Department of Electronics and Communication Engineering,
Faculty of Engineering and Technology, Jamia Millia lslamia, New Delhi-110025

M. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)
Effective from July 2016

Codes for nature of courses
L: Lecture courses
P: Laboratory Based courses

Category of Courses

CBCS: Choice based Credit System

Weightage for Course Evaluation
L Lecture T Tutorial P Practical CCA Continuous Class Assessment
MTE Mid Term Exam

M. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING-I YEAR

	First Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	**T**	**P**	CCA	MTE-1	MTE-2		
01	MEC-101	Random Variables & Stochastic Processes		4	3	1	0	10	15	15	60	100
02	MEC-102	Low Power VLSI Design	**CBCS**	4	3	l	0	10	15	15	60	100
03	MEC-103	Telecommunication Switching & Networks		4	3	l	0	10	15	15	60	100
04	Elective-I	Elective – I		4	3	1	0	10	15	15	60	100
PRACTICAL (LAB.)												
05	MEC-151	Advanced VLSI Lab		2	**0**	**0**	2	30	0	0	20	50
06	MEC-152	Advanced Communication Systems Lab		2	**0**	**0**	2	30	0	0	20	50
		Total		**20**								**500**
	Second Semester											
01	MEC-201	3G/4G Networks & Convergence		4	3	1	**0**	10	15	15	60	100
02	MEC-202	Advanced Digital Signal Processing	**CBCS**	4	3	1	**0**	10	15	15	60	100
03	MEC-203	Modern Instrumentation & Sensors		4	3	1	0	10	15	15	60	100
04	Elective-II	Elective – II		4	3	1	0	10	15	15	60	100
PRACTICAL (LAB.)												
05	MEC-251	Microwave & Optical Communication Lab		2	0	0	2	30	0	0	20	50
06	MEC-252	Digital Signal Processing Lab		2	0	0	2	30	0	0	20	50
		Total		**20**	**Total**							**500**

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Weight age for Course Evaluation
L Lecture T Tutorial P Practical CCA Continuous Class Assessment
MTE Mid Term Exam

M. TECH. ELECTRONICS AND COMMUNICATION ENGINEERING -II YEAR

	Third Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods Per week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	**T**	**P**	CCA	MTE-1	MTE-2		
01	MEC-301	Advanced Signal Processing	**CBCS**	4	3	l	0	10	15	15	60	100
02	Elective-III	Elective – III		4	3	l	0	10	15	15	60	100
PRACTICAL (LAB./MINOR PROJECT)												
03	MEC-351	Seminar		6	-	-	6	90	0	0	60	150
04	MEC-352	Minor Project		10	-	-	10	150	0	0	100	250
Total				**24**								600
	Fourth Semester											
01	MEC-401	Dissertation		16	0	0	**16**	240	0	0	160	400
	Total			**16**							**Total**	**400**

Elective – I
MEC-104 Digital Image Processing
MEC-105 Information Theory and Coding
MEC-106 Nanoelectronics & Devices
Elective – II
MEC-204 Advanced Computer Networks
MEC-205 FPGA Based System Design
MEC-206 Secure Communication
Elective – III
MEC-302 Modern Digital Communication Systems
MEC-303 Advanced Optical Communication
MEC-304 Advanced Embedded Systems

ELECTRONICS & COMMUNICATION ENGINEERING

M. TECH
I SEMESTER

RANDOM VARIABLES AND STOCHASTIC PROCESSES

Paper Code	**MEC-101**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT - I TWO RANDOM VARIABLES** Bivariate Distributions, One Function of Two Variables, Two functions of two variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values **UNIT - II SEQUENCE OF RANDOM VARIABLES** General Concept, Conditional Densities, Characteristic Functions And Normality, Mean Square Estimation, Stochastic Convergence and Limit Theorems, Random Numbers: Meaning and Generation **UNIT - III GENERAL CONCEPTS OF STOCHASTIC PROCESS** Definitions, Statistics of Stochastic Processes, Correlation and Covariance, Stationary Processes: Strict Sense Stationary and Wide Sense Stationary, Systems with Stochastic Input, Power Spectrum, Discrete-Time Processes **UNIT - IV APPLICATION OF STOCHASTIC PROCESSES** Modulation, Bandpass Processes, Frequency Modulation, Cyclostationary Processes, Band Limited Processes and Sampling Theorem, Deterministic Signals in Noise: Matched Filter Principle, White Noise, Colored Noise, Tapped Delay Line **UNIT - V MEAN SQUARE ESTIMATION (MSE)** Introduction of MSE, Prediction, Filtering and Prediction, Kalman Filters

Text Book:

1. “Probability, Random Variables and Stochastic Process” by Athanasios Papouplis & S. Unnikrishna Pillai 4th Edition, 2002, McGraw Hill Education(India) Private Limited, New Delhi

Reference Books:

1. “Probability, Random Variables and Random Signal Principles” by Peyton Z. Peebles Jr., 4th Edition, 2002, McGraw Hill Education(India) Private Limited, New Delhi
2. “Probability And Random Variables with Applications to Signal Processing” by Henry Stark & John W. Woods, 3rd Edition 2002, Pearson education, Delhi

LOW POWER VLSI DESIGNING

Paper Code	**MEC-102**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT - I MOTIVATION FOR LOW POWER DESIGNING AND SOURCES OF POWER IN CMOS** Why low power, advantages and applications, Static power dissipation; Dynamic power dissipation; switching power dissipation. Reduction techniques for dynamic and switching power. **UNIT - II LEAKAGE POWER IN NANOSCALED DEVICES:** Sources of leakage power, leakage components, short channel effects, drain induced barrier lowering, charge sharing, punch-through, gate tunneling, GIDL, subthreshold conduction. Reduction techniques of leakage power at the device and circuit levels. **UNIT - III POWER ESTIMATION: INTRODUCTION** Probabilistic technique; Statistical technique; Estimation of glitching power; Power estimation at the circuit level; High level power estimation; Information theory based approaches. **UNIT - IV SYNTHESIS FOR LOW POWER:** Behavioral level transforms; Logic level optimization; Circuit level; Low voltage CMOS circuits. **UNIT - V SOFTWARE DESIGN FOR LOW POWER:** Introduction; Sources of software power dissipation; Software power estimation; software power optimizations.
Prerequisites:	Digital designing, Computer architecture

Text/References

1. Y. Taur and T.H. Ning, Fundamentals of Modern VLSI Devices. New York: Cambridge Univ. Press, 1998, ch.2, pp. 97-99.
2. K. Roy and S.C. Prasad Low Power CMOS VLSI Circuit Design. New York: Wiley, 2000, ch.2, pp. 82-29.
3. J.M. Rabaey, Digital Integrated Circuits, Englewood Cliffs, NJ: Prentice-Hall, 1996, ch.2, pp. 55-56.
4. M.C. Johnson and K. Roy, "Software design for low power".

Course Outcomes

CO1: Motivation and importance of low power VLSI Designing**.** Awareness of different sources of power.

CO2: Learning various components of leakage power, their sources and the ways to reduce them. .

CO3: Achieving the thorough knowledge of power estimation at various design abstraction levels.

CO4: Learning about the synthesis for low power designing, ways, importance and applications.

CO5: Learning various sources of power in software and their reduction techniques.

TELECOMMUNICATION SWITCHING AND NETWORKS

Paper Code **MEC-103**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I TELEPHONE NETWORKS

Introduction, Evolution of telecommunications, classification of switching systems, Step by step switching, Trunking diagram of 1000 line switching system, 10000 switching system, Electronic Exchange, Subscriber loop systems, length and attenuation limitation of subscriber loop, Unigauge subscriber loop, Loading Coils, Pair gain systems, Echo, Echo suppressor, 2 wire to 4 wire conversion; Hybrid, subscriber loop interface; BORSCHT

UNIT- II TELECOMMUNICATION TRAFFIC ENGINERRING

Introduction, Unit of traffic, Traffic measurement, Network traffic load and parameters, Grade of service, Blocking probability, Lost call systems, Erlang B formula (Loss formula), Delay systems, Probability of delay

UNIT- III SWITCHING NETWORKS AND SIGNALLING

Introduction, Single stage networks, Multistage networks, Two stage networks, Three stage networks, Three stage non blocking networks, Probability graph, Lee Formula, Time Division Switching, Combinational switching, Signalling, Customer line signaling, Pulse dialing, Tone dialing, DTMF signaling, SS#7 Architecture

UNIT- IV ISDN AND ATM NETWORKS

Motivation for ISDN, ISDN Services, ISDN Architecture, Transmission Channels, User Network Interfaces, Basic Rate Interface, Primary Rate Interface, BISDN Reference Model, ATM technology, ATM cell header format, HEC, ATM switching

UNIT- V DATA NETWORKS

Data Transmission in PSTN, Switching techniques for data transmission, Circuit switching, Message switching, Packet switching, Virtual circuit switching, Datagram, Data Communication Architecture, ISO-OSI Reference model, DSL, Features of ADSL, DMT

Prerequisites: Probability Theory, Analog and digital communication

Text/ Reference books

1. Thiagarajan Viswanathan, “Telecommunication switching systems and Networks”, Prentice Hall of India Pvt. Ltd, 2007.

2. J.E. Flood, “Telecommunication switching, Traffic and Networks ”, Pearson Education, 2006
3. John C Belamy, “Digital Telephony”, John Willey, Third Edition

Course Outcome:

CO1. An Ablity to analyze the switching behaviors of different switches & switching systems and have thorough understanding of Electronic Switching Systems and Telephone Network.

CO2. Ablity to design & analyze Loss system and Delay System and have a thorough understanding of performance parameters like Traffic Intensity, Call Completion Rate, Grade of Service & Blocking Probability and Delay.

CO3. A thorough understanding of the operational principles and characteristics of digital switching and systems and signaling techniques, and an ability to design two stage and three stage blocking and non-blocking networks with optimum switching elements.

CO4. A thorough understanding of ISDN and ATM networks, ISDN Services and Architecture, BISDN model, ATM technology and ATM switching,

CO5. A thorough understanding of circuit switching, message switching and packet switching, OSI Reference model, DSL and DMT

INFORMATION THEORY AND CODING

Paper Code	**MEC-105**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT-I INFORMATION THEORY AND SOURCE CODING** Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, Shannon-Fano-Elias Coding, Lempel-Ziv Algorithm, Run Length Encoding, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Parallel Gaussian Channel, Channel Capacity for MIMO Systems, Random selection of codes. **UNIT-II LINEAR BLOCK CODES FOR ERROR CORRECTION** Introduction to Error Correcting Codes, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (probability of Error Correction), Perfect Codes, Hamming Codes, Low Density Parity Check Codes, Optional Linear Codes, Maximum Distance Separable Codes, Bounds on Minimum Distance, Space Time Block Codes. **UNIT-III CYCLIC CODES AND BOSE–CHAUDHURI HOCQUENGHEM (BCH) CODES** Introduction to Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check Codes, Circuit implementation of Cyclic codes. Introduction to BCH Codes, Primitive Element, Minimal Polynomial, Generator Polynomial in Terms of Minimal Polynomial, Some Examples of BCH Codes, Decoding of

BCH Codes, Reed Solomon Codes, Implementation of RS encoders and decoders.

UNIT-IV CONVOLUTIONAL CODES

Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Distance Notations for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Performance Bounds.

UNIT-V TRELLIS CODED MODULATION

Introduction to TCM, The Concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder.

Prerequisites: Probability, Linear Algebra, Digital Communication.

Text Book: Information Theory, Coding and Cryptography, Ranjan Bose, 3rd Edition, Mc Graw Hill Education.

Reference Book: Introduction to Error- Control Codes, S. Gravano, Oxford University Press.

Course Outcome:

CO1: An ability to analyze various source coding techniques, determine channel capacity, explain the need of channel coding theorem and discuss ramifications of Information capacity theorem.

CO2: Thorough understanding of the basics of error control coding, linear block encoding and decoding process and identification of some known good linear block codes on the basis of performance bounds.

CO3: An ability to generate cyclic codes, implement them in circuits and understand encoding and decoding of BCH and RS codes.

CO4: Capability to implement encoding using convolutional encoders, perform Viterbi decoding and apply distance bounds.

CO5: An ability to understand and design TCM scheme for AWGN channels.

ELECTRONICS & COMMUNICATION ENGINEERING

M. TECH
II SEMESTER

3G/ 4G NETWORKS AND CONVERGENCE

Paper Code	**MEC-201**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT- I** 1G, AMPS, 2G, GSM, IS-54, IS-136, IS-95, 2G-Cordless Telephone, 3G System, WCDMA, HSDPA, HSUPA, CDMA-2000, EDGE/UWC-136 **UNIT- II** GSM Services: Bearer Services, Tele services, Supplementary Services GSM System Architecture and Interface, MS, BSS, NSS, OSS, GSM Interface Standard, GSM Network Architecture. **UNIT - III** Basic of GSM Air Interface/Radio link: Multiple Access, Frequency Hopping, Channel Type and Channel modes, Burst Formatting and Frame Hierarchy, Channel Codes, Mode of Voice Transmission, Discontinuous Reception (DRX) Power Control, GSM Evolution, IS-95 System Architecture, IS-95 Interface, IS -95 Functional model, “Communication Control plane” and “Radio Resource Control Plane” using IN concept. **UNIT - IV** CDMA: Basic of CDMA, Fundamental of CDMA, Correlation Properties of Random CDMA Spreading Sequences, CDMA advantage and RAKE receiver Multi-User CDMA, Multi user CDMA downlink , multi user uplink and Asynchronous CDMA, CDMA near far problem. **UNIT – V** GPRS, General Architecture, GPRS network elements: Serving GPRS Support node (SGSN), Gateway GPRS support node (GGSN), Charging gateway (CG), Lawful interception Gateway (LIG), Domain Name System (DNS), GPRS Air Interface and Resource sharing with GSM, EDGE, Evolution of mobile communication system.

Prerequisite Course

1. An undergraduate course in Communication Theory
2. An undergraduate course in Mobile or Wireless Communications.

Reference Books:

1. Wireless Communications by Andrea Goldsmith, Cambridge University Press.
2. Wireless Communications: Principles and Practice by Theodore Rappaport, Prentice Hall.

Course Outcomes:

CO1: Providing a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. Building on the prior knowledge on digital communications, develop further understanding on the challenges and opportunities brought by the wireless medium in designing current and future wireless communication systems and networks.
CO2: Comprehensive understanding of modern mobile and wireless communication systems.
CO3: An in-depth understanding of the wireless channel and the related impairments
CO4: Understanding the fundamentals of CDMA and various issues related to code division multiple access.
CO5: Comprehensive overview of GPRS and detailed understanding of GPRS architecture

ADVANCED DIGITAL SIGNAL PROCESSING

Paper Code	**MEC-202**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT- I MULTIRATE SIGNAL PROCESSING** Up-Scaling, Down-Scaling, Decimation, Interpolation, and Polyphase Decomposition. **UNIT-II FILTER BANKS** Analysis and Synthesis Filter Banks, Quadrature Mirror Filters (2-Channel and L-Channel), Multilevel Filter Banks. **UNIT-III MULTI-RESOLUTION ANALYSIS OF WAVELETS** Time Frequency Localization, Short Term Fourier Transform, and Discrete-Time Wavelet Transform. **UNIT-IV WIENER FILTERING** Principle of Orthogonally, Wiener Hopf Equations, IIR Wiener Filters, FIR Wiener Filters. Linear Prediction: Forward Linear Prediction, Backward Linear Prediction, Levinson Durban Algorithm, Recursive Least Square Method. **UNIT-V POWER SPECTRUM ESTIMATION** Maximum Likelihood Estimation, Estimates of Auto-Co-Relation Sequences, Non-Parametric and Parametric Spectral Estimation.
Prerequisites:	Signals and Systems and Digital Signal Processing
Text Book:	1. Simon Haykins, “Adaptive Filter Theory” 5th Edition, PHI India, 2013. 2. S.K. Mitra, “Digital Signal Processing”. 2nd Edition Tata McGraw-Hill Company, India, 2001.

Course Outcomes:

CO1: A thorough understanding of requirements of Multirate Signal Processing and their working principle of the same.

CO2: Capability to use the Filter Banks to improve the performance of Multirate Signal Processing systems.

CO3: A thorough understanding of requirements, use, and the limitations of different transformation processes in application of audio, speech, and image processing.

CO4: An ability to use the different prediction and filtering methods in application of audio, speech, and image processing.

CO5: An ability to utilize the various Power Spectrum Estimation techniques to estimate the power spectral density of a random signal from a sequence of time samples of the signal and their application of the same in different field of signal processing.

MODERN INSTRUMENTATION AND SENSORS

Paper Code	**MEC-203**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1
Course description	**UNIT- I** Review of Electronic measurement and instrumentation, Advance and intelligent techniques for the measurement of different types of impedances and other measuring quantities, Errors in higher order instruments (first order, second order) **UNIT- II** Active bridge techniques for the measurement of simple and "in-circuit" resistances and impedances, Applications of various AC bridges in the measurement of non-electrical quantities **UNIT- III** Data Acquisition System (DAS), Classification, characteristics and applications of DAS. Microprocessors used in precision measurement, its characteristics and application for the measurement of impedance, frequency etc., Data loggers **UNIT- IV** Sensors in electronics instrumentation, Sensor networks, Wireless sensor networks and its applications, Concept of Biomedical Instrumentation, Various Sensors used in biomedical instrumentation e.g. Si, TiO2 etc **UNIT - V** Origin of biopotential and its used in the development of ECG and EEG machines, Basic requirements of amplifiers used in Electrocardiograph machine, Cardiac monitor and its details, Enthoven triangle for cardiac vector, Noise reduction techniques. Signal processors

Text/ Reference Books:

1. C.S. Ranjan Et.al. “Instrumentation Devices & Systems”, Tata McGraw Hill
2. L. Cromwellet.al “Biomedical Instrumentation & Measurements, Pearsons
3. D.V.S. Murthuy, “Sensor & Instrumentation”, PHI
4. S. Sawahni, Dhanpat roy publication, “Advance Instrumentation

Course Outcomes:

CO1: Advance understanding towards the unit, dimension and different standards of measurement and the factors that affect the performance of the measurement such as accuracy, precision, sensitivity, resolution, errors and the ways to optimize /minimize the effects of these. To know the basic and operating principle of intelligent instruments.

CO2: The ability to measure and determine the simple and “in circuit quantities” using Active Bridge techniques. To know the classification and applications of various AC bridges for the measurement of non-electrical quantities.

CO3: Understanding towards the Classification, characteristics and applications of Data Acquisition Systems and Data loggers. To know the role of Microprocessors in precision measurement, its characteristics and application for the measurement of impedance, and frequency etc.

CO4: A thorough understanding of the fundamental concept and working knowledge of transducer, sensor, wireless sensor network, basic biomedical instruments and their applications.

CO5: Understanding of Origin of bio potential and its used in the development of ECG, EMG and EEG machines. Amplifiers used in these machines. Cardiac Monitor and its details. Noise reduction techniques and signal processors for biomedical instruments

ADVANCED COMPUTER NETWORKS

Paper Code **MEC-204**

Course Credits 4

Lectures/ Week 3

Tutorials/ Week 1

Course description

UNIT- I

Motivation for inter networking, physical network connection with routers, Internet Architecture, Significance of Internetworking and TCP/IP, Layering and TCP/IP Protocols, addresses for virtual internet, the IP addressing scheme, classes of IP addresses, routers and IP addressing principle.

UNIT – II

Binding Protocol Address (ARP)= Address Resolution, Address Resolution protocol, ARP message delivery and format, Layering Address Resolution and Protocol Addresses, Virtual packets, the IP datagram, IP addresses and Routing table entries, best effort delivery, IP datagram header format.

UNIT – III

IP Encapsulation, MTU and datagram size, reassembly, Fragment loss and fragmenting a fragment, need for reliable transport, transmission control protocol, the services TCP provides to application, achieving reliability, packet loss and retransmission, flow control and windows, three way handshake, congestion control, TCP segment format.

UNIT – IV

The success of IP, motivation for change, IPv6 features, IPv6 datagram format, how IPv6 handles multiple headers, fragmentation, reassembly, and path MTU, IPv6 addressing, transition from IPv4 to IPv6 dual stack, tunneling and header translation.

UNIT – V

Secure networks and policies, aspects of security, access and control password, encryption and confidentiality, message integrity, message authentication, digital signature, internet firewall concept, packet filtering, virtual private networks, tunneling, security technologies.

Books:

1. Computer networks and Internets, by Douglas E. Comer
2. Data Communication and Networking, by Behrouz A. Forouzan
3. Networks by Tannin Bourn

Course Outcome:

CO1: A familiarity to discriminate the functionality between the Layers in OSI model and TCP/IP suite

CO2: An ability to employ protocols to facilitate the transmission of frames and to decide the efficiency of the protocols

CO3: An understanding of IEEE standards designed to regulate the manufacturing and interconnectivity between different LANs

CO4: Ability to analyze the global addressing schemes in the Internet and configure the addresses for the subnet

CO5: A familiarity to future protocol IPv6 and understanding of network security.

ELECTRONICS & COMMUNICATION ENGINEERING

M. TECH
III SEMESTER

ADVANCED SIGNAL PROCESSING

Paper Code	**MEC-301**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT- I ACTIVE ELEMENTS AND THEIR APPLICATIONS

Introduction to active elements, Different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier to realize the active elements and their applications in analog signal processing.

UNIT- II INTRODUCTION TO CM AND VM BIQUAD CIRCUITS

Introduction to current-mode and voltage mode circuit by showing their advantages, Realization of CM/VM biquad using different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier etc and their sensitivity analysis of frequency components.

UNIT - III CMOS TRANSCONDUCTOR AND ITS APPLICATION

Introduction to CMOS transconductor, symbolic notation, CMOS structure and its small signal analysis, Realization of single element controlled oscillators (SECOs), Biquad Filters etc.

UNIT - IV SIGNAL GENERATION CIRCUITS AND ITS APPLICATIONS

Introduction to Barkhausen criterion for oscillation, sinusoidal waveform generators using different ABBs like Op-amp, OTA, current feedback operational amplifier, voltage differencing transconductance amplifier, current differencing transconductance amplifier etc, VCOs, Quadrature oscillator design.

UNIT - V IC ANALOG MULTIPLIER AND ITS APPLICATIONS

Gilbert multiplier cell, 2-quadrant and 4-quadrant operations, IC analog multipliers: AD 533 and AD534, modulating, demodulating and frequency changing with multipliers, voltage-controlled filters and oscillators.

Pre-requisite: Active Filters and Signal Processing

Text/Reference books

1. Analog IC Design: the Current-mode approach: Edited by C. Toumazuo, F.J. Lidge and D.G. Haigh IEE Circuits and Systems Series 2.
2. Wai Kai Chen, "Passive and Active Filter Theory and Implementations:, John Wiley and Sons, 1986
3. Behzard Razavi, Design of Analog CMOS Integrated Circuits", Tata McGraw Hill Edition, New Delhi, 2003.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI: Signal and Information Processing" McGraw Hill International Editions, New Delhi, 1994

Course Outcomes:

CO1: A thorough understanding of the different active building blocks used in signal processing and their applications

CO2: The capability to realize and employ different current-mode and voltage mode circuit and their sensitivity analysis.

CO3: An understanding of CMOS transconductor and its application to design single elements oscillators and filters

CO4: A capability to design and realize signal generation circuits, and compare the performance with predicted circuit models.

CO5: An ability to gain an intuitive understanding of the role and applications of analog multipliers.

MODERN DIGITAL COMMUNICATION SYSTEMS

Paper Code	**MEC-302**
Course Credits	4
Lectures/ Week	3
Tutorials/ Week	1

Course description

UNIT- I OPTIMUM RECEIVER FOR AWGN CHANNELS

Waveform and vector channel models, Optimal Detection for a General Vector Channel, Waveform and Vector Channels, Optimal Detection for a General Vector AWGN Channel,, Implementation of the Optimal Receivers for AWGN Channels, Detection of Signalling Scheme with Memory, The Maximum Likelihood Sequence Detector(MLSD)

UNIT - II DIGITAL COMMUNICATION THROUGH BANDLIMITED CHANNELS

Signal Design for Bandlimited Channels, Nyquist Criteria for zero ISI and Raised Cosine Function, Design of band Limited Signals with Controlled ISI- Partial Response Signaling: Signal design for Channel with Distortion.

UNIT - III OPTIMAL RECEIVERS FOR CHANNELS WITH ISI AND AWGN

Data detection for controlled ISI, Optimal receivers for Channels with ISI and AWGN, Optimum Maximum Likelihood Receivers, A Discrete Time Model for a Channel with ISI , Maximum Likelihood Sequence Estimation for Discrete Time White Noise Filter Model

UNIT - IV EQUALIZATION

Linear Equalization, Peak Distortion Criterion, Means Square Error (MSE) Criterion, Fractionally Spaced Equalizer (FSE), Base band and band pass Linear equalizer, baseband and band pass Linear Equalizer, Decision Feedback Equalization (DFE), Coefficient Optimization, Performance Characteristics of DFE, Iterative Equalization and Decoding: Turbo Equalization (Introduction only), Adaptive Linear Equalization and algorithms.

UNIT - V FADING CHANNELS: CHARACTERIZATION AND SIGNALING

Characterization of fading Multipath channel, Channel Correlation Function and power Spectra, Statistical Models for Fading Channels, The Effect of Signal Characteristics on the Choice of Channel Model, Diversity techniques for Fading Multipath Channels, Signaling over a Frequency-Selective Slowly Fading Channel: RAKE Demodulator.

Text Book:

1. Communication System Engineering by JG Prokies and Masoud Salehi, PHI 2nd Edition 2006
2. Modern Digital and Analog Communication System by BP Lathi, Oxford University Press, Forth Edition 2010

Reference Books:

1. Digital analog and Communication Systems by Leon W Couch II, PHI, 6TH Edition, 2008
2. Digital Communication by Ian A Glover and Peter m Grant, Pearson education, 2nd Edition , 2004

Course Outcome:

CO1: A thorough understanding of optimal receivers for AWGN channels.

CO2: Capability to understand digital communication through band limited channels.

CO3: An ability to apply various techniques for data for channel with ISI & AWGN.

CO4: Capability to understand the various equalization techniques to combat ISI.

CO5: An ability to characterize and signal design for fading channels.