M. Tech – COMMUNICATION SYSTEMS (FULL TIME)

Curriculum & Syllabus

(2015-2016 & onwards)

Faculty of Engineering & Technology,
SRM University,
SRM Nagar, Kattankulathur – 603 203
## M. Tech. COMMUNICATION SYSTEMS (FULL TIME)

### Curriculum & Syllabus

Batch 2015–2016 & onwards

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**Credits per semester**

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**Total Credits**: 74

*Main Project-Phase I  ** Main Project-Phase II

## Core courses

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Supportive Courses

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Other Courses

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Total Contact Hours – 60  
Prerequisite : Nil

PURPOSE
In order to transfer data without error from source to destination, focus must be made on coding. This syllabus is highly intended to emphasize on various block coding techniques.

INSTRUCTIONAL OBJECTIVES
1. To understand Galois field arithmetic and its implementation in coding theory.  
2. To get a clear concept of block codes and cyclic codes.

UNIT I - GALOIS FIELDS (12 hours)

UNIT II - POLYNOMIALS OVER GALOIS FIELDS (12 hours)
Euclidean domains and Euclid’s algorithm – Minimal polynomials and Conjugate elements – Factoring $x^n - 1$ - Ideals in the Ring $\frac{GF(q)[x]}{x^n - 1}$.

UNIT III - LINEAR BLOCK CODES (12 hours)
Block error control codes – Linear block codes – Standard array and syndrome-table decoding – Weight distribution of block codes – Hamming codes – Modified linear codes.

UNIT IV - CYCLIC CODES (12 hours)
General theory of linear cyclic codes – Shift register encoders and decoders for cyclic codes – Shortened cyclic codes and CRC error detection.

UNIT V - BCH AND REED SOLOMON CODES (12 hours)
Generator polynomial approach to BCH codes – Weight distribution for some binary BCH codes – Basic properties of Reed Solomon codes – Decoding algorithms for binary BCH codes, non-binary BCH codes, Reed Solomon codes (Berlekamp’s algorithm) – Binary and non-binary erasure decoding.

REFERENCES
To learn the basic principles that forms the background of the analysis and design of digital communication systems.

**INSTRUCTIONAL OBJECTIVES**

1. To learn about Representation of signals and spectra
2. Formatting, baseband and M-ary modulation/demodulation, and Symbol error rate
3. Synchronization and Digital communications in fading channels.

**UNIT I - SIGNALS AND SPECTRA** (15 hours)

**UNIT II - FORMATTING AND BASEBAND TRANSMISSION** (15 hours)

**UNIT III – BANDPASS - MODULATION/DEMODULATION & SYMBOLERROR PERFORMANCE** (15 hours)
Digital bandpass modulation/demodulation - M-ary signaling and modulation - Detection of signals in Gaussian noise – Coherent detection – Non-coherent detection – Error performance of binary systems – Symbol error performance for M-ary signaling. Matlab exercises

**UNIT IV - SYNCHRONIZATION** (15 hours)

**UNIT V - DIGITAL COMMUNICATIONS THROUGH MULTIPATH FADING CHANNELS** (15 hours)
Characterization of multipath fading channels – Effect of signal characteristics on the choice of a channel model – Frequency non-selective/selective slow fading channel – Diversity techniques for multipath fading channel – Multiple-antenna systems. Matlab exercises

**REFERENCES**
PURPOSE
This course is intended to bring to the students the information necessary to understand the design, operation and capabilities of fiber systems. Students will be introduced to the fundamental concepts of various optical components. Latest topics are included to keep in touch with the recent trends.

INSTRUCTIONAL OBJECTIVES

1. To introduce the terminology used in optical fibers
2. To describe the building blocks of an Optical Fiber system and to give clear understanding of various components such as Optical fibers, Optical sources, Photo-detectors and fiber amplifiers
3. To introduce loss and dispersion management
4. To introduce coherent and multichannel systems

UNIT I – INTRODUCTION TO OPTICAL COMMUNICATION AND FIBER CHARACTERISTICS (9 hours)
Evolution of Light wave systems, System components, Optical fibers - Step Index & Graded index - Mode theory, Fiber modes – Dispersion in fibers, Limitations due to dispersion - Fiber Losses - Non-linear effects

UNIT II - OPTICAL TRANSMITTERS AND RECEIVERS (9 hours)
Transmitter’s basic concepts - LED’s structures - Spectral Distribution - Semiconductor lasers - Threshold conditions – Single mode semiconductor laser –Laser Characteristics- Modulation - Transmitter design Receiver’s basic Concepts - PIN and APD diodes structures- Photo detector Noise- Receiver sensitivity – BER and quantum limit - Receiver design

UNIT III - LOSS AND DISPERSION MANAGEMENT (9 hours)
Compensation of Fiber losses - Semiconductor optical amplifiers - Erbium-doped fiber amplifiers, Raman and Brillouin amplifiers Dispersion problems and its solution - Dispersion shifted and dispersion flattened fibers – Dispersion compensated fibers – PMD dispersion – Precompensation at the transmitter and compensation at the receiver Optical solitons - Soliton based communication system.

UNIT IV - ADVANCED LIGHTWAVE SYSTEMS (9 hours)
Homodyne and heterodyne detectors – Advanced modulation formats - Demodulation schemes - BER in synchronous receivers - Sensitivity degradation –Systems with the DBPSK format and DQPSK – System employing Orthogonal FDM

UNIT V - MULTICHANNEL SYSTEMS (9 hours)
WDM systems, multiple access networks - WDM Components - XPM based and FWM based wavelength converters – Fiber based optical regenerator - Hetero wavelength linear crosstalk and homo wavelength Linear Crosstalk – TDM - Code-division multiplexing

Tutorial = 15
REFERENCES

CO2004

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Total Contact Hours – 60
Prerequisite: Nil

PURPOSE
Antenna Theory is central for all radio systems, and this course will enable the students to understand different radio antennas and their usage.

INSTRUCTIONAL OBJECTIVES
  1. To provide in-depth understanding of modern antenna concepts, and practical antenna design for various applications
  2. To explain the theory of different types of antennas used in communication systems
  3. An in-depth study will be made for the analysis and design of arrays
  4. Provide an overview of advanced analytical and numerical methods used to analyze and design antennas
  5. Provide a solid background for research in the field of antenna analysis and design

UNIT I - FUNDAMENTAL CONCEPTS AND RADIATION FROM WIRE ANTENNAS
(9 hours)
Physical concept of radiation- Radiation pattern-near-and far-field regions-antenna theorem-formulation of fundamental antenna properties - Friis transmission equation-radiation integrals and auxiliary potential functions-Infinitesimal dipole-finite-length dipole-linear elements near conductors- dipoles for mobile communication-small circular loop.

UNIT II - ANTENNA ARRAYS AND SYNTHESIS
(9 hours)

UNIT III - APERTURE AND REFLECTOR ANTENNAS
(9 hours)
Huygens' principle- radiation from rectangular and circular apertures- design considerations - Babinet's principle - Radiation from sectoral and pyramidal horns-design concepts prime-focus parabolic reflector and cassegrain antennas.

UNIT IV - BROADBAND AND MICROSTRIP ANTENNAS
(9 hours)
Log-periodic and Yagi antennas- frequency independent antennas- helical antennas -Basic characteristics of microstrip antennas - feeding methods- methods of analysis -design of rectangular and circular patch antennas-microstrip arrays.
UNIT V - ANTENNA MEASUREMENTS, SMART ANTENNAS AND CE (9 hours)

REFERENCES

COR2005

MOBILE COMMUNICATION SYSTEMS & STANDARDS

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Total Contact Hours – 60
Prerequisite : Nil

PURPOSE
To train the students in the technological developments of mobile communication systems and standards.

INSTRUCTIONAL OBJECTIVES
To impart
1. Developments in the current and next generation mobile technologies.
2. Details of advanced mobile communication standards and their evolution.
3. Knowledge on mobility support in network layers.

UNIT I – EVOLUTION OF MODERN MOBILE COMMUNICATION (12 hours)
Personal communication systems –Wireless local area networks – Wireless broadband access systems - Wireless wide area networks – Cellular systems and design fundamentals.

UNIT II – 2G AND 3G CELLULAR SYSTEMS (12 hours)

UNIT III – ADVANCED MOBILE COMMUNICATION STANDARDS (12 hours)
UNIT IV – BEYOND 3G (12 hours)

UNIT V – MOBILE NETWORK, TRANSPORT AND APPLICATION LAYERS (12 hours)

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PURPOSE
The course is designed to make the student understand the basic principles of high speed communication networking. It provides a balance between the description of existing networks and the development of analytical tools. The descriptive material is used to illustrate the underlying concepts, and the analytical material is used to analyze the performance of various networks, and to sharpen one’s conceptual and intuitive understanding of the field.

INSTRUCTIONAL OBJECTIVES

1. Explanation of major concepts and principles in a simple non-mathematical way.
2. Description of modeling issues and mathematical analysis.
3. To acquire deeper understanding and the ability to do research in this field

UNIT I - LAYERED NETWORK ARCHITECTURES (15 hours)
Review of Open Systems Interconnection (OSI) and Transmission Control Protocol/Internet Protocol, and Internetworking

UNIT II - POINT-TO-POINT PROTOCOLS AND LINKS (15 hours)
Error detection – ARQ: Retransmission strategies – Framing – Point-to-point protocols at the network layer – The Transport layer – Broadband ISDN – Frame Relay – Asynchronous Transfer Mode. Lab exercise

UNIT III - DELAY MODELS IN DATA NETWORKS (15 hours)
M/M/1, M/M/m, M/M/m/m, M/M/∞, M/G/1 queuing models – Networks of Transmission lines - Time reversibility (Burke’s theorem) – Network of Queues (Jackson’s theorem). Lab exercise
UNIT IV - ROUTING IN DATA NETWORKS AND INTERNET ROUTING (15 hours)

UNIT V - CONGESTION, TRAFFIC MANAGEMENT AND FLOW CONTROL (15 hours)

REFERENCES

<table>
<thead>
<tr>
<th>CO2007</th>
<th>WIRELESS MIMO COMMUNICATIONS</th>
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PURPOSE
Purpose of the course is to provide a comprehensive coverage of coding techniques for multiple-input, multiple-output (MIMO) communication systems.

INSTRUCTIONAL OBJECTIVES
1. To learn about basic MIMO communication systems, Space-time block codes, Space-time trellis codes, MIMO systems for frequency-selective (FS) fading channels, Turbo codes and iterative decoding for MIMO systems.

UNIT I - FADING CHANNELS AND DIVERSITY TECHNIQUES (15 hours)
Wireless channels – Error/Outage probability over fading channels – Diversity techniques – Channel coding as a means of time diversity – Multiple antennas in wireless communications.

UNIT II - CAPACITY AND INFORMATION RATES OF MIMO CHANNELS (15 hours)
Capacity and Information rates of noisy, AWGN and fading channels – Capacity of MIMO channels – Capacity of non-coherent MIMO channels – Constrained signaling for MIMO communications. Matlab exercise
UNIT III - SPACE-TIME BLOCK AND TRELLIS CODES
(15 hours)
Transmit diversity with two antennas: The Alamouti scheme – Orthogonal and Quasi-orthogonal space-time block codes – Linear dispersion codes – Generic space-time trellis codes – Basic space-time code design principles – Representation of space-time trellis codes for PSK constellation – Performance analysis for space-time trellis codes – Comparison of space-time block and trellis codes. Matlab exercise

UNIT IV - CONCATENATED CODES AND ITERATIVE DECODING
(15 hours)
Development of concatenated codes – Concatenated codes for AWGN and MIMO channels – Turbo coded modulation for MIMO channels – Concatenated space-time block coding. Matlab exercise

UNIT V - SPACE-TIME CODING FOR FREQUENCY SELECTIVE FADING CHANNELS
(15 hours)
MIMO frequency-selective channels – Capacity and Information rates of MIMO FS fading channels – Space-time coding and Channel detection for MIMO FS channels – MIMO OFDM systems. Matlab exercise

REFERENCES

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</table>
UNIT II - SIGNAL CHARACTERISTICS

UNIT III - GPS RECEIVERS & DATA ERRORS

UNIT IV - DIFFERENTIAL GPS

UNIT V - GPS APPLICATIONS
GPS in surveying, Mapping and Geographical Information System – Precision approach Aircraft landing system – Military and Space application – Intelligent transportation system.

REFERENCES

CO2009

<table>
<thead>
<tr>
<th>MOBILE ADHOC NETWORKS</th>
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PURPOSE
To study the functionality of Mobile Adhoc Networking.

INSTRUCTIONAL OBJECTIVES
1. To review the concept of packet radio networks
2. To explore the routing protocols of MANET

UNIT I - ADHOC NETWORKING

UNIT II - TABLE DRIVEN PROTOCOLS

UNIT III - ON-DEMAND PROTOCOLS
UNIT IV - HYBRID AND LINK REVERSAL ROUTING (9 hours)

UNIT V - BEACONING AND BANDWIDTH EFFICIENT ROUTING (9 hours)

Tutorial = 15

REFERENCE

<table>
<thead>
<tr>
<th>Course Code</th>
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<td><strong>ADAPTIVE SIGNAL PROCESSING</strong></td>
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PURPOSE
The purpose of this course is to make the students conversant with the design aspects of Advanced Digital Signal Processing.

INSTRUCTIONAL OBJECTIVES
At the end of the course, student should be able to know
1. Discrete Random Signal Processing
2. Spectrum Estimation
3. Linear Estimation and Prediction
4. Adaptive Filtering Concepts
5. Multirate Signal Processing Concepts

UNIT I - INTRODUCTION TO DISCRETE RANDOM SIGNAL PROCESSING (9 hours)

UNIT II - SPECTRUM ESTIMATION (9 hours)

UNIT III - LINEAR ESTIMATION AND PREDICTION (9 hours)

UNIT IV - ADAPTIVE FILTERING (9 hours)
FIR Adaptive Filters, Steepest Descent Methods - Widrow Hoff, LMS Adaptive Algorithm – Adaptive filter applications in communication system, RLS Adaptive Filters and it's types - Simplified IIR LMS Adaptive Filter - Delay Line Structures.
UNIT V - MULTIRATE SIGNAL PROCESSING
Mathematical Description of Change of Sampling Rate - Integer sampling rate conversions, Single and Multistage Realization - Poly Phase Realization - Application to Sub Band Coding and Coding Gain - Wavelet Transform and Filter Bank Implementation of Wavelet expansion of signals. 2D Filter Banks.

Tutorial = 15

REFERENCES

CO2011

<table>
<thead>
<tr>
<th>MICROWAVE COMMUNICATION</th>
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PURPOSE
This course is intended to bring to the students the information necessary to understand the design of microwave system components. Students will be introduced to the state of the art RF systems using microwave principle to develop cutting edge technological products.

INSTRUCTIONAL OBJECTIVES
1. To introduce the terminology used in microwave, analysis of RF and microwave transmission lines
2. To design the building blocks of an Microwave transmission system
3. To measure various parameters at microwave frequencies
4. To learn about microwave systems and its application in various fields

UNIT I - INTRODUCTION TO MICROWAVES
History of Microwaves, Microwave Frequency bands, Applications of Microwaves: Civil and Military, Medical, EMI/EMC. Mathematical model of Microwave Transmission, Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses in microwave transmission, Concept of Impedance in Microwave transmission.

UNIT II - ANALYSIS OF MICROWAVE TRANSMISSION LINES
Analysis of RF and Microwave Transmission Lines- Coaxial Line, Rectangular Waveguide, Circular waveguide, Stripline, Microstrip Line. Microwave Network Analysis -Equivalent Voltages and currents for non-TEM lines - Network parameters for microwave Circuits - Scattering Parameters.
UNIT III - MICROWAVE DESIGN PRINCIPLES (9 hours)

UNIT IV - MICROWAVE MEASUREMENTS (9 hours)
Power, Frequency and impedance measurement at microwave frequency, Network Analyser and measurement of scattering parameters, Spectrum Analyser and measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure, Measurement of Microwave antenna parameters.

UNIT V - MODERN TRENDS IN MICROWAVE SYSTEMS (9 hours)
Radar Systems, Cellular Phone, Satellite Communication, RFID, GPS. Modern Trends in Microwaves Engineering - Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC), Monolithic Microwave IC fabrication, RFMEMS for microwave components, Microwave Imaging.

REFERENCES

CO2101
CODING TECHNIQUES FOR SPREAD SPECTRUM COMMUNICATIONS

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PURPOSE
This course is about the fundamental aspects that make error control coding work and their implementation in practical application.

INSTRUCTIONAL OBJECTIVES
At the end of the semester, the student should be able to
1. Get an Introduction on Spread spectrum communications
2. Design a system using a convolutional code
3. Design codes to correct burst errors
4. Understand the motivation for and theory of trellis coded modulation
5. Design a system using turbo codes
6. Design error control for channels with feedback

UNIT I - SPREAD SPECTRUM OVERVIEW (9 hours)
Definition and Beneficial attributes of a spread spectrum system – Catalog of spreading techniques - Pseudonoise sequences – Direct-sequence spread-spectrum systems and applications.

UNIT II - CONVOLUTIONAL CODES AND VITERBI DECODING ALGORITHM (9 hours)

UNIT III - SEQUENTIAL DECODING ALGORITHMS & BURST ERROR CORRECTING CODE

UNIT IV - TRELLIS CODED MODULATION(TCM) AND TURBO CODE

UNIT V - ERROR CONTROL FOR CHANNELS WITH FEEDBACK

REFERENCES

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<th>CO2102</th>
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PURPOSE
To study the concept Cognitive Radio and its issues.

INSTRUCTIONAL OBJECTIVES
1. To review the working of SDR.
2. To explore the principle of Cognitive Radio
3. To discuss the research challenges in Cognitive Radio Techniques

UNIT I - SOFTWARE DEFINED RADIO
UNIT II - SDR AS PLATFORM FOR COGNITIVE RADIO (9 hours)
Introduction – Hardware and Software architecture – SDR development process and Design – Application software – Component development – Waveform development – cognitive waveform development

UNIT III - COGNITIVE RADIO TECHNOLOGY (9 hours)

UNIT IV - CR- TECHNICAL CHALLENGES (9 hours)
Design Challenges associated with CR – Hardware requirements – Hidden primary user problem – detecting spread spectrum primary users – sensing duration and frequency – security

UNIT V - SPECTRUM SENSING (9 hours)

REFERENCES

<table>
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PURPOSE
To study various aspects of Network Security Attacks, Services and Mechanisms.

INSTRUCTIONAL OBJECTIVES
1. To deal with various Encryption, Authentication and Digital Signature Algorithms
2. To deal with different general purpose and application of specific security protocols and techniques.

UNIT I CONVENTIONAL ENCRYPTION (9 hours)
Introduction, Conventional Encryption Model, Data Encryption Standard, Block cipher, Encryption algorithms, Confidentiality, Key Distribution.
UNIT II  PUBLIC KEY ENCRYPTION AND HASH & MAC ALGORITHMS (9 hours)

UNIT III  AUTHENTICATION SERVICES AND E-MAIL SECURITY (9 hours)
Kerberos, X.509 Directory Service, Pretty Good Privacy, Secure Multipurpose Internet Mail Extension.

UNIT IV  IP SECURITY AND WEB SECURITY (9 hours)

UNIT V  SYSTEM SECURITY (9 hours)

REFERENCE

<table>
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<th>CO2104</th>
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PREREQUISITE: Nil

PURPOSE
Purpose of this course is to develop a strong foundation in the digital receivers. This subject explains the underlying principles in the Digital Communication receivers. Students are exposed to AWGN and fading channels. Important functions like synchronization and equalization are explained.

INSTRUCTIONAL OBJECTIVES
At the end of this course students will know
1. Linear and nonlinear modulation techniques
2. Various channels like AWGN and fading
3. Synchronization Techniques

UNIT I - REVIEW OF DIGITAL COMMUNICATION TECHNIQUES (9 hours)
Baseband and bandpass communication, signal space representation, linear and nonlinear modulation techniques and spectral characteristics of digital modulation.

UNIT II - OPTIMUM RECEIVERS FOR AWGN CHANNEL (9 hours)
Correlation demodulator, matched filter, maximum likelihood sequence detector, Optimum demodulation and detection of CPM signals, M-ary orthogonal signals, envelope detectors for M-ary and correlated binary signals.
UNIT III - RECEIVERS FOR FADING CHANNELS  
Characterisation of fading multiple channels, statistical models, slow fading, frequency selective fading, diversity technique, RAKE demodulator, Bit interleaved coded modulation, Trellis coded modulation.

UNIT IV - SYNCHRONIZATION TECHNIQUES  
Carrier and symbol synchronization, carrier phase estimation-PLL, Decision directed loops, symbol timing estimation, maximum likelihood and non-decision directed timing estimation, joint estimation.

UNIT V - ADAPTIVE EQUALISATION  
Zero-forcing algorithm, LMS algorithm, adaptive decision-feedback equalizer and Equalisation of Trellis-Coded signals, Kalman algorithm, blind equalizers and stochastic gradient algorithm.

REFERENCES

CO2105

ELECTROMAGNETIC INTERFERENCE & COMPATIBILITY IN SYSTEM DESIGN  
Total Contact Hours - 45  
Prerequisite: Nil

PURPOSE
The purpose of this course is to expose the students to the basics and fundamentals of Electromagnetic Interference and Compatibility in System Design.

INSTRUCTIONAL OBJECTIVES
At the end of the course, student should be able to know:
1. EMI Coupling Principles
2. EMI Specification, Standards and Limits
3. EMI Measurements and Control Techniques
4. EMC Design of PCBs

UNIT I - INTRODUCTION AND SOURCES OF EMI  
EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

UNIT II - TYPES OF ELECTROMAGNETIC COUPLING  
Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near78 Field Cable to Cable Coupling, Power Mains and Power Supply coupling.
UNIT III - EMI MEASUREMENTS (9 hours)
EMI Shielded Chamber, Open Area Test Site, TEM Cell, GTEM cell Sensors/ Injectors/ Couplers, LISN, voltage probe, Current probe. Test beds for ESD and EFT.

UNIT IV - EMI MITIGATION TECHNIQUES (9 hours)
Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V - EMC SYSTEM DESIGN (9 hours)

REFERENCES

CO2106

<table>
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<th>HIGH SPEED SWITCHING ARCHITECTURE</th>
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Prerequisite: Nil

PURPOSE

Speed is one of the demand put forth by the users of communication resources. So focus must be made on the switch architectures suitable for high speed application. This syllabus has been framed based on the above requirements.

INSTRUCTIONAL OBJECTIVES

1. To understand the types of switch fabrics for high speed applications.
2. To get a clear idea about the traffic and Queuing systems

UNIT I - BROADBAND NETWORKING (9 hours)

UNIT II - SWITCHING CONCEPTS (9 hours)
Switch Forwarding Techniques, Switch Path Control, LAN Switching, Cut through Forwarding, Store and forward, Virtual LANs.

UNIT III - SWITCHING ARCHITECTURES (9 hours)
UNIT IV - QUEUING MODELS  
SS7 Signaling - Traffic and queuing models - Input Queuing- Output Queuing -Shared Queuing- 
Performance analysis of Input, Output & Multiple shared Queuing  

UNIT V - IP SWITCHING  
Addressing Model, IP switching types, Flow driven and topology driven solutions, IP over ATM, 
Address and next hop resolution Multicasting, IPv6 over ATM.  

REFERENCES  
1. Achille Pattavina, “Switching Theory Architectures and performance in Broadband ATM 
3. Ranier Handel, Manfred N Huber, Stefab Schrodder, ” ATM Networks - Concepts, Protocols, 
4. Thiggarajan Viswanathan, "Tele Communication Switching System and Networks", Prentice 

CO2107  
MICROWAVE INTEGRATED CIRCUITS  
Total Contact Hours – 45  
Prerequisite : Nil  

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PURPOSE  
This course will give a broad introduction to MIC techniques, and will give students an opportunity 
to study the current literature and to design MICs. Goal of this course is to cover a sufficient 
selection of the huge number of technology used in MICs such that the fabrication and operation of 
many microwave devices will be understandable.  

INSTRUCTIONAL OBJECTIVES  
1. The student should master the following topics and perform the following tasks  
2. Understanding of the different types of MICs and different transmission lines to be used in 
   MICs.  
3. Knowledge of the concept of microstrip line and its interpretation in the analysis and design of 
   microstrip line  
4. Design and Analysis of non-reciprocal components, active devices, High Power and Low 
   Power Circuits.  
5. Micro fabrication of MIC devices will be covered in order to understand the major MIC 
   fabrication techniques and how they interact with system design strategies.  

UNIT I - ANALYSIS OF MIC  
Introduction, Types of MICs and their technology, Propagating models, Analysis of MIC by 
conformal transformation, Numerical method, Hybrid mode analysis, Losses in microstrip, 
Introduction to slot line and coplanar waveguide.  

UNIT II - COUPLERS AND LUMPED ELEMENTS IN MIC  
Introduction to coupled microstrip, Even and odd mode analysis, Branch line couplers, Design and 
fabrication of lumped elements for MICs, Comparison with distributed circuits.
UNIT III - PASSIVE AND ACTIVE COMPONENTS IN MIC  
Ferrimagnetic substrates and inserts, Microstrip circulators, Phase shifters, Microwave transistors, 
Parametric diodes and amplifiers, PIN diodes, Transferred electron devices, Avalanche diodes, 
IMPATT, BARITT devices.

UNIT IV - MIC CIRCUITS AND ITS APPLICATION  
Introduction, Impedance transformers, Filters, High power circuits, Low power circuits, MICs in 
Radar and satellite

UNIT V - FABRICATION PROCESS IN MIC  
Fabrication process of MMIC, Hybrid MICs, Dielectric substances, Thick film and thin film 
technology and materials, Testing methods, Encapsulatation and mounting of devices.

REFERENCES

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PURPOSE
To know about the advanced area of multiple access and signal detection.

INSTRUCTIONAL OBJECTIVES
To impart
1. Code division multiple access channels
2. Optimum detection matched filter design

UNIT I - MULTIACCESS COMMUNICATION  
The multi-access channel - FDMA and TDMA - Random Multiaccess-CDMA - CDMA channel - 
Basic synchronous and asynchronous CDMA model - signature waveform- data streams-
modulation-fading-antenna arrays- Discrete time synchronous and asynchronous models.

UNIT II - SINGLE USER MATCHED FILTER  
Hypothesis testing - Optimal receiver for single user channel - Q function- matched filter in the 
CDMA function- Asymptotic multiuser efficiency and related measures- coherent single user 
matched filter in Reyleigh fading - differentially coherent demodulation- non coherent demodulation.

UNIT III - OPTIMUM MULTIUSER DETECTION  
Optimum Detection and error probability for synchronous and asynchronous - channels - Reyleigh 
fading- optimum noncoherent multiuser detection - decorrelating detector in synchronous and 
asynchronous channel.

UNIT IV - NONDECORRELATING LINEAR MULTIUSER DETECTION  
Optimum linear multiuser detection- Minimum mean square linear multiuser detection- performance 
of MMSE linear multiuser detection- Adaptive MMSE linear multiuser detection-canonical 
representation of linear multiuser detectors-blind MMSE multiuser detection.
UNIT V - DECISION – DRIVEN MULTIUSER DETECTORS (9 hours)
Successive cancellation - performance analysis of successive cancellation - multistage detection - CT tentative decisions - decision feedback multiuser detection.

REFERENCES

CO2109

<table>
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<th>NON - LINEAR FIBER OPTICS</th>
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Total Contact Hours – 45
Prerequisite: Nil

PURPOSE
Acquire an overall understanding of the origin, magnitude and importance of nonlinear optical effects. Become sufficiently well acquainted with the principles of nonlinear optics to be able to make intelligent use of numerical tools for designing and simulating fiber optic communication systems.

INSTRUCTIONAL OBJECTIVES
1. To introduce the fundamentals of nonlinear optics and applications in integrated devices.
2. To present the theory of fiber for pulse compression
3. To introduce and teach the optical solitons used in modern optical systems
4. To broaden the perception of the role of optical engineering in communication sector.

UNIT I - FIBER CHARACTERISTICS AND NON-LINEARITIES (9 hours)
Optical losses - Chromatic dispersion - Modal birefringence – Non-linear refraction Stimulated Inelastic scattering – Importance of non-linear optical effects.

UNIT II - GROUP VELOCITY DISPERSION AND SELF-PHASE MODULATION (9 hours)

UNIT III - OPTICAL SOLITONS AND PULSE COMPRESSION (9 hours)

UNIT IV - CROSS-PHASE MODULATION (9 hours)

UNIT V - STIMULATED RAMAN AND BRILLOUIN SCATTERING (9 hours)
REFERENCES

CO2110

<table>
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Prerequisite : Nil

PURPOSE
The purpose of this course is to provide a state-of-art research status and an indepth treatment of selected topics in OFDM and OFDMA which would provide enough background in wireless network characteristics not realizable with current wireless infrastructure.

INSTRUCTIONAL OBJECTIVES
The objectives of this course are to
1. Take a comprehensive look at OFDMA/OFDM including channel modeling, spectrum efficiency, and resource management
2. Know how OFDMA/OFDM can combine with MIMO to give high data rate transmissions,
3. Know about adaptive modulation, channel estimation, and synchronization in OFDM/OFDMA systems,
4. Know about co-operative OFDMA, and performance and optimization of relay assisted OFDMA networks, and
5. Know about OFDMA applications and OFDMA based mobile WIMAX.

UNIT I - RADIO CHANNEL MODELING, RESOURCE ALLOCATION, AND SPECTRUM EFFICIENCY (9 hours)

UNIT II - RESOURCE MANAGEMENT AND SYNCHRONIZATION: OFDM VS OFDMA (9 hours)
Resource allocation and Scheduling algorithms – Synchronization in OFDMA downlink and uplink – Synchronization for WIMAX

UNIT III - ADAPTIVE MODULATION AND TRAINING SEQUENCE DESIGN (9 hours)
Adaptive modulation algorithms – Channel feedback – Optimal condition for training sequence – Realization of Optimal training – Differential Space time Block codes – Differential Space frequency block codes

UNIT IV - COOPERATIVE OFDMA, PERFORMANCE AND OPTIMIZATION OF RELAY ASSISTED OFDMA NETWORKS (9 hours)
UNIT V-VOFDMA SYSTEMS AND APPLICATIONS, AND OFDMA BASED MOBILE WIMAX (9 hours)

REFERENCES

CO2111

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<th>OPTICAL NETWORK AND PHOTONIC SWITCHING</th>
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Prerequisite : Nil

PURPOSE
The main purpose of this course is to introduce students the important areas of communication networks, mainly optical networks and photonic switching. This will enable the students to acquire a solid understanding of foundations of optical networks technologies, systems, networks issues as well as economic deployment considerations and also photonic switching.

INSTRUCTIONAL OBJECTIVES
To learn about
1. Various components of optical networks
2. Multiplexing techniques and fiber characteristics
3. First generation and broadcast optical network
4. Network management and access networks
5. Various photonic switches

UNIT I - INTRODUCTION TO OPTICAL NETWORKS AND FIBER CHARACTERISTICS (9 hours)

UNIT II - NETWORK COMPONENTS (9 hours)

UNIT III - OPTICAL NETWORKS (9 hours)
UNIT IV - NETWORK MANAGEMENT AND ACCESS NETWORKS (9 hours)
Network Management functions - Optical Layer services and Interfacing - Performance and fault management - optical safety; Access networks – Network Architecture Overview – HFC - FTTC.

UNIT V - PHOTONIC PACKET SWITCHING (9 hours)

REFERENCES

<table>
<thead>
<tr>
<th>CO2112</th>
<th>RF MEMS FOR WIRELESS COMMUNICATION</th>
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PURPOSE
The purpose of this course is to make the students understand the fundamentals of RF MEMS circuit elements, MEMS based circuit design and its applications to wireless communications.

INSTRUCTIONAL OBJECTIVES
At the end of the course, student should be able to:
1. To introduce the physical aspects of RF circuit design
2. To familiarize with Micro fabrication and Actuation Mechanisms in MEMS
3. To know RF MEMS circuit elements such as switches, resonators
4. To understand the working of RF MEMS Phase Shifters, Filters, Oscillators
5. To explore on various Case Study of RF MEMS Devices

UNIT I - WIRELESS SYSTEMS AND ELEMENTS OF RF CIRCUIT DESIGN (9 hours)
Introduction, spheres of wireless activities, the home and office, the ground fixed/ mobile platform, the space platform, wireless standards, systems and architectures, wireless standards, conceptual wireless systems, wireless transceiver architectures, power and bandwidth-efficient wireless systems & challenges, MEMS based wireless appliances enable ubiquitous connectivity. Physical aspects of RF circuit design, skin effect, transmission lines on thin substrates, self-resonance frequency, quality factor packaging, practical aspects of RF circuit design, dc biasing, impedance mismatch effects in RF MEMS.

UNIT II - MICROFABRICATION AND ACTUATION MECHANISMS IN MEMS (9 hours)
Introduction to Microfabrication Techniques- Materials properties, Bulk and surface micromachining, Wet and dry etching, Thin-film depositions (LPCVD, Sputtering, Evaporation), other techniques (LIGA, Electroplating)
Actuation Mechanisms in MEMS- Piezoelectric, Electrostatic, Thermal, Magnetic
UNIT III- RF MEMS SWITCHES, INDUCTOR AND CAPACITOR (9 hours)

UNIT IV - MICROMACHINED RF FILTERS, ANTENNAS AND MEMS PHASE SHIFTER (9 hours)

UNIT V - RF MEMS BASED CIRCUIT DESIGN AND CASE STUDIES (9 hours)
Phase shifters - fundamentals, X-Band RF MEMS Phase shifter for phased array applications, Ka-Band RF MEMS Phase shifter for radar systems applications, Film bulk acoustic wave filters - FBAR filter fundamentals, FBAR filter for PCS applications, RF MEMS filters - A Ka-Band millimeter-wave Micromachined tunable filter, A High-Q 8-MHz MEM Resonator filter, RF MEMS Oscillators - fundamentals, A 14-GHz MEM Oscillator, A Ka - Band Micromachined cavity oscillator, A 2.4 GHz MEMS based voltage controlled oscillator.

REFERENCES

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PURPOSE
To impart the modeling of RF system design in the field of communication system.

INSTRUCTIONAL OBJECTIVES
1. RF Filter designing
2. Study of RF Active components
3. RF transistor amplifier design
4. Oscillators and mixers used in RF design

UNIT I - RESONATORS (9 hours)
Basic resonator and filter configurations-special filter realization-filter implementation-coupled filter.
UNIT II - RF DIODE AND BJT  
RF diodes-bipolar junction transistor - RF field effect transistor-high electron mobility transistors-diode models-transistor models-measurement of active devices-scattering parameter device characterization.

UNIT III - IMPEDANCE MATCHING  
Impedance matching using discrete components-microstrip line matching networks-amplifier classes of operation and biasing networks.

UNIT IV - CHARACTERISTICS OF AMPLIFIERS  
Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers.

UNIT V - HIGH FREQUENCY OSCILLATORS  
Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer.

REFERENCES  

CO2114  
SATELLITE COMMUNICATION  
Total Contact Hours – 45  
Prerequisite: Nil

PURPOSE  
Purpose of this course is to develop a strong foundation in the field of Satellite Communication. The subject gives the students an opportunity to know the communication principles involved in the satellite communications. Students are taught about the earth and space subsystems involved and their importance. Various types of satellite system used nowadays are explained.

INSTRUCTIONAL OBJECTIVES  
At the end of this course students will gain knowledge in the topics such as  
1. Various types of traffic management systems  
2. Power budget calculation  
3. Satellite applications

UNIT I - ORBITS & LAUNCHING METHODS  

UNIT II - SPACE LINK  
UNIT III - SPACE & EARTH SEGMENT (9 hours)

UNIT IV - MULTIPLEXING & MULTIPLE ACCESS (9 hours)

UNIT V - SATELLITE SERVICES (9 hours)

REFERENCES

CO2115
| STATISTICAL SIGNAL PROCESSING | L | T | P | C |
| Total Contact Hours – 45 | 3 | 0 | 0 | 3 |

PURPOSE
To present a Graduate level overview of diverse statistical signal processing algorithmic approaches.

INSTRUCTIONAL OBJECTIVES
To learn about
1. Discrete-time Random processes and Signal modeling
2. Linear estimation and prediction
3. Levinson’s recursion and Spectral factorization
4. Spectral estimation
5. Adaptive filtering.

UNIT I - DISCRETE-TIME RANDOM PROCESSES AND SIGNAL MODELING (9 hours)

UNIT II - LINEAR ESTIMATION AND PREDICTION (9 hours)
**UNIT III - LEVINSON'S RECURSION AND SPECTRAL FACTORIZATION (9 hours)**

**UNIT IV - SPECTRUM ESTIMATION (9 hours)**

**UNIT V - ADAPTIVE FILTERING (9 hours)**

**REFERENCES**

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<tr>
<th>CO2116</th>
<th>STATISTICAL THEORY OF COMMUNICATION</th>
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**PURPOSE**
The course presents a unified approach to the problem of detection, estimation and modulation theory, which are common tools used in many applications of communication systems, signal processing and system theory. The idea is to develop a qualitative understanding of these three areas by examining problems of interest.

**INSTRUCTIONAL OBJECTIVES**
The goal is to develop decision, estimation and modulation theories to demonstrate how they can be used to solve a wealth of practical problems in many diverse physical situations.
UNIT III - DETECTION OF SIGNALS – ESTIMATION OF SIGNAL PARAMETERS
(9 hours)

UNIT IV - ESTIMATION OF CONTINUOUS WAVEFORMS
(9 hours)
Derivation of Estimator equations – A Lower bound on the mean square estimation error – Multidimensional waveform estimation – Non random waveform estimation.

UNIT V - LINEAR ESTIMATION
(9 hours)

REFERENCES

CO2117
ULTRA WIDEBAND COMMUNICATION SYSTEMS
Total Contact Hours - 45
Prerequisite: Nil

PURPOSE
This course focuses on the basic signal processing techniques that concerns present and future dynamic UWB communication systems. This course encompasses all areas of design and implementation of UWB systems.

INSTRUCTIONAL OBJECTIVES
At the end of the semester, the student should be able to develop a comprehensive overview of UWB system design that spans propagation, transmit and receive antenna implementations, standards and advanced topics, modulation and multiple access, network issues, and applications.

UNIT I - UWB SIGNALS AND SYSTEMS WITH UWB WAVEFORMS
(9 hours)

UNIT II - SIGNAL PROCESSING TECHNIQUES FOR UWB SYSTEMS AND UWB CHANNEL MODELING
(9 hours)
UNIT III - UWB COMMUNICATIONS AND ADVANCED UWB PULSE GENERATION
(9 hours)
UWB modulation methods – Pulse trains – UWB transmitter/receiver – Multiple access techniques in UWB – Capacity of UWB systems – Comparison of UWB with other wideband communication systems – Interference and coexistence of UWB with other systems – Hermite pulses – Orthogonal prolate spheroidal wave functions – Wavelet packets in UWB PSM – Applications of UWB communication systems.

UNIT IV - UWB ANTENNAS AND ARRAYS, POSITION AND LOCATION WITH UWB SIGNALS
(9 hours)

UNIT V - UWB COMMUNICATION STANDARDS AND ADVANCED TOPICS IN UWB COMMUNICATION SYSTEMS
(9 hours)

REFERENCES

CO2118

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<th>WCDMA FOR UMTS</th>
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PURPOSE
To impart the knowledge of 3G systems.

INSTRUCTIONAL OBJECTIVES
At the end of this course students will gain knowledge in the topics such as
1. Introduction to UMTS, its services and applications.
2. Radio network planning, resource management and 3G systems.

UNIT I - UMTS SERVICES AND APPLICATIONS
(9 hours)
Introduction – Person-to-Person Circuit Switched Service-Person-to Person Packet Switched Services-Content-to-Person Services-Quality of Services Differentiation-Location Services in WCDMA – Summary of the Main parameters in WCDMA – Spreading and Despreading – Multipath Radio Channels – Power Control.
UNIT II - PHYSICAL LAYERS (9 hours)

UNIT III - RADIO NETWORK PLANNING (9 hours)

UNIT IV - RADIO RESOURCE MANAGEMENT (9 hours)

UNIT V - QUALITY OF SERVICE IN 3G SYSTEMS (9 hours)
Introduction – Overview of the concepts-Classification of traffic-UTMS service attributes – Requesting Qos-Admission control-Providing requested Qos-Differentiated services.

REFERENCES

CO2119

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PURPOSE
To explore the functionalities Wireless Sensor Networks.

INSTRUCTIONAL OBJECTIVES
1. To review the architecture of WSN.
2. To study the various protocols layers of WSN.
3. To study the establishment of WSN infrastructure

UNIT I - INTRODUCTION (9 hours)
Architectural Elements, Basic Technology, Sensor Node, Hardware and Software, Sensor Taxonomy, Design challenges, Characteristics and requirements of WSNs, Applications.

UNIT II - MAC PROTOCOLS FOR WSN (9 hours)

UNIT III - ROUTING PROTOCOLS FOR WSN (9 hours)
Data Dissemination and Gathering, Challenges and Design Issues, Network Scale and Time-Varying Characteristics, Routing Strategies, Flooding and it’s variants.
UNIT IV - TRANSPORT CONTROL PROTOCOLS FOR WSN (9 hours)

UNIT V - WSN INFRASTRUCTURE ESTABLISHMENT (9 hours)
Topology Control, Clustering, Time Synchronization, localization and positioning, Sensor Tasking and Control.

REFERENCES


CO2120

STOCHASTIC PROCESSES AND QUEUING THEORY

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Total Contact hours - 45
Prerequisite : Nil

PURPOSE
This course provides an introduction to stochastic processes in communications and signal processing. Topics include continuous and discrete random processes, spectral representation and estimation, entropy, Markov processes and queuing theory.

INSTRUCTIONAL OBJECTIVES
1. The objective of this course is to develop the subject of probability and stochastic processes as a deductive discipline and to illustrate the theory with basic applications of general interest. Clarity and economy is discussed, avoiding sophisticated mathematics, or at the other end, a detailed discussion of practical applications is made.

UNIT I - GENERAL CONCEPTS AND BASIC APPLICATIONS (9 hours)

UNIT II - SPECTRAL REPRESENTATION (9 hours)

UNIT III: SPECTRAL ESTIMATION AND MEAN-SQUARE ESTIMATION (9 hours)
UNIT IV - ENTROPY

UNIT V - MARKOV PROCESSES AND QUEUING THEORY
The Level Crossing problem – Queuing theory – Network of Queues – Markov Processes

REFERENCES

CO2121
MULTICASTING TECHNIQUES IN MANETS
Total Contact hours – 45
Prerequisite: Nil

PURPOSE
To provide a comprehensive guide on the new ideas in the area of Multicast Communication.

INSTRUCTIONAL OBJECTIVES
1. To study the fundamentals of Communication Paradigms in MANETs
2. To learn the Modeling and simulation tools for MANETs
3. To study the multicast routing protocols and routing techniques in MANETs

UNIT-I ROUTING IN MANETS

UNIT-II COMMUNICATION TECHNIQUES

UNIT-III MULTICAST ROUTING PROTOCOL

UNIT-IV IMPLEMENTATION AND SIMULATION
Introduction – Modeling and Simulation tools for MANETs – Network simulator, Glomosim, Qualnet and Opnet - Calculation of Metrics – Simulation parameters – Simulation Results – Conclusion.

UNIT-V SECURITY ASPECTS
REFERENCES

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<tr>
<th>CO2122</th>
<th>WAVELET TRANSFORMS AND APPLICATIONS</th>
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**PURPOSE**
The purpose of this course is to acquire knowledge about various wavelet transforms and the design of wavelet transforms. Then apply wavelet transform for various signal & image processing applications.

**INSTRUCTIONAL OBJECTIVES**
1. To study the basics of signal representation and Fourier theory
2. To understand Multi Resolution Analysis and Wavelet concepts
3. To study the wavelet transform in both continuous and discrete domain
4. To understand the design of wavelets using Lifting scheme
5. To understand the applications of Wavelet transform

**UNIT I- FUNDAMENTALS** (9hours)

**UNIT II-MULTI RESOLUTION ANALYSIS** (9hours)
Definition of Multi Resolution Analysis (MRA) – Haar Basis – Construction of General Orthonormal MRA – Wavelet Basis for MRA – Continuous Time MRA Interpretation for the DTWT – Discrete Time MRA – Basis Functions for the DTWT – PRQMF Filter Banks.

**UNIT III- CONTINUOUS WAVELET TRANSFORMS** (9hours)
Wavelet Transform – Definition and Properties – Concept of Scale and its Relation with Frequency – Continuous Wavelet Transform (CWT) – Scaling Function and Wavelet Functions (Daubechies Coiflet, Mexican Hat, Sinc, Gaussian, Bi Orthogonal)– Tiling of Time – Scale Plane for CWT.

**UNIT IV- DISCRETE WAVELET TRANSFORM** (9hours)
UNIT V- APPLICATIONS

REFERENCES

CO2123

ANTENNAS FOR PERSONAL AREA COMMUNICATION

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TOTAL CONTACT HOURS – 45

Prerequisite: Nil

PURPOSE:
Antenna Theory is central for all Radio Systems, and this course will enable the learners to understand different Radio Antennas and their usage.

INSTRUCTIONAL OBJECTIVES:
1. To List the various types of Printed Antennas
2. To understand about Wearable Antennas
3. To gain the knowledge about Active Integrated Antennas
4. To apply the Reconfigurability function in Antenna Design
5. To study about different array techniques

UNIT-I PRINTED ANTENNAS (9 hours)

UNIT-II WEARABLE ANTENNAS (9 hours)
UNIT-III ACTIVE INTEGRATED ANTENNAS (9 hours)

UNIT-IV RECONFIGURABLE ANTENNAS (9 hours)
Reconfigurable methodologies, Design Considerations for Reconfigurable systems, Reconfigurable Planar/printed antenna configurations, Active reconfigurable systems.

UNIT-V ARRAY ANTENNAS (9 hours)
Linear and planar array fundamentals, Mutual Coupling in Arrays, Multidimensional Arrays, Switched beam and Phased Arrays, Array Feeding Techniques, Array optimization techniques.

REFERENCES

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<th>CO2124</th>
<th>RECONFIGURABLE ANTENNAS</th>
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PURPOSE
This course introduces the emerging area of reconfigurable antennas from basic concepts that provide insight into the fundamental design approaches to advanced techniques and examples that offer important new capabilities for next generation applications.

INSTRUCTIONAL OBJECTIVES
1. To understand the basics of reconfigurable antennas and study the various reconfiguration Mechanism
2. To design, analyze and optimization of reconfigurable antenna using Graph Model
3. To gain knowledge on reflect array antennas

UNIT I-INTRODUCTION TO RECONFIGURABLE ANTENNA 9 hrs
Introduction-Definitions of critical parameters for antenna operation-Frequency response-Radiation characteristics-Linkage between frequency response and radiation characteristics-Implications for reconfigurable antennas

UNIT II-RECONFIGURATION TECHNIQUES AND CLASSIFICATION OF RECONFIGURABLE ANTENNAS 9hrs
Reconfiguration mechanism-Types of reconfigurable antennas-Methods for achieving frequency reconfigurability-Methods for achieving polarization reconfigurability-Methods for achieving pattern reconfigurability-Methods for achieving compound reconfigurability-Practical issues for implementing reconfigurable antennas-Reconfigurable antennas application and requirements

UNIT III - OPTIMIZATION TECHNIQUES FOR PLANAR ANTENNAS 9 hrs
Introduction-basic optimization concept-Real coded genetic algorithm-Neurospectral design of antenna-ANN Technique-Particle swarm optimization Techniques

UNIT IV - RECONFIGURABLE ANTENNA DESIGN USING GRAPH MODEL 9 hrs
Introduction to Graphs-Rules and Guidelines for graph modeling antennas-Graph Algorithm-reconfigurable antenna design steps using graph-Redundancy reduction in antenna structure-Analyzing the complexity and reliability of reconfigurable antennas—Detection and correction of switch failures in reconfigurable antennas.

UNIT V - REFLECTARRAY ANTENNAS 9 hrs
Introduction-General review of reflect array antennas-Comparisons of reflect array and conventional reflector-wideband techniques for reflect arrays- cell elements and applications-development of novel loop based cell elements.

REFERENCES
3. Debatosh Guha, Yahia, M.M. Antar, “Microstrip and Printed Antennas; new trends, techniques, applications,” John Wiley & Sons Ltd. 2011

CO2125
<table>
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<tr>
<th>FIBER WIRELESS ACCESS NETWORKS</th>
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PURPOSE
This course introduces the students to the emerging areas of access network technology and advantages with solid knowledge of fiber wire line access technologies like PON and RoF, and wireless accessing technologies like WiFi, WiMAX and LTE.

INSTRUCTIONAL OBJECTIVES
1. To understand the basics of PON and RoF
2. To learn about WiFi, WiMAX, LTE Wireless Access Technologies.
3. To analyze the architecture of FiWi access network

UNIT I: FIBER ACCESS NETWORKS 9 hours

UNIT II: INTRODUCTION TO RADIO OVER FIBER 9 hours
UNIT-III: ROF SYSTEM DESIGN FOR DBWS  (9 hours)
Wireless Trends - Provision of Broadband Access - System Capacity - Power Efficiency
Fairness in Access - Architecture Options - The Global Centralized Architecture - Distributed
Broadband Wireless Systems (DBWS) Architecture Elements - Physical Elements of the DBWS
Radio over Fiber Link Design Issues - Number of Channels - Peak-to-Average-Power Ratio -
Modulation Scheme - Uplink Power Control - Example Link Design

UNIT-III: WIRELESS ACCESS NETWORKS  (9 hours)
WiFi - Legacy WLAN - QoS in WLAN - HT WLAN - VHT WLAN - WiMAX - Fixed WiMAX -
Mobile WiMAX - Next-Generation WiMAX - LTE - PHY layer - MAC layer - Power saving -
Handover - LTE-Advanced.

UNIT-V: FIWI ACCESS NETWORKS  (9 hours)
RoF vs. R&F networks - Enabling technologies - State-of-the-art test beds - Challenges and open
issues - Architectures - Cellular architectures - WiMAX based architectures - WiFi based
architectures.

REFERENCES

CO2126  
Semiconductor Optical Amplifier based All Optical
Circuits and Devices  
Total Contact Hours – 45  
Prerequisite: Nil

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PURPOSE
To familiarize the student with SOA based All optical circuits

INSTRUCTIONAL OBJECTIVES
1. To learn the operating principles of SOA
2. To understand the SOA Nonlinearities
3. To design and analyze SOA based All optical circuits

UNIT-I: Semiconductor Optical Amplifiers  (9 hours)
Introduction - Operation Principles - SOA Gain - Refractive Index - Line width Enhancement Factor –
Amplifier Rate Equations for Pulse Propagation - Pulse Amplification - Multichannel
Amplification - Amplifier Application in Optical Transmission Systems - Amplifier Noise - Gain
Dynamics

UNIT-II: SOAs Nonlinearities and Applications  (9 hours)
Four-Wave Mixing - Cross Gain Modulation - Cross Phase Modulation - Wavelength Conversion –
Optical Demultiplexing - OTDM System Applications
UNIT-III: Optical Logic Operations (9hours)
SOA-MZI Gate - SOA-MZI Transfer Function - Michelson Interferometer - Optical Logic XOR - Optical Logic OR - Optical Logic AND - Optical Logic NOT - Optical Logic NOR - Optical Logic XNOR - Optical Logic NAND

UNIT IV: Optical Logic Circuits (9hours)
All optical Flip Flop – Adder - Parity Checker - All-Optical Pseudorandom Binary Sequence (PRBS) Generator - All-Optical Clock Recovery

UNIT-V: All Optical signal processing and switching circuits (9hours)
All optical regeneration – Data format conversion – All-Optical Header/Payload separation - All-Optical correlator - All-Optical packet routing - All-Optical Header Processor

REFERENCES

CO2127
Semiconductor Optoelectronic Devices

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Total Contact Hours – 45
Prerequisite: Nil

PURPOSE
This course introduces the students to the semiconductor optoelectronic devices which find applications in display devices, Optical sources and detectors. Also, it deals with modulation and switching devices which can be used for optical signal processing.

INSTRUCTIONAL OBJECTIVES
1. Acquire fundamental understanding of the basic physics behind optoelectronic devices.
2. Develop basic understanding of display devices, light emitting diodes and Lasers
3. Acquire in depth understanding of Optical detector devices
4. Acquire detailed knowledge optoelectronic modulation and switching devices.
5. Develop basic understanding of optoelectronic integrated circuits.

UNIT I OPTICAL PROCESSES IN SEMICONDUCTORS

UNIT II DISPLAY DEVICES AND LASERS
Liquid crystal cells - Challenges in scaling to a display screen – Passive Matrix LCD – TFT – Field emission displays, Plasma Display, Numeric Displays

UNIT III OPTICAL DETECTION DEVICES
Photo Conductors, Junction Photo diodes- PIN and Heterojunction diodes - Avalanche Photodiodes, Special detection schemes – Phototransistor, Modulated Barrier Photodiode, Schottky Barrier photodiode, MSM photodiode, Wavelength selective detection, Microcavity photodiodes- Photovoltaics and Solar cells

UNIT IV MODULATION AND SWITCHING DEVICES

UNIT V OPTICAL INTEGRATED CIRCUITS

REFERENCES

<table>
<thead>
<tr>
<th>CO2128</th>
<th>Wireless Optical Communication</th>
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<td>To familiarize the student with the design of communication systems for wireless optical channels. To expose the physical aspects of wireless optical channels including propagation characteristics to serve as an introduction to communication specialists.</td>
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<th>INSTRUCTIONAL OBJECTIVES</th>
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<tr>
<td>1.</td>
<td>To understand the extension of the wealth of modern design practices from electrical channels to optical intensity domain</td>
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<td>2.</td>
<td>To analyze vector representation of optical signals, design and capacity of signaling sets and use of multiple transmitter and receivers to improve spectral efficiency</td>
</tr>
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</table>
UNIT I – FUNDAMENTALS OF WIRELESS COMMUNICATION (9 hours)

UNIT II – INTRODUCTION TO OPTICAL SIGNALLING (9 hours)

UNIT III – SIGNALLING DESIGN (9 hours)
Optical intensity signal space model: Signal space model – Admissible region– Peak optical power bounding region – Peak optical power per symbol – Peak-symmetric signalling schemes, Example and geometric properties – Atmospheric turbulence channel modeling.

UNIT IV – OPTICAL CHANNEL CAPACITY (9 hours)
Channel capacity: Background, problem definition, bandwidth constraints, upper bound on channel capacity,lower bound on channel capacity, example and discussion – Channel capacity of hybrid free space optical wireless channels.

UNIT V – MUTIELEMENT TECHNIQUES (9 hours)

REFERENCES

CO2129

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Total Contact Hours – 45
Pre-requisite: Nil

PURPOSE
To provide mathematical knowledge to address the real world signal acquisition and compression using compressive sensing.

INSTRUCTIONAL OBJECTIVES
1. To acquire knowledge on the basics and applications of sparse signals
2. Basic algorithms and tools from linear algebra and probability theory.
3. Coherence and isometry property of under sampling technique.

UNIT I – BASIC ALGORITHMS (9 hours)
Introduction to Compressive Sensing, Applications, Motivations Extensions, Sparse Solutions to underdetermined Systems- Sparsity and compressibility, minimal number of measurements, NP-
Hardness of ℓ0 minimization. **Basic Algorithms** - Optimization Methods, Greedy Methods, Thresholding Based methods.

**UNIT II – TOOLS FROM LINEAR ALGEBRA**

*Basic pursuit* - Null Space property, stability, robustness, recovery, Low-rank matrix recovery.

**UNIT III – TOOLS FROM PROBABILITY THEORY**

Essentials, moments and trials, Cramer’s theorem, Hoeffding’s inequality, sub Gaussian random variables, Bernstein Inequalities.

**UNIT IV – COHERENCE AND ISOMETRY PROPERTY**

Definition and basic properties, Matrices with Small Coherence, Analysis of Orthogonal Matching Pursuit, Analysis of Basis Pursuit, Analysis of thresholding algorithm, Analysis of Greedy algorithm.

**UNIT V – SPARSE RECOVERY WITH RANDOM MATRICES**

Restricted Isometry property for subgaussian matrices and gaussian matrices, Nonuniform Recovery, Null Space Property for Gaussian Matrices.

**REFERENCES**


### CO2130

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<td>Photonic Integrated Circuits</td>
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<td>Total Contact Hours – 45</td>
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**PURPOSE**

To familiarize the student with the basics of Photonic Integrated Circuits

**INSTRUCTIONAL OBJECTIVES**

1. To analyze optical waveguides and devices and coupling between them
2. To study various applications of PICs

**UNIT I: THEORY OF OPTICAL WAVEGUIDES AND COUPLING MODE THEORY**

UNIT II: INTEGRATED LASER DIODES AND INTEGRATED DETECTORS  (9hours)

UNIT III: OPTOELECTRONIC INTEGRATED CIRCUITS AND AMPLIFIERS  (9hours)

UNIT IV: ACTIVE PHOTONIC INTEGRATED CIRCUITS – A SIMULATION STUDY  (9hours)

UNIT V: APPLICATIONS OF PHOTONIC INTEGRATED CIRCUITS  (9hours)

REFERENCES
This course is intended to bring to the students the basic theory and fundamentals of photonic microring resonators. Topics included in this course will enlighten the student with the research activity in the field of ring resonators.

INSTRUCTIONAL OBJECTIVES
1. To describe the fundamental theory and principles of Microring resonators
2. To introduce tuning activity ring resonator systems
3. To introduce various techniques of fabricating ring resonators

UNIT I: MICRO RING RESONATORS – THEORY AND PRINCIPLES (9 hours)
Introduction to microring resonators – Putting the micro in micro ring – Building Blocks of ring resonator devices – Couplers – Bends - Spot size converters for light in and outcoupling - General characteristics of micro ring resonators – Sources of loss in micro ring resonators – Nonlinear susceptibility - Resonator enhanced $\chi^{(2)}$ nonlinear effects - Enhanced nonlinear phase shift - Enhanced four wave mixing efficiency in micro ring resonators

UNIT II: TUNING IN MICRO RING RESONATORS (9 hours)

UNIT III: MICRO RING RESONATORS – TYPES AND APPLICATIONS (9 hours)
All pass ring resonators – Add drop ring resonators - Series coupled ring resonators – Parallel coupled ring resonators - Spectral filters -General IIR Optical transfer functions - Sum–Difference all-pass micro ring filters - Optical delay lines - Label-free biosensors – Modulators

UNIT IV: MICRO RING RESONATORS FOR COMMUNICATION AND SIGNAL PROCESSING APPLICATIONS (9 hours)
Functions of ring resonators in Optical communication and signal processing - Channel adding/dropping in TDM systems - Generation and demodulation for advanced data formats - Frequency comb generation for arbitrary waveform generation - Dispersion compensators – Optical AND, OR, XNOR logic gates using MRR.

UNIT V: FABRICATION TECHNIQUES FOR MICRO RING RESONATORS (9 hours)
REFERENCES

**CO2132**

<table>
<thead>
<tr>
<th>NEAR-FIELD OPTICS AND PLASMONICS</th>
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**PURPOSE**
To provide an introduction to the fundamentals of nano-optics and to get exposure on design and analysis of computational methods

**INSTRUCTIONAL OBJECTIVES**
At the end of the course, the learner will be able to
1. understand the fundamentals of nano-optics
2. gain knowledge in Finite Time Domain Method tools for the design and analysis of opto-electronic devices
3. get an overview of nanoantenna’s application and designing the plasmonic materials
4. understand the concepts of biosensors in the field of optics

**UNIT–I: FUNDAMENTAL CONCEPTS OF EM WAVES** (9 hours)
Wave optics and wave mechanics - scattering, propagation, focusing Angular spectrum representation of EM waves- resolution limits in classical optics - Near-fields and far-fields – diffraction limit

**UNIT–II: COMPUTATIONAL METHODS IN NANO-OPTICS** (9 hours)
Typical boundary-value problems for Maxwell equations in nanostructures: effective constitutive relations and effective boundary conditions. Introduction to FDTD – 1D FDTD: formulation, implementation, post processing, examples – 2D FDTD: PML, formulation, implementation – Periodic FDTD – 3D FDTD and advanced optics.

**UNIT–III: NANOANTENNAS** (9 hours)

**UNIT–IV: APPLICATIONS OF NANOANTENNAS** (9 hours)

**UNIT–V: OPTICAL BIOSENSOR** (9 hours)
Overview of biosensors – optical sensing/detection techniques and instrumentation - photonic structures in sensing: Optical label-free detection, Optical fluorescence detection – Surface Enhanced
Raman Spectroscopy - Microfluidics and optofluidics – Overview of nanotechnology in bio/chemical sensing – optical manipulation and sorting

REFERENCES

<table>
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<tr>
<td>SIGNAL PROCESSING TECHNIQUES FOR SPEECH RECOGNITION</td>
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<td>Prerequisite: Nil</td>
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PURPOSE: To present overview of speech production mechanism and the algorithms

INSTRUCTIONAL OBJECTIVES: To learn about
1. Speech Production Mechanism
2. Speech Signal Processing concepts
3. Speech recognition, Feature selection
4. Distance measures for comparing speech patterns
5. GCI/GOI Algorithms

UNIT-I: THE SPEECH PRODUCTION MECHANISM (9 hours)
Physiological and Mathematical Model-Relating the physiological and mathematical model-Categorization of Speech Sounds based on the source-system and the articulatory model. Basic Speech Signal Processing Concepts-Discrete time speech signals, relevant properties of the fast Fourier transform.

UNIT-II: SPEECH MODELING (9 hours)
Z-transform for speech recognition, convolution, linear and nonlinear filter banks-Spectral estimation of speech using the Discrete Fourier transforms-Pole-zero modeling of speech and linear prediction (LP) analysis of speech-Homomorphic speech signal de-convolution, real and complex cepstrum, application of cepstral analysis to speech signals.

UNIT-III: FEATURE EXTRACTION FOR SPEECH RECOGNITION (9 hours)
Static and dynamic features for speech recognition, robustness issues, discrimination in the feature space, feature selection-Mel frequency cepstral co-efficients (MFCC), Linear prediction cepstral coefficients (LPCC), Perceptual LPCC. Distance measures for comparing speech patterns-Log spectral distance, cepstral distances, weighted cepstral distances, distances for linear and warped scales.
UNIT-IV: DYNAMIC TIME WARping FOR ISOLATED WORD RECOGNITION

Statistical models for speech recognition-Vector quantization models and applications in speaker recognition-Gaussian mixture modeling for speaker and speech recognition-Discrete and Continuous Hidden Markov modeling for isolated word and continuous speech recognition.

UNIT-V: GLOTTAL CLOSURE/OPENING INSTANTS ALGORITHMS

Hilbert Envelope based detection(HE) method-Dynamic Programming Phase Slope Algorithm (DYPSA)-Zero frequency resonator – based method(ZFR)-Speech Event Detection using Residual Excitation And a Mean-based Signal(SEDREAMS) and the Yet Another GCI Algorithm (YAGA).

References

MA2009
APPLIED MATHEMATICS

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Total Contact hours - 45
Prerequisite : Nil

PURPOSE
To develop analytical capability and to impart knowledge in Mathematical and Statistical methods and their applications in Engineering and Technology and to apply these concepts in engineering problems they would come across.

INSTRUCTIONAL OBJECTIVES

1. At the end of the course, Students should be able to understand Mathematical and Statistical concepts, Discrete Fourier transform, Z transform, queueing theory concepts and apply the concepts in solving the engineering problems.

UNIT I – BOUNDARY VALUE PROBLEMS
Solution of initial and boundary value problems - Characteristics - D'Alembert's Solution - Significance of Characteristic curves - Laplace transform solutions for displacement in a long string - a long string under its weight - a bar with prescribed force on one end - free vibration of a string.

UNIT II – SPECIAL FUNCTIONS
Series solutions - Bessel's equation - Bessel Functions - Legendre's equation - Legendre Polynomials - Rodrigue's formula - Recurrence relations - Generating Functions and orthogonal property for Bessel functions of the first kind.

UNIT III – DISCRETE TRANSFORMS

UNIT IV – RANDOM VARIABLES
Review of Probability distributions - Random variables -Moment generating functions and their properties - Functions of Random variables.

UNIT V – QUEUEING THEORY
Single and Multiple server Markovian Queueing models - Customer impatience - Queueing applications.

REFERENCES
1. Veerarajan T, "Mathematics IV", Tata McGraw Hill, 2000. (Unit II Chapter 3 Section 3.4 Unit I Chapter 5)
3. Sankara Rao K., "Introduction to Partial Differential Equations", PHI, 1995 (Unit II - Chapter 1, Section 1.3, Chapter 6 Section 6.13)
4. Veerajan T, "Probability, Statistics and Random Processes", 2004 (Unit IV - Chapter 1,2,3,4 Unit V - Chapter 5)
PURPOSE
This course is designed to familiarize the student with the design, analysis operation and management of modern data communications networks. The course will provide the student with a working knowledge of the types of communications network management systems and their strengths and weaknesses in solving various information network management problems.

INSTRUCTIONAL OBJECTIVES
1. To understand the fundamental concepts of network management
2. To provide an exposure to network security aspects

UNIT I - OVERVIEW OF NETWORK MANAGEMENT (9 hours)

UNIT II - SNMP NETWORK MANAGEMENT (9 hours)
SNMP - organizational model - system overview, information model, communication model - Functional model. SNMPv2 system architecture, SNMPv3 architecture, SNMP management: RMON.

UNIT III - BROADBAND ATM NETWORKS (9 hours)
ATM Technology - VP, VC, ATM Packet, Integrated service, ATMLAN emulation, Virtual LAN, ATM Network Management - ATM Network reference model, ATM Management Information base, ATM Management, M1, M2, M3, M4 interface

UNIT IV - NETWORK MANAGEMENT TOOLS AND SYSTEMS (9 hours)
Network Management Tools, Network Statistics measurement systems, System management.

UNIT V - NETWORK MANAGEMENT APPLICATIONS (9 hours)

REFERENCES

<table>
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<tr>
<th>CO2202</th>
<th>SIMULATION OF COMMUNICATION SYSTEMS &amp; NETWORKS</th>
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**PURPOSE**
To impart the modeling of communication networks and their simulation.

**INSTRUCTIONAL OBJECTIVES**
To learn about
1. Monte Carlo simulations involving random variables and random processes
2. Modeling of Communication systems: Transceiver systems
3. Communication channels and models,

**UNIT I - FUNDAMENTALS OF RANDOM VARIABLES AND RANDOM PROCESSES FOR SIMULATION** (9 hours)

**UNIT II - MONTE CARLO SIMULATION AND GENERATION OF RANDOM NUMBERS** (9 hours)

**UNIT III - MODELING OF COMMUNICATION SYSTEMS: TRANSMITTER AND RECEIVER SUBSYSTEMS** (9 hours)

**UNIT IV - COMMUNICATION CHANNELS AND MODELS** (9 hours)
Fading and multipath channels – The Almost free-space channel – Conducting and Guided wave media – Finite-state channel models – Methodology for simulating communication systems operating over fading channels.

**UNIT V - ESTIMATION OF PARAMETERS AND PERFORMANCE MEASURES IN SIMULATION** (9 hours)
REFERENCES

**CO2203**

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<th>LINEAR ALGEBRA</th>
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**PURPOSE**
The purpose of this course is to apply the learned concepts in real world phenomena such as communication networks, traffic flow, and electrical networks, and to use MATLAB to perform matrix computations and to explore and analyze linear algebra concepts.

**INSTRUCTIONAL OBJECTIVES**

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<tr>
<td>1.</td>
<td>Understand several important concepts in linear algebra, including systems of linear equations and their solutions, matrices and their properties, determinants and their properties, vector spaces, linear independence of vectors, subspaces, basis and dimensions of vector spaces, inner product space, linear transformations, eigenvalues and eigenvectors.</td>
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<td>2.</td>
<td>Improve our ability to prove mathematical theorems.</td>
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<td>Improve our ability to think logically, analytically, and abstractly.</td>
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<td>4.</td>
<td>Improve our ability to communicate mathematics, both orally and in writing.</td>
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**UNIT I - MATRICES AND SYSTEMS OF EQUATIONS, DETERMINANTS** (9 hours)

**UNIT II - VECTOR SPACES AND LINEAR TRANSFORMATIONS** (9 hours)
Definition and examples – Subspaces – Linear independence – Basis and dimensions – Change of basis – Row space and Column space – Linear transformations: Definition – Matrix representations

**UNIT III - ORTHOGONALITY AND EIGENVALUES** (9 hours)

**UNIT IV - NUMERICAL LINEAR ALGEBRA** (9 hours)

**UNIT V - ITERATIVE METHODS AND CANONICAL FORMS** (9 hours)
REFERENCES

CO2204

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<th>PRINCIPLES OF UNCERTAINTY</th>
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Prerequisite: Nil

PURPOSE
To give the fundamental methods of using uncertainty, randomness in the computer programming.

INSTRUCTIONAL OBJECTIVES
1. To make the student learn uncertainty, randomness, fuzziness and their applications for various problems.
2. To develop skills for implementation of these concepts as algorithms and computer programs and learn the mathematical basis for testing and verification.

UNIT I – INTRODUCTION  (9 hours)
Probability- conditional probability and Bayes theorem – Discrete random variables – continuous random variables.

UNIT II – DECISION METHODS (9 hours)

UNIT III – MATHEMATICAL LOGIC (9 hours)
Induction – Number theory – graph theory – communication networks – relations and functions.

UNIT IV – COMPUTATIONAL MATHEMATICS (9 hours)

UNIT V – FUZZY LOGIC (9 hours)
Logic and fuzzy systems, Fuzzy arithmetic and the extension principle, monotone measures: belief, plausibility, probability and possibility.

REFERENCE BOOKS:
Purpose
To develop the ability to use the concepts of matrix algebra for solving problems related to communication networks. To formulate and construct a mathematical model for vector field problems in specific areas of communication engineering. To expose the students to numerical methods and solving differential equations by various techniques.

INSTRUCTIONAL OBJECTIVES
1. At the end of the course, the students will have an in depth understanding of the usefulness of mathematical and statistical methods in communication engineering. The course will cover vector and matrix algebra, differential equations (for understanding Maxwell's electrodynamics, wave equations etc.) and statistical theory (to perceive sources of noise in communication systems, information theory etc.)

UNIT-I: Matrix Algebra

UNIT- II: Review of Ordinary Differential Equations and Laplace Transforms
Solution of 1st order differential equations by separation of variables, homogenous first order differential equation, linear first order differential equations and second order differential equation, Simple problems on non-linear differential equation, Laplace Transformation: basic properties and simple problems – L [e^atf(t)] – L [tnf(t)]-L[e^atf(t)] –L[f(t)/t] .

UNIT – III: Numerical Methods and Solutions
Scatter diagram, Curve fitting, method of least squares, Numerical Integration: A general quadrature formula for equally spaced arguments, trapezoidal rule, Simpsons one third rule.

UNIT – IV: Vector Analysis

UNIT – V: Probability Distributions and Statistics
Introduction to Binomial and Normal distributions, Basics of Markov Chains, Linear correlation, product moment formula for determining linear correlation coefficient, significance of correlation coefficient, Introduction to linear regression, least square linear regression lines.

REFERENCES
PURPOSE
To enhance holistic development of students and improve their employability skills

INSTRUCTIONAL OBJECTIVES
1. To improve aptitude, problem solving skills and reasoning ability of the student.
2. To collectively solve problems in teams & group.
3. Understand the importance of verbal and written communication in the workplace
4. Understand the significance of oral presentations, and when they may be used
5. Practice verbal communication by making a technical presentation to the class
6. Develop time management Skills

UNIT I–BASIC NUMERACY: Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II-ARITHMETIC – I: Percentages, Profit & Loss, Equations

UNIT III-REASONING – I: Logical Reasoning

UNIT IV-SOFT SKILLS – I: Presentation skills, E-mail Etiquette

UNIT V-SOFT SKILLS – II: Goal Setting and Prioritizing

ASSESSMENT
Soft Skills (Internal)
Assessment of presentation and writing skills.

Quantitative Aptitude (External)
- Objective Questions- 60 marks
- Descriptive case lets- 40 marks*
- Duration: 3 hours
*Engineering problems will be given as descriptive case lets.

REFERENCES
1. Quantitative Aptitude by Dinesh Khattar – Pearsons Publicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill Publications
4. Soft Skills for Everyone by Jeff Butterfield – Cengage Learning India Private Limited
5. Six Thinking Hats is a book by Edward de Bono - Little Brown and Company
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut
UNIT I-ARITHMETIC – II: Ratios & Proportions, Mixtures & Solutions

UNIT II - MODERN MATHEMATICS: Sets & Functions, Data Interpretation, Data Sufficiency

UNIT III – REASONING – II: Analytical Reasoning

UNIT IV – COMMUNICATION – I: Group discussion, Personal interview

UNIT V - COMMUNICATION – II: Verbal Reasoning test papers

ASSESSMENT

1. Communication (Internal)
   - Individuals are put through formal GD and personal interviews.
   - Comprehensive assessment of individuals’ performance in GD & PI will be carried out.

2. Quantitative Aptitude (External)
   
   Objective Questions- 60 marks (30 Verbal +30 Quants)
   Descriptive case lets- 40 marks*
   Duration: 3 hours
   *Engineering problems will be given as descriptive case lets.

REFERENCES

1. Quantitative Aptitude by Dinesh Khattar – Pearsons Publicaitons
2. Quantitative Aptitude and Reasoning by RV Praveen – EEE Publications
3. Quantitative Aptitude by Abijith Guha – TATA Mc GRAW Hill Publications
4. General English for Competitive Examination by A.P. Bharadwaj – Pearson Educaiton
5. English for Competitive Examination by Showick Thorpe - Pearson Educaiton
6. IBPS PO - CWE Success Master by Arihant - Arihant Publications(I) Pvt.Ltd - Meerut
7. Verbal Ability for CAT by Sujith Kumar - Pearson India
8. Verbal Ability & Reading Comprehension by Arun Sharma - Tata McGraw - Hill Education

#
Purpose
To develop professional skills abreast with contemporary teaching learning methodologies

Instructional Objectives
At the end of the course the student will be able to
1. acquire knowledge on planning, preparing and designing a learning program
2. prepare effective learning resources for active practice sessions
3. facilitate active learning with new methodologies and approaches
4. create balanced assessment tools
5. hone teaching skills for further enrichment

Unit-I: Design
Planning & Preparing a learning program, Planning & Preparing a learning session

Unit-II: Practice
Facilitating active learning, Engaging learners

Unit-III: Assessment
Assessing learner’s progress, Assessing learner’s achievement

Unit-IV: Hands On Training
Group activities – designing learning session, Designing teaching learning resources, Designing assessment tools, Mock teaching session

Unit-V: Teaching in Action
Live teaching sessions, Assessments

Assessment (Internal)

Weightage:
Design - 40%
Practice – 40%
Quiz – 10%
Assessment – 10%

References
1. Cambridge International Diploma for Teachers and Trainers Text book by Ian Barker - Foundation books
Every student will be required to present a seminar talk on a topic approved by the Department. The Committee constituted by the Head of the Department will evaluate the presentation and will award the marks based on

- Comprehensible arguments and organization.
- Accessible delivery
- Accessible visuals in support of arguments.
- Question and Answers.

Student has to identify the faculty supervisor (Guide), topic, objectives, deliverables and work plan. The topic should be of advanced standing requiring use of knowledge from program core and be preferably hardware oriented. Students are evaluated on monthly basis, by conducting reviews by the department throughout the project period. Student has to submit a report describing his/her project work. End semester examination/ Viva-voce will be conducted by the Department.

Student has to continue the project work he/she was doing in phase –I. The Student will be evaluated with monthly reviews and an end semester examination / viva-voce. The students are encouraged to submit his/her project work in Conference/Journal and due weightage will be given in their evaluation.
## AMENDMENTS

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<th>Approval with date</th>
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<td>1.</td>
<td>CO2121 24th Academic Council Meeting (ACM), Agenda No. 3.3.3</td>
<td>19-Oct-2013</td>
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<td>2.</td>
<td>CO2122 to CO2127, CO2204 26th ACM, Agenda No. 3.3.6</td>
<td>25-Jul-2014</td>
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<td>CO2128, CO2205 28th ACM, Agenda No. 3.3.4</td>
<td>23-Mar-2015</td>
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<td>COR2005 29th ACM, Agenda No. 3.3.19</td>
<td>29-Aug-2015</td>
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<td>5.</td>
<td>CO2129 to CO2131 31st ACM, Agenda No. 3.3.10</td>
<td>24-Mar-2016</td>
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