Disk I/O and File Systems.

Books Recommended

1. Systems programming and operating systems, D.M.Dhamdhere
2. An introduction to system programming, L Beck and Addison Wesley
3. System programming, John J Donovan

Course code: ECEM-158 (Special Topics in Applied Mathematics): Syllabus will be framed as per student's requirement

Course code: ECEM-159 (Embedded Systems)

Embedded system concepts. Hardware organization and architecture, Micro-controllers, Technological aspects of embedded systems, ADC/DAC, Input/ Output devices, Memory devices, Synchronous/ Asynchronous data transfer. Serial/parallel communication ports, programming embedded systems. Embedded board level design concepts. MEMS.

Books Recommended

1. The 8051 Microcontroller and Embedded systems, Mohammed Ali Mazidi
2. Embedded System DesignFrank Vahid, Tony Givargis, John Wiley.
3. Embedded systems, Raj Kamal

Course code: ECEM-160 (Real Time Operating Systems)

Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection. Operating Systems types, Process Concept. Concurrency and Synchronization, Mutual Exclusion and Deadlock Problems. Process Management. Process States, Process scheduling Algorithms and Implementation. Storage Management. Concepts and implementation of Real and Virtual Storage. File Management, File

Organization, File Systems, Protection and security Performance Evaluation, Case study of the UNIX Operating Systems, Basic issues in Multiprocessor and Distributed Operating Systems.

Books Recommended:

1. Real-Time System Design, S.T. Levi, A.K Agrawala
2. Real-Time Concepts for Embedded Systems, Q.Li, C.Yao,
3. Real-Time Systems Specification, Verification and Analysis, M. Joseph

Course code: ECEM-161 (Optical Communications)

Introduction to optical communication, review of optical sources, fibers and detectors, Optical Signaling scheme viz. IM, PL, PCM/PL, digital PPM, PRM, PFM etc., Various receiver configurations – direct detection, homo-dyne and heterodyne, noise sources in optical communication – model noise, speckle noise, shot noise, phase noise, thermal noise etc., integrated and trans-impedance amplifier, optical line coding, performance evaluation of optical receiver for various modulation and demodulation schemes and their comparative study, PINFET receivers, diversity receivers – phase, polarization and combined, introduction to optical space communication, optical fiber link design, fiber optic networks, LIDAR.

Books Recommended

1. Optical Fiber Communication, Gerd Keiser
2. Fiber-Optic Communications Technology, Djafar K. Mynbaev, Lowell L. Scheiner
3. An Introduction to Fiber optic Systems, John Powers

Course code: ECEM-162 (Telemedicine)

Introduction, Significance, Infrastructure. Picture archiving and communication systems. Transmission and reception of bio signals. Special Topics in Telemedicine. Minor project

Books Recommended

1. E-Health, Telehealth and Telemedicine: A guide to startup and Success, Marlene M. Maheu
2. Telemedicine theory and practice, R Bashshur, J L sanders
3. Introduction to telemedicine, R wootton and j criag

Course code: ECEM-163 (Random Processes and Queuing Theory)

Probability, random variables, probability distribution and density functions, joint statistics, conditional static's, independence. Functions of random variables and random vectors. Expectation moments, characteristic functions. Convergence of a sequence of random variables, law of large numbers, central limit theorem. Random Processes, mean and autocorrelation, stationary ergodicity, cyclostationarity,Power spectral density. Response of memoryless and linear systems. Gaussian, Poisson, Markov and Wiener processes. Bi-spectrum, higher order spectra, Kahunen-Loeve expansion. Detailed study of stochastic processes encountered in queuing theory, namely, point processes – Poisson processes, renewal processes, Markov processes, Markov renewal processes. Study of stationary behavior (queue lengths, delays blocking) of single station and multi-station queuing systems with various disciplines.

Books Recommended

1. Probability & Statistics with Reliability , Qeuing and computer science and application, Kishore . S.Trivedi

2. Probability , Statistics and Random Processes, T. Veerajan

3. Fundamentals of queuing theory, D. Gross and C.M. Harris

Course code: ECEM-164 (VLSI Technology)

Clean room Technology and safety requirements, Wafer cleaning processes and wet chemical etching techniques, Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles, Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultra-thin films. Oxidation technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI, Photolithography, E-beam lithography and newer lithography techniques for mask generation, CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modeling and technology, Metal film deposition : Evaporation and sputtering techniques. Failure mechanisms in metal interconnect; Multi-level metallization schemes, Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI.

Process integration for NMOS, CMOS, Bipolar and BICMOS circuits

References:

1. S. K. Gandhi, VLSI Fabrication Principles: Silicon and Gallium Arsenide, Second Edition, Wiley.
2. G. S. May and S. M. Sze, Fundamentals of Semiconductor Fabrication, Wiley.
3. J. D. Plummer, M. D. Deal and P. B. Griffin, Silicon VLSI Technology: Fundamentals, Practice and Modeling, Pearson/PH.
4. P. Van Zant, Microchip Fabrication: A Practical Guide to Semiconductor Processing, Fifth Edition.
5. C. Y. Chang and S. M. Sze, ULSI Technology, McGraw-Hill.
6. S. M. Sze, VLSI Technology, McGraw-Hill.

Course code: ECEM-165 (Management Information System)

Introduction to data information system and end users. System and system concept, Physical and computed system, Variables of a system, Data and information processing, Characteristics of data processing (DP), Kinds of DP & steps in DP, Methods of system design: Problem definition, System analysis, System design, Logic for problem solution/problem planning, program preparation. Decicion Support system and overview, Characteristics of DSS, Components and classification of DSS. Debugging & testing, Documentation, Maintenance; Types of information, M.I.S.: Past & present projection, Internal & external information, Planning control & operational functions, Uniform information, Proper time frame, Assistance in decision making. Model based management systems, function time, certainty, uncertainty, risk structures

Books Recommended

1.Management Information Systems: Managing the Digital firm, Lauaon Kenneth & L. Jane 2.Management Information Systems – A Management Perspective, Uma G. Gupta 3.Information Systems for Modern Management, Robert G. Murdick, Joel E. Ross and James R. Clagget

Course code: ECEM-166 (Special Topics in Communications)

The syllabus will be framed as per student's requirement

Course code: ECEM-167 (Switching and Statistical Multiplexing inTele-communication networks)

Issues, architectures and performance analysis for statistical bandwidth sharing (multiplexing) and traffic switching in telecommunication networks. Switching: Interconnection networks for circuit and fast packet switching, and their blocking and queuing analysis; call processing architectures; switching system capacity analysis and traffic overload control. Statistical multiplexing; blocking analysis in circuit multiplexed networks, with single rate or multi-rate traffic, call-level multiplexing, burst-level multiplexing. Models for packetised sources, such as voice and video. Models for performance analysis of integrated packet networks; calculation of performance measures; analysis and design of traffic controls. Throughout the course the models will be motivated by problem arising in telephone networks, cellular mobile network and high-speed packet switched networks.

Books Recommended

1. Digital Telephony, John Bellamy
2. Telecommunications Technology fundamentals, Lillian Goleniewski
3. Data and Computer Communication, William Stallings

Course code: ECEM-168 (Analog CMOS Design)

Introduction to MOSFET

MOSFET: structure & operations, threshold voltage and current-voltage equations, second order effects: channel length modulation & body effect, small signal model, MOS capacitance

Amplifiers

Single stage amplifiers: Common source stage, Common gate stage, source follower configuration, Cascode & folded cascode, Differential amplifiers: basic configuration, common mode response, frequency responses: finding poles & zeros for different amplifier configurations, noise in amplifier: thermal noise & flicker noise, feedback in amplifiers: different feedback topologies & loading effects in feedback

Current Mirrors

Basic current mirrors, cascade current mirrors, passive and active current mirrors, applications of current mirrors in differential amplifiers

Operational Amplifier: Differential and Common mode circuits, CMRR, Need for single and multistage amplifiers, Gain boosting techniques, noise, power supply rejection ratio, slew rate, switched capacitor circuits using operation amplifiers

Oscillators & Phase Locked Loops

Ring oscillators, LC oscillators, Voltage controlled oscillators, Problem of lock acquisition, phase Detector. Basic PLL and its dynamics, Charge-pump PLL, Non-ideal effects in PLL: PFD/CL non idealities, Jitter, Delay Locked Loop, Amplifications.

References:

1. B. Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill.

2. K. R. Laker and W. M. C. Sansen, Design of Analog Integrated Circuits and Systems, McGraw-Hill.
3. P. Gray, P. Hurst, S. Lewis and Meyer, Analysis and Design of Analog Integrated Circuits, Wiley.
4. Johns and K. Martin, Analog Integrated Circuit Design, Wiley.

Course code: ECEM-171 (RF IC Design)

Introduction to RF and Wireless Technology: Complexity, design and applications. Choice of Technology. Basic concepts in RF Design: Nonlinearly and Time Variance, intersymbol Interference, random processes and Noise. Definitions of sensitivity and dynamic range, conversion Gains and Distortion. Analog and Digital Modulation for RF circuits: Comparison of various techniques for power efficiency. Coherent and Non coherent defection. Mobile RF Communication systems and basics of Multiple Access techniques. Receiver and Transmitter Architectures and Testing heterodyne, Homodyne, Image-reject, Direct-IF and sub-sampled receivers. Direct Conversion and two steps transmitters. BJT and MOSFET behavior at RF frequencies Modeling of the transistors and SPICE models. Noise performance and limitation of devices. Integrated Parasitic elements at high frequencies and their monolithic implementation. Basic blocks in RF systems and their VLSI implementation : Low Noise Amplifiers design in various technologies, Design of Mixers at GHz frequency range. Various Mixers, their working and implementations, Oscillators: Basic topologies VCO and definition of phase noise. Noise-Power trade-off. Resonatorless VCO design. Quadrature and single-sideband generators, Radio Frequency Synthesizes: PLLS, Various RF synthesizer architectures and frequency dividers, Power Amplifiers design. Linearisation techniques, Design issues in integrated RF filters.

Books Recommended

1. RF Microelectronics, Behzad Razavi
2.CMOS RFIC Design principles, Robert Caverly
3.RFIC Design, Rogers and Plett

Course code: ECEM-172 (System Design)

Basics of system hardware design. Hierarchical design using top-down and bottom-up methodology. System partitioning techniques, interfacing between system components. Handling multiple clock domains, Synchronous and asynchronous design styles. Interface between synchronous and asynchronous blocks. Meta-stability and techniques for handling it. Interfacing linear and digital systems, data conversion circuits. Design of finite state machines, state assignment strategies. Design and optimization of pipelined stages. Use of data flow graphs, Critical path analysis, retiming and scheduling strategies for performance enhancement.

Implementation of DSP algorithms. Signal integrity and high speed behaviour of interconnects: ringing, cross talk and ground bounce. Layout strategies at IC and board level for local and global signals.Power supply decoupling

Books Recommended

1. Systems Design, W. J. Kaiser

Course code: ECEM-173 (Special Topics in Information Technology):

syllabus will be framed as per student's requirement

Course code: ECEM-174 (Object Oriented Database)

Introduction to Object Oriented Database, Refreshing, extension and formalization of basic concepts in object oriented programming and relational databases problems concerning relational databases. Extensions of the relational model especially nested relational systems, theoretical foundations for the nested relational model. Object oriented databases--concepts and problems. Persistent programming ,Object oriented databases--semantic modeling, meta programming, long and short transactions, concurrent problems, version handling, introduction to prototypes and interfaces for object oriented database handling, representation of knowledge in object oriented database systems, modeling methods for object oriented databases, existing commercial and experimental object oriented database handling systems. Distributed object oriented database handling systems. Prototypes and user interfaces. Problems related to temporal and spatial aspects. Existing systems. An overview of commercial as well as academic systems.

Books Recommended

1. Object oriented modeling and design for data base applications, Micheal Blaha
2. Fundamentals of Database Systems, El Masri

Course code: ECEM-175 (Dataware Housing)

Introduction to Data Warehousing. Client/Server Computing model & Data Warehousing. Parallel processors & Cluster Systems. Distributed DBMS implementations. Client/Server RDBMS Solutions. Data Warehousing Components. Building a Data Warehouse. Mapping the Data Warehousing to a Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, cleanup & Transformation Tools. Metadata. Reporting & Query Tools & Applications. On line Analytical Processing (OLAP). Patterns & Models. Statistics. Artificial Intelligence. Introduction to Data Mining. Decision Trees. Neural Networks. Nearest Neighbor & Clustering. Genetic Algorithms. Rule Induction. Selecting & Using the Right Technique.Data visualization & Overall Perspective. Data Visualization. Putting it All Together.

Books Recommended

1. Data Ware Housing Fundamentals, Paulraj Ponniah
2. Data mining and Data ware housing, Bharat Bhushan Agarwal , Sumit Tayal

Course code: ECEM-176 (E-COMMERCE)

Introduction to E-Commerce, Forces behind E-Commerce, E-Commerce Industry Framework, and Brief History of E-Commerce. Inter Organizational E-Commerce, Intra Organizational E-Commerce, and Consumer to Business Electronic Commerce, Architectural framework. Network Infrastructure for E-Commerce, Market forces behind I-way, Component of I Way, Access Equipment, Global Information Distribution Network, Broadband Telecommunication. Introduction to Mobile Commerce, Mobile Computing Application, Wireless Application

Protocols, WAP Technology, Mobile Information Devices. Introduction to Web Security,

Firewalls & Transaction Security, Client Server Network, Emerging Client Server Security Threats, Firewalls & Network Security. World Wide Web & Security, Encryption, Transaction security, Secret Key Encryption, Public Key Encryption, Virtual Private Network (VPM), Implementation Management Issues. Overview of Electronics payment, Digital Token based Electronics Payment System, Smart Cards, Credit Card/Debit Card based EPS, Emerging financial Instruments, Home Banking, Online Banking.EDI, EDI Application in Business, Legal requirement in E-Commerce, Introduction to supply Chain Management, CRM, issues in Customer Relationship Management

Books Recommended

1. Frontiers of Electronic Commerce, Ravi Kalakota, Andrew Winston
2. E-Commerce the cutting edge of Business, Bajaj and Nag

Course code: ECEM-177 (Software Project Management)

Rationale for software project management; software architecture; risk management; change control; team dynamics; theories of software development and project management; software maintenance; management-related people skills (listening, negotiation, conducting meetings, writing, leadership); gender-related and ethical issues in software development.

Books Recommended

1. Software Project Management, M. Cotterell
2. Software Project Management, Kieron Conway

Course code: ECEM-178 (Computer Vision and Artificial Intelligence)

Introduction Artificial Intelligence: history, applications, current challenges, Basic concepts and definitions, intelligent agents. Solving problems by search Uninformed search, Informed, heuristic search, adversarial search. Knowledge Representation and Inference: Logical agents, First-order logic, inference rules, Non-monotonic reasoning, Knowledge representation: semantics, semantic nets, frames, scripts. Planning: The Inference: Uncertainty, Probabilistic reasoning, decision making, Hidden Markov models, Markov random fields, Expert system architectures, Bayesian networks. Learning: Observations, Supervised learning: linear predictors, gradient descent, Sequential decision making, reinforcement learning, Artificial Neural Networks Speech Processing, Computer Vision and Perception: Probabilistic language processing, Perception, computer vision and robotics Vernier technique for small time interval measurement, Measurement of periodic time, Measurement of phase, capacitance, quality factor, time constant and decibel.Digital frequency measurement techniques: Measurement of ratio, product and difference between two frequencies, High frequency measurement, Peak frequency measurement, Fast low frequency measurement, Time reciprocating circuit

Books Recommended

1. Introduction to Artificial Intelligence, Char nick , Addision Wesley
2. Artificial Intelligence, Rich & Knight
3. Computer vision, Ballard and Brown

Course code: ECEM-187 (Physical Electronics I)

Introduction to quantum effects, and Band theory of solids, The physical principles of semiconductors, both silicon and compound materials; Operating principles and device

equations, Homojunctions and Heterojunction, The fundamental operation of semiconductor devices and overview of applications, p-n Junction diode, Photo-detectors, LED, LASERS, Solar Cells etc.

Characterization Techniques for semiconductors: Four probe and Hall measurement; CVs for dopant profile characterization; Capacitance transients and DLTS.

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Books Recommended

1. Solid State Electronic Devices, Ben G.Streetman
2. Semiconductor physics and Devices, J.Neamen
3. Electronic Devices and Circuits, Millmam & Satyabrata

Course code: ECEM-206 (Programming and Programming Methodology)

Software engineering and the software lifecycle, project planning, software development and maintenance. Models of software engineering. Waterfall, prototyping, exploratory programming, formal transformations, code re-use and assembly. Requirements and specifications, requirements validation and prototyping. Software design, Modularity, decomposition, cohesion and coupling. Software qualities, white & black box testing Using fault models to guide testing, user interface attacks. Design methodologies, Representation and analysis, functional and object-oriented design, design notations. Validation and verification

.Code evaluation and examination, metrics, code analysis, errors, defensive design, testing. Programming problems and case studies. Design idioms and patterns, design heuristics, good programming style.

Books Recommended

1. Programming Methodology, Annabelle Mclver and Carrol Morgan
2. Computer Programming Methodology, Wladyslaw Turski and Heyden

Course code: ECEM-207 (Artificial Neural Networks)

Features , structure and working of Biological Neural Network Trends in Computing Comparison of BNN and ANN History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architectureArchitecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning. Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks. Basic feedforward, Basic feedback and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks. Linear responsibility X-OR problem and solution. Analysis of pattern mapping networks summary of basic gradient search method Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network**.** Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.

Books Recommended

1. Artificial neural Networks, B. Yegnanarayana
2. Neural Networks, Satish Kumar
3. Neural networks, Fuzzy logic and Genetic Algorithms, S. Raj sekaran , Vijayalakshmi Pari

Course code: ECEM-208 (Pattern Classification)

Introduction to pattern classification, Issues in classifier design, learning from examples, classification and regression problems, Examples of classifiers, Nearest neighbour, 2-class Bayes classifier for 0-1 loss function. Minimum risk Bayes classifier for 2-class and multiclass cases; some examples.Implementing Bayes classifier, estimating parameters of densityfunctions - overview. Parametric methods, Maximum likelihood and Bayesian estimation examples. Nonparametric density estimation, Parzan window and k-NN methods,Nearest Neighbour classifier. Linear discriminant functions for 2- class case, Perceptron algorithm and convergence proof. Linear least squares regression, pseudoinverse and LMS algorithm.Linear regression for classification, logistic Regression.Fisher linear discriminant, linear discriminant functions for multiclasscase. Generalization abilities of a classifier, basics of statistical learning theory,empirical risk minimization, VC dimension and complexity of learning, regularization. Nonlinear models for classification and Regression: overview.

Books Recommended

1. Pattern Recognition and Machine Learning, C.M. Bishop
2. Pattern Classification, Duda, R.O., Hart, P.E., and Stork, D.G.
3. Pattern Recognition, Theodoridis, S. and Koutroumbas

Course code: ECEM-209 (Advanced Image Processing)

Elements of visual perception, brightness, contrast, hue, saturation, mach band effect,2D image transforms-DFT, DCT, KLT, and SVD. Image enhancement in spatial and frequency domain, Review of morphological image processing

Edge detection, Thresholding, Region growing, Fuzzy clustering, Watershed algorithm, Active contour methods, Texture feature based segmentation, Model based segmentation, Atlas based segmentation, Wavelet based Segmentation methods First and second order edge detection operators, Phase congruency, Localized feature extraction-detecting image curvature, shape features Hough transform, shape skeletonization, Boundary descriptors, Moments, Texture descriptors- Autocorrelation, Co-occurrence features, Runlength features, Fractal model based features, Gabor filter, wavelet features Registration- Preprocessing, Feature selection-points, lines, regions and templates Feature correspondence-Point pattern matching, Line matching, region matching Template matching .Transformation functions-Similarity transformation and Affine Transformation. Resampling- Nearest Neighbour and Cubic Splines Image Fusion-Overview of image fusion, pixel fusion, Multiresolution based fusion discrete wavelet transform, Curvelet transform. Region based fusion Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on 3D images.

Books Recommended

1. The Image Processing Handbook, John C.Russ
2. Feature Extraction and Image Processing, Mark Nixon, Alberto Aguado
3. Multisensor image fusion and its Applications, Rick S.Blum,Zheng Liu

Course code: ECEM-210 (Network Security Laboratory)

Section A Programming

1. Writing program in C++ or Java to implement RSA algorithm for key generation and cipher verification
2. Write a Client – Server program in C++ or Java for authentication verification.
3. Develop and program in C++ or Java based on number theory such as chinese remainder or Extended Euclidian algorithm. (Or any other to illustrate number theory for security)

Section B Cryptography Library (API)

1. Writing program in C++, C# or Java to implement RSA algorithm using Libraries (API).
2. Writing program in C++, C# or Java to implement SHA-1 algorithm using Libraries (API).
3. Writing program in C++, C# or Java to implement AES algorithm using Libraries (API).

Section C Security Tools

1. Configure and demonstrate use of IDS tool such as snort.
2. Configure and demonstrate use of Traffic monitoring tool such as Wireshark with security perspective.
3. Configure and demonstrate use of velnerability assessment tool such as NESSUS.
4. Implement web security with Open SSL tool kit.

Course code: ECEM-211 (Network Security Assessment and Monitoring)

Network Security Assesment: The business Benefits, Classifying internet based Attackers, Assessment Service Definitions, Network Security Assessment Methodology, Cyclic Assessment Approach.

Network Security Assessment Platform: Virtualization Software, Operating Systems, Reconnaissance Tools, Network Scanning Tools, Exploitation Frameworks, Web Application Testing Tools. **Internet Host and Network Enumeration**: Querying Web and Newsgroup Search Engines, Querying Domain WHOIS Registrars, Querying IP WHOIS Registrars, BGP Querying, DNS Querying, Web Server Crawling, Automating Enumeration, SMTP Probing, Enumeration Technique Recap, Enumeration Countermeasures.

IP Network Scanning: ICMP Probing, TCP Port Scanning, UDP Port Scanning, IDS Evasion and Filter Circumvention, Low-Level IP Assessment, Network Scanning Recap and Countermeasures.

A**ssessing Remote Information Services:** DNS, NTP, SNMP, LDAP, Remote Information Services Countermeasures.

Assessing Web Servers: Fingerprinting accessible Web Servers, Enumerating Virtual Hosts and Web Sites, Basic Web Server Crawling and Countermeasures, Web Security Checklist

Assessing Remote Maintenance Services: FTP, SSH, Telnet, VNC.

Assessing Database and Email Services: Oracle, Email Service Protocols, SMTP, Email Services Countermeasures.

Security Monitoring: Why Monitor, Challenges to Monitoring, Outsourcing Security Monitoring, Open Source vs. Commercial Products.

Implementing Policies for Monitoring: Blacklist Monitoring, Anomaly Monitoring, Policy Monitoring, Monitoring against defined policies, Types of Policies

Knowing your Network: Network Taxonomy, Network Telemetry.

Select Targets for Monitoring: Methods for selecting targets, Practical considerations. **Network Intrusion Detection Systems**: Packet analyzing and alerting, Network Intrusion Prevention Systems. Intrusion Detection or Intrusion Prevention

Books Recommended

1. Network Security Assesment, Chris Mcnab
2. Security Monitoring, Chris Fry & Martin Nystron

Course code: ECEM-212 (Research Methodologies and Techniques)

Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem

Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code. Quantitative Methods for problem solving**:** Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.Tabular and graphical description of data**:** Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis Soft Computing**:** Computer and its role in research, Use of statistical soft ware SPSS, GRETL etc in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems. Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing

Books Recommended

1. Research Methodology Methods and Techniques, C.R. Kothari
2. Research Methods, Donald H.McBurney

Course code: ECEM-213 (Operating Systems)

Introduction: Operating system and function, Evolution of operating system, Batch, Interactive, Time Sharing and Real Time System, System protection.

Operating System Structure: System Components, System structure, Operating System Services. Concurrent Processes**:** Process concept, Principle of Concurrency, Producer Consumer Problem, Critical Section problem, Semaphores, Classical problems in Concurrency, Inter Process Communication, Process Generation, Process Scheduling.

CPU Scheduling: Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.

Deadlock: System Model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from deadlock combined approach.

Memory Management: Base machine, Resident monitor, Multiprogramming with fixed partition, Multiprogramming with variable partition, Multiple base register, Paging, Segmentation, Virtual memory concept, Demand paging, Performance, Paged replaced algorithm, Allocation of frames, Thrashing, Cache memory, Organization, Impact on performance.

I/O Management & Disk Scheduling: I/O devices and organization of I/O function, I/O Buffering, DISK I/O, and Operating System Design Issues.

File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues

Books Recommended

1. Design of the Unix Operating System, M. J. Bach
2. Operating System Concepts, A.Silberschatz and P. Galvin
3. Operating System Concepts, J. Peterson, A. Silberschatz, and P. Galvin

Course code: ECEM-214 (Theory of computation)

Introduction: Scope of study as limits to compubality and tractability. Why it suffices to consider only decision problems, equivalently, set membership problems. Notion of a formal language DFAs and notion for their acceptance, informal and then formal definitions. Class of regular languages. Closure of the class under complementation, union and intersection. Strategy for designing DFAs. Pumping lemma for regular languages. Its use as an adversarial game. Generalized version. Converses of lemmas do not hold. NFAs. Notion of computation trees. Definition of languages accepted. Construction of equivalent DFAs of NFAs. NFAs with epsilon transitions. Guess and check paradigm for design of NFAs. Regular expressions. Proof that they capture precisely class of regular languages. Closure properties of and decision problems for regular languages. Myhill-Nerode theorem as characterization of regular languages.States minimization of DFAs. Notion of grammars and languages generated by grammars.Equivalence of regular grammarsand finite automata. Context free grammars and their parse trees. Context free languages. Ambiguity. Pushdown automata (PDAs): deterministic and nondeterministic. Instantaneous descriptions of PDAs.Language acceptance by final states and by empty stack. Equivalence of these two. PDAs and CFGs capture precisely the same language class. Elimination of useless symbols, epsilon productions, unit productions from CFGs. Chomsky normal form. Pumping lemma for CFLs and its use. Closure properties of CFLs. Decision problems for CFLs. Informal proofs that some computational problems cannot be solved.Turing machines (TMs), their instantaneous descriptions. Language acceptance by TMs. Hennie convention for TM transition diagrams.Robustness of the model- - equivalence of natural generalizations as well as restrictions equivalent to basic model. Church-Turing hypothesis and its foundational implications. Codes for TMs. Recursively enumerable (r.e.) and recursive languages. Existence of non-r.e. languages. Notion of undecidable problems. Universal language and universal TM. Separation of recursive and r.e. classes. Notion of reduction. Some undecidable problems of TMs. Rice's theorem. Undecidability of Post's correspondence problem (PCP), some simple applications of undecidability of PCP. Notion of tractability/feasibility. The classes NP and co-NP, their importance. Polynomial time manyone reduction. Completeness under this reduction. Cook-Levin theorem: NP completeness of propositional satisfiability, other variants of satisfiability. NP-complete problems from other domains: graphs (clique, vertex cover, independent sets, Hamiltonian cycle), number problem (partition), set cover.

Books Recommended

1. Automata Theory, Languages, and Computation , John E. Hopcroft, Rajeev Motwani and Jeffery D. Ullman
2. Introduction to the Theory of Computation, Michael Sipser
3. Introduction to Automata Theory, Languages and Computation, JE Hopcroft and JD Ullman

Course code ECEM-215 (High Speed Networks)

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11 Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control. TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management Integrated Services Architecture – Approach, Components, Services-Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

Books Recommended

1. High Speed Networks And Internet, William Stallings
2. High Performance Communication Networks, Warland, Pravin Varaiya

Course code: ECEM-216 (Logic Programming)

Programming Paradigms and Logic Programming Prolog Syntax; Unification Meaning of Prolog Programs List Processing : Operators Arithmetic: Structures Controlling Backtrack in Negation as Failure Built-in Procedures Definite Clause Grammars Meta-Programming/Interpreters Constraint Logic Programming Practical Application Logic and Models : Semantics of Prolog Programs (cont'd) Inductive Logic Pogramming Query Evaluation Strategies; Efficiency Semantic Web and Logic Programming.

Books recommended

1. Logic Programming and Prolog, Ulf Nilsson and Jan Maluszynki
2. Programming in Tabled Prolog, David S. Warren

Course code: ECEM-217 (Biometrics)

Introduction - Biometric fundamentals-Biometric technologies – Biometrics Vs traditional techniques – Characteristics of a good biometric system – Benefits of biometrics – Key biometric processes: verification, identification and biometric matching – Performance measures in biometric systems: FAR, FRR, FTE rate, EER and ATV rate. Introduction of biometric traits and its aim. Physiological biometrics - Leading technologies: Finger-scan – Facial-scan – Iris-scan – Voice- scan – Hand Scan, Retina Scan - components, working principles, competing technologies, strengths and weaknesses. Selection of suitable biometric. Biometric attributes, zephyr charts, types of multi biometrics. Verifications on multimodal system, normalization strategy, fusion methods, multimodal identification. Automated biometric system and behavioral biometrics - Automated fingerprint identification systems - Leading technologies: Signature-scan – Keystroke scan – components, working principles, strengths and weaknesses. Biometric system security, Biometric system vulnerabilities, circumvention, covert acquisition, quality control, template generation, interoperability data storage. Recognition systems: face, signature, fingerprint, ear, iris, Palm etc. Biometric applications - Categorizing biometric applications – application areas: criminal and citizen identification, surveillance, PC/network access, e-commerce and retail/ATM – costs to deploy – other issues in deployment Privacy and standards

in biometrics - Assessing the Privacy Risks of Biometrics – Designing Privacy-Sympathetic Biometric Systems – Need for standards – different biometric standards.

Watermarking: Applications, technqiues, models, detection techniques. Visible and invisible watermarks. Embedding. Robust watermarking, watermark security. Least Bit, DCT, Spread spectrum. Audio steganography. Steganalysis techniques.

Books recommended

1. Biometrics for Network Security, Paul Reid
2. Biometric Technologies and Verification Systems, John R Vacca
3.Handbook of Biometrics, Anil K Jain, Patrick Flynn, Arun A Ross

Course code: ECEM-218 (Simulation and Modeling Techniques)

Handling Stepped and Event-based Time in Simulations Discrete versus Continuous Modeling Numerical Techniques Sources and Propagation of Error Graph or Network Transitions Based Simulations Actor Based Simulations Mesh Based Simulations Hybrid Simulations Partitioning the Data Partitioning the Algorithms Handling Inter-partition Dependencies Introduction to Queues and Random Noise Random Variates Generation Sensitivity Analysis Display Forms: Tables, Graphs, and Multidimensional Visualization Terminals, X and MS Windows, and Web Interfaces Validation of Model Results

Books Recommended

1. Ledin, Jim, Simulation Engineering: Building Better Embedded Systems Faster
2. Bronson, Richard and Naadimuthu, Govindasami, Schaum's Outline of Theory and Problems of Operations Research
3. Neyland, David, Virtual Combat, A Guide to Distributed Interactive Simulation

Course code ECEM-219 (Next Generation Networks)

Evolution of public mobile services - motivations for IP based services, Wireless IP network architecture – 3GPP packet data network architecture. Introduction to next generation networks - Changes, Opportunities and Challenges, Technologies, Networks, and Services, Next Generation Society, future Trends. IMS Architecture - IMS services, QoS Control and Authentication, Network and Service management for NGN, IMS advantages, Next Generation OSS Architecture – standards important to oss architecture, Information framework, OSS interaction with IMS, NGN OSS function/ information view reference model, DMTF CIM. Technology overview –MPLS & QoS, MPLS services and components – layer 2 VPN, layer 2 internetworking, VPN services, signaling, layer 3 VPN –Technology overview, Remote Access and IPsec integration with MPLS VPN. MPLS Multicast VPN overview – Applications, examples, IPv6 and MPLS – Technology overview, Future of MPLS –Integrating IP and optical networks, Future layer 3 services, future layer 2 services. Network Management and Provisioning – Configuration, Accounting, performance, security, case study for MPLS, Future enhancements – Adaptive self healing networks

Books Recommended

1. MPLS and Next Generation Networks: Foundations for NGN and Enterprise Virtualization, Robert Wood
2. MPLS enabled Applications – Emerging developments and new technologies
Ina Minie, Julian Lucek
3. Next Generation Network Services, Neill Wilkinson

Course code: ECEM-220 (Distributed Computing)

What is distributed computing? Basic network concepts, Basic operating system concepts, The Internet, Network resources and their identification, Security, Fault Tolerance Basic model, Primitives (operations): connect, send, receive, disconnect. Connection oriented /Connectionless, Data marshalling, data flattening, data representation, serialization, Event synchronization, Event diagram, sequence diagram. Evolution and overview of paradigms. The socket API-The basic model ,Stream-mode (connection-oriented) socket , Datagram socket (connectionless) socket , Java socket API , Using socket to implement a client ,Using socket to implement a server , A simple middleware using sockets, Secure sockets and the Java secure socket extension API. The daytime protocol and a sample client-server suite, the echo protocol and a sample client-server suite, Connection-oriented client server, Connectionless client-server, Iterative server and concurrent server, Stateful server and stateless server. Unicast versus multicast

Basic model of group communications, The Java multicast API, Sample multicast sender program, Sample multicast listener program, Multicast and message ordering, Reliable multicast

/ broadcast. Distributed objects-Message passing versus distributed objects, The basic model, Remote procedure call , Remote method invocation: basic architecture, object registry, remote interface, interface implementation, server implementation, client implementation, algorithm for developing client-side and server-side software

RMI stub downloading, security policy, Callback. Internet applications: Basic components and protocols: HTTP, HTML, MIME, web server, browser, web forms. Web document types: static, dynamic, executable, active, CGI: background, interaction and passing of data among browser, web server, and scripts(s), HTTP Session state information: hidden tags, cookies, session objects, Client-side programming: Applets, Java Script , Server-side programming: common gateway Interface (CGI), servlets , server pages. Th**e** Common Object Request Broker Architecture: (CORBA): Basic architecture, Object Servers and Object Clients, Object References, Naming services, Object services, Object adapters, Java IDL. Message queue system, Mobile agents, Network services, Object spaces.

Books Recommended

1. Distributed Computing – Concepts and Applications, M. L. Liu
2. Distributed Systems –Principles and Paradigms, Andrew S Tanenbaum , Maartenvan Steen
3. Distributed Systems, Sape Mullender

Course code: ECEM-221 (Fault Tolerant Computing)

Introduction, Dependability measures, Combinational modeling, State-space modeling, Defect avoidance and circumvention, Fault testing, Fault masking, Error detection, Error correction, Malfunction diagnosis and tolerance, Degradation allowance and management, Failure confinement, Hardware implementation strategies, Software reliability and redundancy, Algorithm design methods, Agreement and adjudication

Books Recommended

1. Fault-Tolerant Computer System Design, Pradhan, D.K.
2. Design and Analysis of Fault-Tolerant Digital Systems, Johnson,

B.W 3.Self-checking and Fault-Tolerant Digital Design, Lala, P.K.,

Course code: ECEM-222 (Advanced Network Security)

Introduction to network security, Basic concepts: security services, security mechanisms, Secret key and public key cryptosystems (RSA, DSA, Diffie-Hellman key exchange), one-way hash function One-way key chain, Merkle hash tree Traditional key distribution techniques (Key distribution center, Certificate based key distribution) Client puzzles Zero-knowledge proof Bloom filter Secret sharing ID-based cryptography Secret handshake Rabin's information dispersal algorithm Electronic billing systems Micropayments Fair exchange protocols TESLA and EMSS BiBa Basic concepts in group key management Group key agreement protocols (GDH, B-D protocols, TGDH) Group key distribution protocols (LKH, secret-sharing based protocols, SDR) Secure ad-hoc routing protocols Detecting selfish or malicious nodes Broadcast authentication Key management for sensor networks Secure location verification Intrusion alert correlation

Books Recommended

1. A digital signature based on a conventional encryption function, Merkle.
2. A certified digital signature."R. Merkle

Course code: MTHM-104 (Operations Research)

Linear algebra :Finite Dimensional vector space, sub –spaces, linear independence, bases and dimensions.Algebra of transformation, range and null space of linear transformation .Matrix algebra ,simultaneous equations. Operations Research :Linear Programming :Simplex Method, 2

–Phase Simplex Method.Tramsportation and Assignment problem, Non linear Programming Problem: Quadratic Programming. Langrangian Metod, Karush-Kuhn –Tucker optimal condtions **Books Recommended**

1. Operations Research, Hamdy.A .Taha
2. Linear Programming, S.I. Grass
3. Operations ResearchKanti Swarup and P.K Gupta
4. NON –Linear Programming, S.I.GASS

Course code: MTHM-105 (Advanced Engineering Mathematics)

Groups Rings and Fields: Groups Abelian groups, Subgroups, Necessary and sufficient condition for a subset to be a subgroup of a group, Order of a group , lagranges theorem , cosets ,Normal subgroups, Cyclic group,.Rings, Subrings, Necessary and sufficient condition for a subset to be a subring of a ring, Commutative rings, Intergral domains. Fields, Finite fields, Fields of the form GF(P), Multiplicative inverse in GF(P). Introduction to Number Theory Prime numbers, relatively prime numbers, G.C.D ., Fundamental theorem of algorithm, Fermats theorem, Eulers totient function , Eulers theorem, testing for primality, Chinese remainder theorem, Order of 'a' modulo 'n', Primitive roots of n.

Modular Arithmetic , Eulicid,s Algorithm and Polynomial Arithmetic

Divisors. Modular operator and its properties, Modular Arithmetic operation and its properties, polynomials, Monic polynomials, Ordinary polynomial arithmetic, polynomial arithmeticwith coffecients in Zp, Reducible and irreducible polynomials over a field F, Polynomial ring, Division of polynomials, G.C.D of two polynomials

Queuing Systems

Poisson and exponential Distributions, Birth and deatg Process, Poisson arrival and exponential service , Single Channel Queuing Model

Books Recommended

1. Number Theory, T.M.Apostal
2. Modern Algorithm, I.N.Herssein

11. Course code: ECEM-112 (Communication skills & Research Techniques)

Basics of communication, communication skills, public speaking, communication methods and media, e-mail & beyond, learning through internet, multimedia presentations, effective meetings, professional care of your voice, group discussions & interviews, literature survey, research techniques, optimizations of research parameters, making video films, basic elements of ETV production, distance education.

Books Recommended

1. Developing Communication Skills, Meera Banerji
2. Effective Technical Communication, M Ashraf Rizvi

Course code: ECEM-xxx (Current Mode Analog Circuits)

Module 1 (10 Lectures)

Introduction to current mode circuits: Introduction, comparison of current mode circuits with voltage mode circuits; Current mode circuits: Principle of operation, trans-linear principle, concept of nullator and norator, advantages, applications; Some current mode circuits: vector difference circuit, TL one quadrant squaring circuit, absolute value circuit, TL multiplier/divider.

Module 2 (12 Lectures)

Some BJT and MOS based current mode Building blocks: CCI, CCII, CCCII, CCCII (-IR), OTRA, internal structures, principle of operation; port relationship, analysis and applications;
Multi-output current conveyors: Construction, advantages, applications

Module 3 (17 Lectures)

Transconductance Amplifier: Internal structure and analysis, use of transconductance amplifier as variable resistance, inductance simulator, oscillator and filter; Non-linear applications: Schmitt trigger, multiplier; Operational Mirror Amplifier (OMA): principle of operation, applications as voltage controlled current source, current controlled current source, voltage controlled voltage source, current controlled voltage source, high CMRR instrumentation amplifier.

Text:

1. Analogue IC design : the current-mode approach / edited by C. Toumazou, F.J. Lidgey & D.G. Haigh , Institution of Engineering and Technology, 1993.
2. Current conveyors : variants, applications and hardware implementations / Raj Senani, D.R. Bhaskar, A.K. Singh, Switzerland : Springer International Publishing, 2015.
3. Current Feedback Operational Amplifiers and Their Applications, Senani, R., Bhaskar, D., Singh, A.K., Singh, V.K.,Springer, 2013
4. Analog Circuits and Signal Processing, Ismail, Mohammed, Sawan, Mohamad, Springer.
5. Current-Mode VLSI Analog Filters: Design and Applications, Mohan, P.V. Ananda, Springer, 2003.
6. CMOS Current-Mode Circuits for Data Communications, Fei Yuan, Springer, 2007

Course code: ECEM-xxx (Multirate filter banks and wavelets)

Fundamentals of multirate systems

Introduction, basic multirate operations, Decimation and interpolation, Interconnection of building blocks, the polyphase representation, multistage implementations, applications of multirate systems

Maximally decimated filter banks

QMF filter bank, Errors created in QMF filter bank, Power symmetric QMF filter banks, M channel filter bank, Polyphase representation, Perfect reconstruction (PR) systems, Alisa free filter banks, paraunitary perfect reconstruction filter banks, Linear phase perfect construction filter banks, Cosine modulated filter banks

Wavelets

Wavelets and wavelet expansion systems, discrete wavelet transform, continuous wavelet transform, scaling and wavelet functions, multiresolution analysis, filter banks and discrete wavelet transform, orthogonal an biorthogonal bases, wavelet based signal processing and applications

Books

1. P.P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice-Hall, Englewood Cliffs, NJ, 1993.

2. C Sidney Burrus, Ramesh a Gopinath, Haitao Guo , Introduction to wavelets and wavelet transforms- a Primer, Prentice-Hall

Course code: ECEM-xxx (Solar Photovoltaics)

Introduction to Solar Photovoltaics

Solar Resource, Solar Energy Conversion Technologies, Need of Solar PV, Prospects of PV technology.

Fundamentals of Solar cells

Light Absorption, Charge Excitation, Charge Drift/Diffusion, Charge Separation, Charge Collection, PN junction diodes: Dark IV, illuminated IV, Device Performance parameters: Short Circuit Current, Open Circuit Voltage, Fill Factor, Efficiency, Series/ Shunt Resistance, Factors affecting the performance parameters, Detailed Balanced Limit.

Solar Cell Fabrication:

Vacuum Based Deposition Techniques: Chemical Vapor Deposition (CVD): PECVD, LPCVD, MOCVD, Physical Vapor Deposition (PVD): Sputtering, Electron Beam Evaporation, Vapor Transfer Deposition, Pulsed Laser Deposition, Atomic Layer Deposition, Molecular Beam Epitaxy.

Solution Based Deposition Techniques: Electrodeposition, Spin Casting, Printing, Layer-by Layer Deposition, Colloidal Synthesis.

Solar Cell Characterization:

Solar Simulator, Quantum Efficiency Measurement, Secondary Ion Mass Spectroscopy, FESEM, Energy Dispersive X-Ray Spectroscopy, Photo-Luminescence (Basic and Time Resolved)

Commercial and Emerging Technologies in Solar cells

Silicon PV Technology, Chalcopyrite/ Kesterite Solar Cells, Organic Photovoltaics, Dye Sensitized Solar Cells, Perovskite Solar cells, Transparent Photovoltaic Devices, Flexible PV Devices, Multijunction Devices, Concentrator Solar Cells.

Cutting-edge Themes and PV Modules

Light manipulation in PV Devices: Plasmonic Integration, Surface Texturing, Spectrum Splitting Techniques.
Module Design, Interconnection effects, Temperature effects, Lifetime of PV modules, Module measurement.

PV Device Modeling
Basics of Solar Cell Device Modeling, Thin-Film Solar Cell Device Modeling: Hands-on with an Open Source Tool, Modeling of PV Modules
Books Recommended:

1. Martin A. Green, "Solar Cells: Operating Principles, Technology and System Applications",, Prentice-Hall, 1986.
2. Jenny Nelson, "The Physics of Solar cells", World Scientific, 2003.
3. Smets Arno et al., "Solar Energy Fundamentals, Technology, and Systems", UIT Cambridge. 2013
4. D. K. Schroder, "Semiconductor Material and Device Characterization", Wiley Interscience, 2006
5. Konrad Mertens, "Photovoltaics Fundamentals, Technology, and Practice", Wiley, 2018,
6. J. Poortmans and V. Arkhipov, "Thin Film Solar Cells: Fabrication, Characterization and Applications", Willey, 2006.

Course code: ECEM-xxx (Advanced Signal Processing)

Background Material
Z transform, linear time invariant filters, Discrete Fourier transform, FFT algorithms, Design of FIR and IIR digital filters.
Discrete time random process
Random variables, ensemble averages, independent, uncorrelated and orthogonal random variables, Random process, ensemble averages, autocorrelation matrix, the power spectrum, filtering random Processes, AR, MA and ARMA process.
Wiener Filters
Linear optimum filtering: Problem statement, Principle of orthogonality, Minimum mean square error, Wiener-Hopf equations. Error- performance surface, linear prediction: Forward linear prediction, backward linear prediction.
Adaptive Filters
Method of steepest descent algorithm, least mean square (LMS) adaptation algorithm, Convergence of LMS algorithm, variants of LMS, RLS algorithm, Applications of adaptive filters: adaptive line enhancer, system modeling, Inverse system modeling adaptive channel equalization, adaptive echo canceller, adaptive interference cancellation. Adaptive beamforming
Multirate Systems and Filter Bank
Fundamentals of multirate systems: Basic multirate operations, Interconnection of building blocks, the Polyphase representation, two channel QMF filter bank, Errors created in the QMF filter Bank, A simple alias free QMF system, M-channel filter Bank, Perfect reconstruction Systems, sub-band coding.
Books

1. Simon Haykin, Adaptive Filter Theory, third ed., Prentice-Hall Inc., Englewood Cliffs, NJ, 1996.
2. Monson H Hayes, statistical digital signal processing and modeling, John Wiley and sons, 1996
3. P.P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice-Hall, Englewood Cliffs, NJ, 1993.

4. J. G. Proakis and D. G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Pearson Prentice Hall, 2007
5. A. V. Oppenheim, R. W. Schafer and J. R. Buck, Discrete-time Signal Processing , 2nd Edn., Prentice Hall, 1999.

ECEM-xxx (Detection and estimation theory)

ECEM-xxx (Next generation Communication systems)

ECEM-xxx (Quantum Computing)