DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.TECH (COMMUNICATION SYSTEMS)

Scheme of Instruction and Examination
(Regulation:R16)
(with effect from **2016-2017** admitted batch onwards)

I - SEMESTER

Code No.	Course title	Credits	Lecture Hrs	Lab Hrs	Total Contact Hrs/ Week	Sessional Marks	Exam Marks	Total Marks
M16 CS 1101	Communication Theory	4	4	--	4	30	70	100
M16 CS 1102	Communication Techniques	4	4	--	4	30	70	100
M16 CS 1103	Satellite Communication and Phased Arrays	4	4	--	4	30	70	100
M16 CS 1104	Digital signal processing	4	4	--	4	30	70	100
M16 CS 1105	Optical Fibers and Applications	4	4	--	4	30	70	100
#1	Elective –I	4	4	--	4	30	70	100
M16 CS 1110	Communication Engineering Lab	2	-	4	4	50	50	100
M16 CS 1111	Seminar - I	2	-	3	3	100	--	100
Total		**28**	**24**	**7**	**31**	**330**	**470**	**800**

	Course Code	Course
#1-Elective-I	M16 CS 1106	EMI/EMC
	M16 CS 1107	Microwave Components and Networks
	M16 CS 1108	Advanced Microprocessor
	M16 CS 1109	Embedded Systems

Code: M16 CS 1101

COMMUNICATION THEORY

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To prepare mathematical background for communication signal analysis.
2. To understand the building blocks of Analog and digital communication system.
3. To understand and analyze the signal flow in Analog and digital communication system.
4. To present the essential digital communication concepts by understanding the elements of digital communication system, fundamental concepts of sampling theorem.
5. To analyze error performance of a digital communication system in presence of noise and other interferences.
6. To learn different estimation methods.

COURSE OUTCOMES:

Acquired knowledge about
1. AM transmission and reception
2. FM and PM transmission and reception, pulse modulation, noise
3. Digital communication, quantization, coding, digital modulation techniques, ISI
4. Different estimation methods.

SYLLABUS

Analog Communication: Mathematical treatment of Linear (AM, DSB-SC, SSB and VSB) and exponential (PM and FM) modulation; spectra of angle modulated signals; Noise performance of linear and exponential modulated signals; PE and DE in FM.

Pulse Modulation: Sampling of low-pass and band-pass signals, PAM, PWM, PPM,quantization, PCM, DPCM, Delta modulation, base band digital communication; Nyquist pulse shaping, line codes.

Digital Modulation Techniques: Representation of digital signal waveforms, Introduction to digital modulation schemes- ASK, PSK and FSK; Digital demodulation and the optimal receiver, performance of digital communication systems in the presence of noise, coherent quadrature modulation techniques.

Detection and Estimation Theory: Binary hypothesis testing, Bayes, Minimax and Neyman-Pearson tests; Bayesean parameter estimation, MMSE, MMAE and MAP estimation procedures.

TEXT BOOKS:

1. John G. Proakis and Masoud Salehi, "Communication Systems Engineering," Prentice-Hall, 2nd Edition, 2002.
2. Fundamentals of Communication Systems, Proakis and Salehi, Prentice Hall
3. Simon Haykin, Communication Systems, John Wiley & Sons, NY 4th edition 2001.
4. Herbert Taub & Donald L Schlling, Principles of Communication Systems, 3rd edition, Tata Mc Grawhill,2008.

REFERENCE BOOKS:

1. Communication Systems, Stern & Mahmoud, Prentice Hall
2. M. Simon, S. Hinedi, and W. Lindsey, "Digital Communication Techniques," Prentice-Hall, 1995
3. Bruce Carlson Communication Systems, 3rd edition, Tata Mc Grawhill.

Code: M16 CS 1102

COMMUNICATION TECHNIQUES

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To understand the building blocks of digital communication system.
2. To prepare mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a digital communication system.
4. To present the essential digital communication concepts by understanding the elements of digital communication system, fundamental concepts of sampling theorem and coding.
5. To analyze error performance of a digital communication system in presence of noise and other interferences.
6. To understand concept of spread spectrum communication system.
7. To provide knowledge about error detection and correction, different types of channel coding techniques such as linear block codes, cyclic code and convolution codes are to be discussed.

COURSE OUTCOMES:

After successfully completing the course students will be able to,

1. Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Select the blocks in a design of digital communication system.
4. Select the relevant digital modulation technique for specific application.
5. Choose the coding technique for minimum errors in transmitting information.
6. Ability to use channel coding techniques (such as block & convolutional codes) in communication systems.
7. Ability to use modulation techniques (such as frequency & phase-shift keying) in communication systems.
8. Analyze Performance of spread spectrum communication system.

SYLLABUS

Channel Coding-I: Waveform coding and structured sequences-Types of error control, structured sequences, Linear block codes –soft/hard decision decoding of linear block codes – Polynomial representation of codes – Cyclic codes – Convolution codes – viterbi decoding algorithm.

Channel Coding-II: Non binary block codes and concatenated block codes - Reed Solomon codes – Turbo codes.

Baseband Signaling Concepts: Signaling formats – RZ/NRZ, Duobinary splitphase (Manchester) and high density bipolar coding – scrambling & unscrambling – channel equalization – tapped delay line and traversal filters.

Synchronization: Receiver synchronization, costas loop, symbol synchronization, synchronization with CPM – Data aided and Non aided synchronization- synchronization methods based on properties of wide sense cyclo-stationary random process – Carrier recovery circuits – Symbol clock estimation schemes.

Spread Spectrum Systems: PN sequences, DS spread spectrum systems; FH spread spectrum systems and performance of FHSS in AWGN – Synchronization – Jamming considerations – Commercial Applications – Cellular subsystems.

TEXT BOOKS:

1. Bernard sklar, "Digital communications", Pearson Education Asia,2001.
2. Das,J Etal, " Principles of Digital Communications and Spread spectrum Systems", Willey Eastern Limited,1985.
3. Ziemer R E & Peterson R L, "Digital Communication and Spread spectrum Systems", McMillan publishing co., 1985.

REFERENCE BOOKS:

1. Proakis J G, "Digital communications", McGraw Hill Inc, 1983.
2. Haykin,Simon.S. ,"Digital communications", John Wiley & Sons, 1988

Code: M16 CS 1103

SATELLITE COMMUNICATION AND PHASED ARRAYS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To learn about the science behind the orbiting satellites, various multiplexing schemes and earth station parameters used for satellite communication.
2. To learn about link budgets for uplink and downlink for both satellite communication and mobile communication.
3. To understand knowledge regarding earth station equipment.
4. To know the operation of MSAT and VSAT networks and its applications.
5. To provide a brief introduction about phased array antennas.

COURSE OUTCOMES:

1. The students will learn the dynamics of the satellite in the orbit.
2. Understand communication satellite design and how analog and digital technologies are used for satellite communication networks.
3. The students will be able to design satellite uplink and down link and calculate link budgets.
4. Understand the operation of Earth station equipment, MSAT and VSAT networks.
5. The students will understand the concept of phased arrays

SYLLABUS

Introduction: Kepler's Laws of motion, Orbital aspects of Satellite Communications, Look Angle and Orbit determinations, Orbital effects in communication system Performance, Space craft subsystems, AOCS, TTC&M, Power system, Satellite transponder, spacecraft Antennas, Satellite Link Design-- System Noise temperature and G/T ratio - Design of downlink, Uplink - Design of satellite links for specified C/N, Implementation of error Detection on satellite links.

Multiple Access: FDMA, TDMA, CDMA, SSMA- comparison of multiple access techniques, Practical Demand Access systems, Multiple Access With on board processing.

Earth Station Technology: Earth Station Design, Design of Large Antennas, Tracking, Small earth station Antennas, Equipment for earth station; Satellite Packet Communications- Message transmission by FDMA: The M/G/1 Queue, Message transmission by TDMA - Pure ALOHA

Very small Aperture Terminal Networks: VSAT Technologies - Network Configurations, Polling VSAT Networks; Mobile Satellite Networks--Operating Environment - MSAT Network concept.

Phased Arrays in Radar and Communication Systems: System requirements for radar and communication antennas, Array characterization for radar and communication systems, Fundamental results from array theory.

TEXT BOOKS:

1. Satellite Communications by T. Pratt and C.W. Bostian, John Wiley & Sons
2. Digital Satellite Communication by Tri T. Ha , McGraw Hill Co.(2^{nd} edition)
3. Phased Array Antenna Hand Book – Robert J. Mailloux, Artech House, Boston, London, 1994.

REFERENCE BOOKS:

1. Satellite Communications - by Dr. D.C. Agarwal, khanna Publishers, NewDelhi
2. Electronic Communication Systems -by Tomasi. W, PHI

Code: M16 CS 1104

DIGITAL SIGNAL PROCESSING

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To learn about various optimization techniques used in designing the digital filters.
2. To learn about the sampling rate requirement in the digital signal applications
3. To learn about the need for prediction, filtering & smoothening of the signals to minimize the mean-square error (MSE).
4. To learn different DSP algorithms used for DFT computation procedures.
5. To know the applications of DSP in real time.

COURSE OUTCOMES:

1. Using filter optimization techniques students will be able to design a filter with Least Mean Square error.
2. Students will be able to solve research papers related to multirate signal processing— Data Acquisition, Bandwidth reduction in a system etc.
3. Apply methods for prediction of real world signals, based on signal modeling and advanced filtering techniques, such as Linear Predictive Filters and Optimal Linear Filters.
4. Apply fundamental principles, methodologies and techniques of the course to analyze and design various problems encountered in academic research, industry and R&D practice.
5. This course is basis for understanding Adaptive signal processing, statistical signal processing and wavelet transform subjects.

SYLLABUS

Advanced digital filter design techniques : Multiple band optimal FIR filters – design of filters with simultaneous constraints in time and frequency response, optimization methods for designing IIR filters, comparison of optimum FIR filters and delay equalized elliptic filters.

Multirate DSP : The basic sample rate alteration – time – domain characterization, frequency – domain characterization : Cascade equivalences, filters in sampling rate alteration systems, digital filter banks and their analysis and applications, multi level filter banks, estimations of spectra from finite – duration observation of signals.

Linear prediction and optimum liner filters: forward and backward linear prediction, AR Lattice and ARMA lattice – ladder filters, Wieners filters for filtering on prediction.

DSP Algorithms : The Goertzel algorithm, the chirp – z transform algorithm the Levinson – Durbin algorithms, the Schur algorithm, and other algorithms, computations of the DFT, concept of tunable digital filters.

Applications of DSP :

a) Speech : Model of speech production, speech analysis – synthesis system vocoder analyzers and synthesizers, linear prediction of speech.

b) DTMF System

TEXT BOOKS :

1. Theory and applications of digital signal processing by Lawrence R. Rabiner and Bernard Gold, PHI
2. Digital Signal Processing. Principles, algorithms, and applications by John G. Proakis and Dimitris G. Manolakis, PHI, 1997.
3. Digital Signal Processing, A Computer – Based approach, by Sanjit K. Mitra, Tata Mc Graw-Hill, 1998

REFERENCE BOOKS:

1. S.Salivahanan, A.Vallava Raj, C.Gnana Priya, Digital Signal Processing,TMH International 2007.
2. E.C.Ifeachor and B.W.Jervis " Digital Signal Processing- A Practical approach", 2nd edition Pearson,2002.

Code: M16 CS 1105

OPTICAL FIBERS AND APPLICATIONS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design.
2. To analyze the operation of LEDs, laser diodes, and PIN photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.
3. To explain the principles, compare and contrast single- and multi-mode optical fiber characteristics.
4. To analyze and design optical communication and fiber optic sensor systems.
5. To design, build, and demonstrate optical fiber experiments in the laboratory.
6. To locate, read, and discuss current technical literature dealing with optical fiber systems.

COURSE OUTCOMES:

1. Recognize and classify the structures of Optical fiber and types.
2. Discuss the channel impairments like losses and dispersion.
3. Analyze various coupling losses.
4. Classify the Optical sources and detectors and to discuss their principle.
5. Familiar with Design considerations of fiber optic systems.
6. To perform characteristics of optical fiber, sources and detectors, design as well as conduct experiments in software and hardware, analyze the results to provide valid conclusions.

SYLLABUS

Optic Fiber Waveguides: Step – Index Fiber, Graded – Index Fiber, Attenuation, Modes in Step-Index Fibers, Modes in Graded – Index Fibers, Pulse Distortion and Information Rate in Optic Fibers, Construction of Optic Fibers, Optic Fibers, Optic Fiber Cables.

Light Sources and Detectors : Light-Emitting Diodes, Light-Emitting – Diodes Operating Characteristics, Laser Principles, Laser Diodes, Laser-Diode Operating Characteristics, Distributed – Feedback Laser Diode, Optical Amplifiers, Fiber Laser, Vertical-Cavity Surface-Emitting Laser Diode. Principles of Photo detection, Photomultiplier, Semiconductor Photodiode, PIN Photodiode, Avalanche Photodiode.

Couplers and Connectors: Principles, Fiber end Preparation, Splices, Connectors, Source Coupling, Distribution Networks and Fiber Components, Distribution Networks, Directional Couplers, Star Couplers, Switches, Fiber Optical Isolator, Wavelength-Division Multiplexing, Fiber Bragg Gratings, Other Components : Attenuator, Circulator and Polarization Controller.

Modulation, Noise and Detection: Light-Emitting-Diode Modulation and Circuits, Laser-Diode Modulation and Circuits, Analog-Modulation Formats, Digital-Modulation Formats, Optic Heterodyne Receivers, Thermal and Shot Noise, Signal-to-Noise Ratio, Error Rates, Modal Noise, Amplifier Noise, Laser Noise, and Jitter, Additional Noise Contributors, receiver Circuit Design

System Design and Fiber Optical Applications: Analog System Design, Digital System Design, Applications of Fiber Optics.

TEXT BOOK:

1. Fiber Optic Communications, Joseph. C. Palais, Pearson Education, Asia, 2002

REFERENCE BOOKS:

1. Fiber Optic Systems, John Powers, Irwin Publications, 1997
2. Optical Fiber Communication, Howes M.J., Morgen, D.V John Wiely

Code: M16 CS 1106

EMI / EMC

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To familiarize with the fundamentals those are essential for electronics industry in the field of EMI / EMC
2. To understand EMI sources and its measurements.
3. To understand the various techniques for electromagnetic compatibility.

COURSE OUTCOMES:

At the end of the course the student will be able to learn the concepts of

1. Real-world EMC design constraints and make appropriate tradeoffs to achieve the most cost-effective design that meets all requirements.
2. Designing electronic systems that function without errors or problems related to electromagnetic compatibility
3. Diagnose and solve basic electromagnetic compatibility problems.

SYLLABUS

Introduction, Natural and Nuclear sources of EMI / EMC: Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI / EMC, Natural and Nuclear sources of EMI.

EMI from apparatus, circuits and open area test sites: Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

Radiated and conducted interference measurements and ESD: Anechoic chamber, TEM cell, GH TEM Cell, characterization of conduction currents / voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

Grounding, shielding, bonding and EMI filters : Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

Cables, connectors, components and EMC standards :EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

TEXT BOOKS:

1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT –Delhi, Modules 1–9.

REFERENCE BOOKS:

1. Introduction to Electromagnetic Compatibility, Ny, John Wiley, 1992, by C.R. Pal.
2. EMI/EMC Computational modeling Hand book, 2nd edition, Springer International series by Archam Beault, Bruce,Ramahi,OmarM,Brench, Colin.

Code: M16 CS 1107

MICROWAVE COMPONENTS AND NETWORKS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To explain the concepts of static electric fields, steady magnetic fields, Maxwell's Equations and EM wave concepts.
2. To explain the operation of signal generators and waveguide components at Microwave frequencies.
3. To analyze the operation of different waveguide components using scattering matrix.
4. To familiarize with the materials used and fabrication techniques of MMICs.
5. To gain an understanding with the experimental procedures involving measurements of different Microwave parameters.

COURSE OUTCOMES:

After completing the course the student will be able to demonstrate the knowledge and will have the ability to:

1. Explain the operation of different microwave signal generators and waveguide components.
2. Mathematically analyze the operation of different Signal generators.
3. Mathematically analyze the operation of different waveguide components using scattering matrix.
4. Understand different fabrication techniques involving Microwave integrated circuits.
5. Understand and implement different experimental procedures involving measurement of microwave parameters

SYLLABUS

Introduction: Microwaves and applications, advantages of microwaves, EM spectrum domain, electric and magnetic fields static electric and magnetic fields, time varying electric and magnetic fields, electromagnetic field equations, maxwell's equations for time-varying fields, meaning of maxwell's equations, characteristics of free space, power flow by microwaves, expression for propagation constant of a microwave in conductive medium, microwave applications, relation between dB, dBm, dBμ.

Microwave Tubes: Limitation of conventional tubes, microwave tubes, velocity modulation, method of producing the velocity modulation, principle of operation of two cavity klystron, reflex klystron principle of operation, velocity modulation in reflex klystron, applegate diagram with gap voltage for a reflex klystron. Principle of operation of magnetron, hull cutoff condition, advantages of slow wave devices, principle of operation of TWT.

Microwave Semiconductor Devices: Microwave bipolar transistor, FET, Principle of Operation and application of tunnel diode, Principle of operation of gunn diode, application of gunn diode advantages of gunn diode, salient features of IMATT and TRAPATT diodes, applications of IMATT and TRAPATT diodes, principle of operation of PIN diode, applications of PIN diode.

Scattering Matrix Parameters of microwave networks: Definition of scattering matrix, characteristics of S-matrix, scattering matrix of a two-port network, salient features of S-matrix, salient features of multiport network, losses in microwave circuits, return loss, insertion loss, transmission loss, reflection loss, impedance matrix, short circuit admittance parameters of a π-network, S-matrix of series element in the transmission line, S-matrix for circulator, S-matrix for isolator, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junctions, S-matrix for directional coupler.

Microwave Passive components: Rectangular waveguides resonator isolator, types of attenuators, fixed attenuators, step attenuators, variable attenuators, salient features of directional coupler, parameters of directional coupler, coupling factor, directivity, applications of directional coupler.

Microwave Integrated Circuits: Salient features of MICs, types of electronic circuits, monolithic microwave integrated circuits (MMICs), film integrated circuit, advantages of MMICs, Basic materials used in MMIC fabrication, examples, characteristics and properties of substrate, conductor, dielectric and resistive materials, MMIC fabrication techniques, diffusion and ion implantation, oxidation and film deposition, epitaxial growth, lithography, etching and photo resist, deposition methods, steps involved in the fabrication of MOSFET

Microwave measurements: Measurement of VSWR, attenuation, dielectric constant, calibration of attenuator and Wave meter.

TEXT BOOKS:

1. "Microwave Engineering" by Prof. GSN Raju, IK International Publishers, 2007
2. "Microwave Engineering" by P.A. Rizzi, PHI, 1999.

REFERENCE BOOKS:

1. "Microwave Engineering : Non-reciprocal active and passive circuits" by Joseph Helszajin, McGraw Hill, 1992.
2. Microwave Engineering by David M.Pozar, 4th Edition, Wiley,2012.

Code: M16 CS 1108

ADVANCED MICROPROCESSOR

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To study about the architecture, pin configuration, timing diagrams and addressing modes of 8086.
2. To study about the instruction sets, Assembler Directives and operators and to acquire the knowledge of programming.
3. To study about the Interrupts of 8086/8088.
4. To study about architecture, Pin-out of 80186 microprocessor, Timing (Read / Write cycles) of 80186.
5. To study about the introduction of 80386, 80486 and Pentium Processor.

COURSE OUTCOMES:

1. After completing of this subject students will learn the basics of 16 bit microprocessor.
2. Understanding the microprocessor architecture assembly language programming.
3. They are able to conclude the delays for 8086.

8086/8088 Microprocessor: Register organization of 8086,architecture, Physical memory organization, I/O addressing capability, Minimum mode and Maximum mode system and timings, addressing modes of 8086

8086/8088 Instruction set: Machine Language Instruction formats, Instruction set of 8086/8088, Assembler Directives and operators, Machine level programming, assembly language programming.

Special architectural features and related programming: Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086/8088, Non maskable interrupts, maskable interrupt (INTR), Interrupt Programming, MACROS, Timing and Delay

80186 and 80286 16 bit microprocessors: 80186/80188 architecture, Pin-out of 80186 microprocessor, Programming the 80186/80188 enhancements, 80186/80188 Timing (Read / Write cycles) ,80186 programmable interrupt controller and DMA Controller , Internal Architecture of 80286

80386/80486 Microprocessors: Introduction to 80386 microprocessor, Special 80386 registers, Memory management, moving to protected mode, Virtual 8086 mode, Memory paging mechanism, Introduction to 80486 and Pentium Processor.

TEXT BOOKS:

1. Advanced microprocessors and peripherals, A.K.Ray & K.M.Bhurchandi, Tata McGraw Hill publications co.ltd, New Delhi Twentieth reprint-2006
2. The INTEL Microprocessors , Barry B Bray,& C.R.Sarma, Pearson Education Ltd, New Delhi, First Indian reprint-2005

REFERENCE BOOKS:

1. The Intel microprocessors 8088/80186,80188,80286,80386,80486,Pentium and Pentium- pro processor Architecture , Programming and Interface by Barray B.Berry, 4th Edition, PHI
2. Microprocessors and interfacing Programming and Applications by Douglas V.Hall, Mc Graw Hill.
3. Microprocessors / Microcomputers Architecture, Software and Systems by A.J.Khambata, John Wiely & Sons.

Code: M16 CS 1109

EMBEDDED SYSTEMS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To introduce students to the modern embedded systems and to show how to understand and program such systems using a concrete platform.
2. Students have knowledge about the basic functions of embedded systems.
3. Students have knowledge about the applications of embedded systems.
4. Students have knowledge about the development of embedded software.

COURSE OUTCOMES:

Students are able to

1. Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
2. Discuss the basics of embedded systems and the interface issues related to it.
3. Learn the different techniques on embedded systems.
4. Discuss the real time models, languages and operating systems.
5. Analyze real time examples.

SYLLABUS

Introduction to Embedded Systems : An embedded system – processor in the system – Hardware units – software embedded into a system – exemplary embedded systems – embedded system – on-chip and in VLSI circuit.

Processor and Memory Organization : structural units in a processor – processor selection for an embedded system – memory devices – memory selection for an embedded system – allocation of memory to program segments and blocks and memory map of a system – direct memory access – interfacing processor, memories and I/O devices.

Devices & Buses for Device Networks : I/O devices – timer & counting devices – serial communication using the 'I^2C', 'CAN' and advanced I/O buses between the networked multiple devices – host system or computer parallel communication between the networked I/O multiple devices using the ISA, PCI, PCI-X and advanced buses.

Device Drivers and Interrupts Servicing Mechanism : Device drivers – parallel port device drivers in a system – serial port device drivers in a system – device drivers for internal programmable timing devices – interrupt servicing mechanism – context and the periods for context switching, deadline and interrupt latency.

Programming Concepts and Embedded Programming in 'C' : Software programming in assembly language (ALP) and in high level language 'C' – 'C' program elements : Header and source files and preprocessor directives – program elements : macros and functions – data types, data structures, modifiers, statements, loops and pointers – Queues – stacks – lists and ordered lists – 'C' program compiler and cross compiler – optimisation of memory needs.

Program modeling concepts in single and multiprocessor systems software-development process: Modeling processor for software analysis before software implementation – programming models for event controlled or response time constrained real time program – modeling of multiprocessor systems.

TEXT BOOKS:

1. Embedded Systems : Architecture, programming and design by Raj Kamal, Tata McGraw Hill, 2003

REFERENCE BOOKS:

1. Embedded System Design : Real world design by Steve Heath, Butter – Worth Heinemann, Newton Mass, USA, May 2002.
2. An introduction to the design of small scale embedded systems with examples from PIC, 8051 and 68HC 05/08 Micro controllers by Tin Wilmshurst, Palgrave, Great Britain, 2001.
3. The 8051 microcontroller and embedded systems by M. Ate Mazidi and J.G. Mazidi, Pearson Education, 2002.

Code: M16 CS 1110

COMMUNICATION ENGINEERING LAB

Lab	**: 4 Periods**	**Sessionals**	**: 50**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

1. To practice the basic theories of communication system.
2. To provide hands-on experience to the students, so that they are able to apply theoretical concepts in practice.
3. To use computer simulation tools such as MATLAB to carry out design experiments as it is a key analysis tool of engineering design.
4. To give a specific design problem to the students, which after completion they will verify using the simulation software or hardware implementation.

COURSE OUTCOMES:

1. Graduate will demonstrate the ability to identify, formulate and solve Communication engineering problems.
2. Graduate will demonstrate the ability to design and conduct experiments, analyze and interpret data.
3. Graduates will demonstrate the ability to design a Communication system or process as per needs and specifications
4. Graduate will demonstrate the skills to use modern engineering tools, softwares and equipment to analyze problem.

LIST OF EXPERIMENTS:

1. Time Division Multiplexing of signals & Framing in the TDM
2. Study of Manchester Coder – Decoder
3. Forming a PC to PC Communication Link using Optical Fider and RS 232 interface
4. Measurement of various losses in an Optical Fiber
5. Measure the Scattering parameters of the devices: Circulator & Hybrid TEE
6. Study of Antenna Radiation Patterns of E-Plane and H-Plane radiation patterns of a Pyramidal Horn using a PC-based Antenna Trainer kit.
7. Measurement of Q-factor of cavity resonator
8. Simulation of Digital Communication Modulators/ Demodulators using MATLAB-SIMULINK
9. Simulation of Channel coding/decoding using MATLAB- SIMULINK
10. Spectrum Analysis using Spectrum Analyzer
11. Study of Cellular communications Systems
12. Study of Satellite communication Receiver

REFERENCE BOOKS:

1. Communication Systems by Simon Haykin, Wiley.
2. Antenna Theory Analysis and Design by Constantine A Balanis, 3rd edition, Wiley.
3. Microwave Engineering by GSN Raju, IK International Publishing House.
4. Satellite Communications 2nd edition Timothy Pratt, Charles W.Bostian, Jeremy E.Allnutt, Wiley.
5. Wireless Communication Principles and Practice by Theodore S. Rappaport, 2nd edition, Printice Hall.

Code: M16 CS 1111

SEMINAR-I

Lab : 3 Periods **Sessionals : 100**
Exam : 3 Hrs. **Credits : 2**

The viva-voce for the seminar shall be held with the faculty member, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 40, 20 and 40 percent by the members respectively.

.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.TECH (COMMUNICATION SYSTEMS)

Scheme of Instruction and Examination
(Regulation:R16)
(with effect from **2016-2017** admitted batch onwards)

II – SEMESTER

Code No.	Course title	Credits	Lecture Hrs	Lab Hrs	Total Contact Hrs/ Week	Sessional Marks	Exam Marks	Total Marks
M16 CS 1201	RF and Microwave Engineering	4	4	--	4	30	70	100
M16 CS 1202	Cellular and Mobile Communications	4	4	--	4	30	70	100
M16 CS 1203	GPS and Applications	4	4	--	4	30	70	100
M16 CS 1204	Telecommunication Switching and Networks	4	4	--	4	30	70	100
#2	Elective - II	4	4	--	4	30	70	100
#3	Elective – III	4	4	--	4	30	70	100
M16 CS 1213	Digital Signal Processing Lab	2	-	4	4	50	50	100
M16 CS 1214	Seminar - II	2	-	3	3	100	--	100
Total		**28**	**24**	**7**	**31**	**330**	**470**	**800**

	Course Code	Course
#2-Elective-II	M16 CS 1205	Modeling and Simulation of Communication Systems
	M16 CS 1206	Modern Radar Systems
	M16 CS 1207	Digital Image Processing
	M16 CS 1208	VLSI Design
#3-Elective-III	M16 CS 1209	Application Specific Integrated Circuits (ASIC)
	M16 CS 1210	Multimedia Communication Systems
	M16 CS 1211	Wavelet Transforms and Its Applications
	M16 CS 1212	Statistical Signal Processing

Code: M16 CS 1201

RF AND MICROWAVE ENGINEERING

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. RF and Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior.
2. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied.
3. Design procedures are presented along with methods to evaluate Matching networks using Smith chart.
4. Analytical techniques are presented for designing of Amplifiers and oscillators at RF and microwave frequencies.

COURSE OUTCOMES:

1. Gain knowledge and understanding of microwave analysis methods.
2. Be able to apply analysis methods to determine circuit properties of passive/active microwave devices.
3. Know how to model and determine the performance characteristics of a microwave circuit or system using Smith chart..
4. Be able to design microwave amplifiers and oscillators for required parameters such as stability, gain , noise.

SYLLABUS

Introduction to RF and Microwave concepts and applications: Introduction, Reasons for using RF/Microwaves, RF/Microwave applications, Radio frequency waves, RF and Microwave circuit design, The unchanging fundamentals versus the ever-evolving structure, General active circuit block diagrams.

RF Electronics Concepts: Introduction, RF/Microwaves versus DC or low AC signals, EM spectrum, Wave length and frequency, Introduction to component basics, Resonant circuits, Analysis of a simple circuit in phasor domain, Impedance transformers, RF impedance matching, Three element matching.

Smith Chart and its Applications: Introduction, A valuable graphical aid the smith chart, Derivation of smith chart, Description of two types of smith charts, Smith charts circular scales, Smith charts radial scales, The normalized impedance-admittance (ZY) smith chart introduction, Applications of the smith chart, Distributed circuit applications, Lumped element circuit applications.

RF and Microwave Amplifiers Small and Large Signal Design: Introduction, Types of amplifiers, Small signal amplifiers, Design of different types of amplifiers, Multistage small signal amplifier design. Introduction, High-power amplifiers, Large signal amplifier design, Microwave power combining/dividing techniques, Signal distortion due to inter modulation products, Multistage amplifiers, Large signal design.

Radio Frequency and Microwave Oscillator Design: Introduction, Oscillator versus amplifier design, Oscillation conditions, Design of transistor oscillators, Generator-tuning networks.

TEXT BOOK:

1. "Radio Frequency and Microwave Electronics", by Mathew M. Radmanesh, Pearson Education Inc., New Delhi

REFERENCE BOOKS:

1. "Microwave Engineering, Active and Non-reciprocal Circuits", by Joseph Helszain, McGraw Hill International Edition, 1992
2. RF & Microwave Engineering : Fundamentals of wireless communications, Frank Gustrau 2012, Wiley.

Code: M16 CS 1202

CELLULAR AND MOBILE COMMUNICATIONS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. Understand the cellular radio concepts such as frequency reuse, handoff and how interference between mobiles and base stations affects the capacity of cellular systems.
2. Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by government regulatory agencies.
3. To have an overview of wireless and mobile communications in different generations.
4. To study the operation of basic cellular system and performance criterion, handoff mechanism.
5. To study the design of cellular mobile system.
6. Understand propagation effects such as fading, time delay spread, and Doppler spread, and describe how to measure and model the impact that signal bandwidth and motion have on the instantaneous received signal through the multipath channel.
7. Understand the information theoretical aspects (such as the capacity) of wireless channels and basic spread spectrum techniques in mobile wireless systems
8. Describe current and future cellular mobile communication systems (GSM, IS95, WCDMA, etc), wireless LANs, adhoc and sensor networks
9. To develop the ability to search, select, organize and present information on new technologies in mobile and cellular communications

COURSE OUTCOMES:

1. Understand the cellular radio concepts such as frequency reuse, handoff and how interference between mobiles and base stations affects the capacity of cellular systems.
2. Students are capable to analyze and solve problems in the field of telecommunications.
3. Students will have the understanding of different generations, operations and design of wireless and mobile communications.
4. Understand the concept of frequency Reuse channels, Deduce the Co-channel interference reduction factor.
5. Design of Antenna system to reduce Co-channel interference. Understand adjacent channel interference, near end far end interference
6. Understand cell site and mobile antennas. Understand frequency management and channel assignment strategies
7. Define Handoff, Distinguish types of handoffs and evaluation of dropped call rates.
8. Understand propagation effects such as fading, time delay spread, and Doppler spread, and describe how to measure and model the impact that signal bandwidth and motion have on the instantaneous received signal through the multipath channel.
9. Understand the information theoretical aspects (such as the capacity) of wireless channels and basic spread spectrum techniques in mobile wireless systems

SYLLABUS

Introduction to wireless communications, examples of wireless communication system, the Cellular concept and system design fundamentals, Frequency reuse, Channel assignment strategies, Handoff strategies, Interfearance and system capacity, Trunk and grade services, Methods for improving coverage and capacity in cellular system .

Multiple access techniques for wireless communications FDMA , TDMA , Spread spectrum techniques, SDMA, Packet Radio, CSMA, Capacity of cellular CDMA with multiple cells and capacity of SDMA.

Wireless systems and standards, AMPS, IS-94, GSM traffic, Examples of GSM cell, Frame structure of GSM cell, details of forward and reverse CDMA channels.

Personal access communication systems, Personal Mobile satellite communications, Integrating GEO, LEO, MEO Satellite and terrestrial mobile systems, Rake receiver

Mobile Radio propagation, Large scale path loss, Reflection, Diffraction, Scattering, Outdoor and Indoor propagation models, Small signal fading and multi path , measurement of small scale path loss, parameters of multi path channels, fading due to multi path, small scale fading models .

TEXT BOOKS:

1. Wireless Communications Principles and Practice, Second Edition, THEODORE S.RAPPAPORT , PHI
2. Wireless Digital Communications, Dr. KAMILO FEHER, PHI
3. Electronic Communication System, WAYNE TOMASI, PHI
4. Wireless Communications, SANJY SHARMA, S.K Kataria & sons

REFERENCE BOOKS:

1. Mobile Cellular Tele Communications-W.C.Y.Lee TMH, 2nd edition 2006.
2. Mobile Cellular Communication, G.Sasibhushan Rao,Pearson Pub.

Code: M16 CS 1203

GLOBAL POSITIONING SYSTEM AND APPLICATIONS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To enable student to understand the basic principle of GPS
2. To enable student to understand the difference between GPS, GALILEO and GLONASS
3. To familiarize the student with the concepts of different co-ordinates system used in GPS
4. To enable student to know about the effect of ionosphere and troposphere on GPS position determination

COURSE OUTCOMES:

1. Students can describe each of the 3 main segments of GPS/GNSS: Space (the three components of the satellite signal), Control (worldwide control stations) and User (the receiver).
2. Students can understand the history of NAVSTAR GPS and other GNSS systems and be able to compare their characteristics: the number of operational satellites, number of orbital planes, orbit shape, orbit inclination, orbital period and satellite altitude.
3. Students can understand how trilateration is used to determine a user's location with a GPS and how to calculate pseudorange.
4. Students understand the different accuracies of consumer, mapping and survey grade GPS units and their respective research applications.

SYLLABUS

Overview of GPS : Basic concept, system architecture, space segment, user segment, GPS aided Geo-augmented navigation (GAGAN) architecture.

GPS Signals : Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

GPS coordinate frames, Time references : Geodetic and Geo centric coordinate systems, ECEF coordinate world geodetic 1984 (WGS 84), GPS time.

GPS orbits and satellite position determination : GPS orbital parameters, description of receiver independent exchange format (RINEX) – Observation data and navigation message data parameters, GPS position determination.

GPS Errors : GPS error sources – clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver.

TEXT BOOK:

1. B. Hoffman – Wellenhof, H. Liehtenegger and J. Collins, 'GPS – Theory and Practice', Springer – Wien, New York (2001).

REFERENCE BOOKS:

1. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
2. Understanding GPS: Principles and Applications by Elliot D.Kaplan, Christopher.J.Hegarty 2nd edition , Artech House.

Code: M16 CS 1204

TELECOMMUNICATION SWITCHING AND NETWORKS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To learn basics of switching systems and design of different switching systems.
2. To understand and designing of multistage networks
3. To understand different switching systems such as electronic space division switching and time division switching
4. To understand different signaling techniques and networks and topologies.
5. To understand the overall data communication and switching networks.

COURSE OUTCOMES:

Students will be able to

1. Understand the complete switching system.
2. Understand the probabilistic methods and statistics to solve communication network problems.
3. Understand effectively the communication principles to design, develop and implement communication networks.
4. Understand the complete system of communication and switching networks.

SYLLABUS

Resource sharing and need for switching: Circuit switching, Store and forward switching, Packet switching, electronic space division switching, Need for networks, two stage networks, three stage networks and n-stage networks.

Time Division Switching: Time switching, space switching, three stage combination switching, n-stage combination switching; Traffic engineering: Hybrid switching, Erlang formula and signaling.

High speed digital access: DSL technology, Cable Modem, SONET.

Local area networks: Traditional ETHERNET, fast ETHERNET, Gigabit ETHERNET, Wireless LAN, Bluetooth, Connecting LAN's, Backbone networks.

Integrated Services Digital Network: Network & protocol architecture, user network interfaces, signaling, inter networking, expert systems in ISDN, Broadband ISDN.

TEXT BOOKS:

1. Telecommunication Switching Systems and Networks- Thiagarajan Viswanathan, Prentice Hall, New Delhi, 2001.
2. Data Communications and Networking- B.A. Forouzan, Tata McGrawhill, Third Edn., 2004.

REFERENCE BOOKS:

1. J.E.Flood,"Telecommunications Switching Traffic & Networks" Pearson.
2. John C. Bellamy, "Digital Telephony", 3rd edition, Wiley Publications.

Code: M16 CS 1205

MODELLING AND SIMULATION OF COMMUNICATION SYSTEMS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. Describe, investigate and analyze complex engineering systems and associated issues (using systems thinking and modeling techniques)
2. Comprehend and apply advanced theory-based understanding of engineering fundamentals and specialist bodies of knowledge in the selected discipline area to predict the effect of engineering activities
3. Apply underpinning natural, physical and engineering sciences, mathematics, statistics, computer and information sciences.
4. Develop creative and innovative solutions to engineering challenges.

COURSE OUTCOMES:

Upon successful completion of this course student should be able to

1. Characterize a given engineering system in terms of its essential elements, that is, purpose, parameters, constraints, performance requirements, subsystems, interconnections and environmental context.
2. Develop a modeling strategy for a real world engineering system, which considers prediction and evaluation against design criteria, and integrates any required sub-system models.
3. Assess and select a model for an engineering system taking into consideration its suitability to facilitate engineering decision making and predicted advantages over alternative models.
4. Interpret the simulation results of an engineering system model, within the context of its capabilities and limitations, to address critical issues in an engineering project.

SYLLABUS

Simulation of Random Variables and Random Process: Univariate and multi-variate models, Transformation of random variables, Bounds and approximation, Random process models-Markov AND ARMA sequences, Sampling rate for simulation, Computer generation and testing of random numbers.

Modeling of Communication Systems: Information Sources, Formatting/Source Coding, Digital Waveforms, Line Coding, Channel Coding, Radio frequency and Optical Modulation, Demodulation and Detection, Filtering, Multiplexing/Multiple Access, Synchronization, Calibration of Simulations.

Communication Channels & Models: Fading & Multipath Channels, Almost Free-Space Channels, Finite State Channel Models, Methodology for Simulating Communication Systems Operating over Fading Channels, Reference Models for Mobile Channels: GSM, UMTS-IMT-2000.

Estimation of Parameters in Simulation: Quality of an estimator, Estimating the Average Level of a Waveform, Estimating the Average power of a waveform, Estimating the Power Spectral Density of a process, Estimating the Delay and Phase.

Estimation of Performance Measures from Simulation: Estimation of SNR, Performance Measures for Digital Systems, Importance sampling method, Efficient Simulation using Importance Sampling, Quasi analytical Estimation. Case Studies: 16-QAM Equalized Line of Sight Digital Radio Link, CDMA Cellular Radio System.

TEXT BOOKS:

1. William H. Tranter, K. Sam Shanmugan, Theodore S. Rappaport, Kurt L. Kosbar, "Principles of Communication Systems Simulation with Wireless Applications", Prentice Hall PTR, 2002.
2. John G. Proakis, Masoud Salehi, Gerhard Bauch, Bill Stenquist, Tom Ziolkowski, "Contemporary Communication Systems Using MATLAB" Thomson-Engineering, 2 edition, 2002.

REFERENCE BOOKS:

1. M.C. Jeruchim, Philip Balaban and K.Sam Shanmugam, "Simulation of Communication Systems, Modeling, Methodology and Techniques", Kluwer Academic/Plenum Publishers, New York, 2000.
2. C. Britton Rorabaugh, "Simulating Wireless Communication Systems: Practical Models In C++" Prentice Hall, 2004.

Code: M16 CS 1206

MODERN RADAR SYSTEMS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To become familiar with fundamentals of RADAR.
2. To gain in depth knowledge about the different types of RADAR and their operations.
3. To explain signal detection in RADAR and various detection techniques.
4. To become familiar with RADAR navigation techniques.

COURSE OUTCOMES:

After completing the course the student will be able to

1. Explain fundamentals of Surveillance Radar and Design.
2. Understand and analyze the operation of different tracking Radars.
3. Understand and explain the waveform design concepts of Radars.
4. Explain Principles of Secondary Surveillance Radar.

SYLLABUS

Fundamentals of Surveillance Radar and Design :
Bandwidth considerations, prf, Unambiguious range and velocity, Pulse length and Sampling, Radar Cross-section and Clutter.

Tracking Radar :
Tracking and Search Radars, Antenna beam shapes required, Radar guidance, Frequency agility, Importance of Monopulse Radar.

Radar waveform design :
Bandwidth and pulse duration requirements, Range and Doppler accuracy uncertainty relation, pulse compression and phase coding.

Principles of Secondary Surveillance Radar:
Radar studies of the atmosphere, OHR and Radar jamming, EC, ECC measures and stealth applications.

TEXT BOOKS:

1. "Understanding of Radar Systems", Simon Kingsley and Shaun Quegan, McGraw Hill, 1993.
2. Radar Handbook by Skolnik.

REFERENCE BOOKS:

1. M.A.Richards et al, Principles of modern Radar ,Basic Principles Vol1,1st editionScitech2010
2. Hamish Meikle, Modern Radar Systems, 2nd edition, Artech House.

Code: M16 CS 1207

DIGITAL IMAGE PROCESSING

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To introduce techniques and tools for digital image processing.
2. To introduce image analysis techniques in the form of image segmentation.
3. To develop on-hand experience in applying tools to process images.
4. To develop engineering skills and intuitive understanding of the tools used in Image Processing.

COURSE OUTCOMES:

At the end of the course, the student will be able to

1. Describe different modalities and current techniques in image acquisition
2. Describe how digital images are represented and stored efficiently depending on the desired quality, color depth, dynamics
3. Use the mathematical principles of digital image enhancement
4. Describe and apply the concepts of feature detection and contour finding algorithms.
5. Analyze the constraints in image processing when dealing with larger data sets.

SYLLABUS

Digital Image Fundamentals : An image model – sampling & quantization – basic relation between pixels : imaging geomentry.

Image Transforms: Properties of 2-D fourier transforms, FFT algorithm and other separable image transforms, Walsh transforms, Hadamard, Cosine, Haar, Slant Transforms, RL Transforms and their properties.

Image Enhancement & Restoration: Spatial domain methods, Frequency domain methods, Histogram Modification technique, Neighborhood averaging, Median filtering, Low pass filtering, Averaging of Multiple Images, Image sharpening by differentiation, High pass Filtering, Degradation model for Continuous functions, Discrete Formulation, Diagonalization of Circulant and Block – Circulant Matrices, Effects of Diagonalization, Constrained and unconstrained Restorations Inverse filtering, Wiener Filter, Constrained least Square Restoration.

Image Encoding: Objective an subjective Fidelity Criteria, the encoding process, the Mapping, the Quantizer and the Coder, Contour Encoding, Run length Encoding, Image Encoding relative to a Fidelity Criterion, Differential Pulse Code Modulation, Transform Encoding.

Image Compression: Fundamentals, Image compression models, error free compression, lossy compression, image compression standards.

Image Segmentation: The detection of Discontinuities, Point Line and Edge Detections, Gradient Operators, Combined Detection, Thresholding.

Image Representation: Representation Schemes, Chain Codes, Polygon Approximation, Boundary Descriptors, Simple Descriptors, Shape Numbers, Fourier Descriptors.

Image Construction from Projections: Radon Transforms, Convolution/filterback Projection.

TEXTBOOKS:

1. Gonzalez RC & Woods RE, Digital Image Processing, Addison Wesley Publishing Company.
2. Jain AK, Fundamentals of Digital Image Processing, PHI
3. Rosefeld & Kak AC, Digital Picture Processing Academic Press Inc.

REFERENCE BOOKS:

1. Kenneth R.Castleman, Digital Image Processing, Pearson 2006
2. William K.Pratt, Digital Image Processing, John Wiley, New York 2002

Code: M16 CS 1208

VLSI DESIGN

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To Study the basics of NMOS, PMOS AND CMOS technologies along with construction, types, working, characteristics and fabrication and the combination of Bipolar and MOS technology and design of logic gates using nMOS, pMOS, CMOS technologies, stick diagrams and layouts.
2. To study Analog VLSI circuits, MOS Multipliers, MOS Resistors, Opamp design in CMOS and Bipolar Configurations
3. To study the design of combinational circuits, power consumption in CMOS circuits, different design techniques to reduce switching activity
4. To study the Data Path Operations ,Addition/Subtraction ,Parity Generators, Comparators, Zero/One Detectors ,Binary Counters, ALUs, Multiplication ,Shifters- Memory elements, control Finite-State Machines- Control Logic Implementation in CMOS sub system design
5. To study the Logic synthesis, simulation and testing, basic features of VHDL language, types of simulations, boundary scan test- fault simulation- automatic test pattern generation.

COURSE OUTCOMES:

1. After completing of this subject, students will learn the basics of MOS and CMOS technologies.
2. They will be able to design combinational logic circuits using MOS and CMOS technologies and develop stick and layout diagrams with design rules.
3. They can also calculate equivalent resistances and capacitances of circuits and estimate power consumption and delay.
4. They will be able to use Switch logic or Gate logic in their design projects.
5. They will be able to design the Combinational and Sequential circuits by using VHDL Language.

SYLLABUS

Introduction To MOS Device: MOS Transistor-First Glance at the MOS device MOS Transistor under static conditions-threshold voltage-Resistive operation-saturation region –channel length modulation-velocity saturation-Hot carrier effect-drain current Vs voltage charts – sub threshold conduction – equivalent resistance-MOS structure capacitance-Design A logic sates using NMOS and PMOS and CMOS devices-Stick Diagram.

Analog VLSI Circuits: Continuous-Time Signal Processing: Primitive Analog Cells-Linear Voltage-Current Converters-MOS Multipliers-MOS Resistors-Winner-Take-All Circuits-Amplifier-Based Signal Processing. Low-Voltage Signal Processing: CMSO Operational Amplifier Design-Bipolar Operational Amplifier.

Design of Combinational Logic Gates In CMOS: Static CMOS design-complementary CMOS – static properties A complementary CMOS design-Power consumption in CMOS logic gates-dynamic or glitching transitions – Design techniques to reduce switching activity – Radioed logic-DC VSL - pass transistor logic – Differential pass transistor logic sizing of level restorer-sizing in pass transistor-Dynamic CMOS design-Basic principles - Domino logic-optimization of Domino logic-NPCMOS-How to choose a logic style -Designing logic for reduced supply voltages.

CMOS Sub System Design: Data Path Operations: Addition/Subtraction- Parity Generators-Comparators- Zero/One Detectors- Binary Counters- ALUs- Multiplication- Shifters- Memory elements- control: Finite-State Machines- Control Logic Implementation.

Logic Synthesis, Simulation and Testing: Basic features of VHDL language for behavioral modeling and simulation- summary of VHDL data types- Dataflow and structural modeling-VHDL and logic synthesis- types of simulation- boundary scan test- fault simulation- automatic test pattern generation.

TEXT BOOKS:

1. Pucknell & Eshraghian : Basic VLSI Design, PHI, (3/e), 1996.
2. Jan.M.Rabaey, Anitha Chandrakasan Borivoje Nikolic, “Digital Integrated Circuits” second Edition, PHI
3. Neil H.E Weste and Kamran Eshraghian, "Principles of CMOS VLSI Design”, 2nd Edition, Addition Wesley, 1998.

REFERENCE BOOKS:

1. Jacob Backer, Harry W.Li and David E.Boyce, CMOS Circuit Design, Layout and simulation, Prentice Hall of India, 1998.
2. Mohammed Ismail, Terri Fiez, “Analog VLSI signal and Information Processing", McGraw-Hill International Editons, 1994.

Code: M16 CS 1209

APPLICATION SPECIFIC INTEGRATED CIRCUITS (ASIC)

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. The course focuses on the semi custom IC Design and introduces the principles of design logic cells, I/O cells and interconnect architecture, with equal importance given to FPGA and ASIC styles.
2. The entire FPGA and ASIC design flow is dealt with from the circuit and layout design point of view
3. Deals with the supply circuit modules which are crucial modules in an IC design.
4. Clock generation circuits play a major role in High Speed Broad Band Communication circuits, High Speed I/O‟s, Memory modules and Data Conversion Circuits.
5. This course focuses on the design aspect of Clock Generation circuits and their design constraints.

COURSE OUTCOMES:

After completing this course:

1. The student would have gained knowledge in the circuit design aspects at the next transistor and block level abstractions of FPGA and ASIC design. In combination with the course on CAD for VLSI, the student would have gained sufficient theoretical knowledge for carrying out FPGA and ASIC designs.
2. Essential know how to a designer to construct Supply reference circuits and Clock Generation Circuits for given design specifications and aids the designer to understand the design specifications related to Supply and Clock Generation Circuits.

SYLLABUS

Introduction to ASICs: Types of ASICs, Design flow, Economics of ASICs, ASIC cell libraries, CMOS Logic, CMOS design rules, Logic cells, I/O cells, cell compilers.

ASIC Library Design: Transistors as resistors, Transistor parasitic capacitance, Logical effort, Cell design, Programmable ASICs, Programmable ASIC logic cells, Programmable ASIC I/O cells, Programmable ASIC interconnect, Programmable ASIC design software.

Low-level design entry: Schematic entry, low-level design languages, PLA tools, EDIF, An overview of VHDL and verilog, Logic synthesis, Simulation.

ASIC construction, Floor planning and placement.

CMOS System Core Studies: Dynamic Warp Processors: Introduction, The problem, the algorithm, a functional overview, detailed functional specification, structural floor plan, physical design, fabrication, Hierarchical layout and design of single chip 32 bit CPU : Introduction, Design methodology, Technology updatability and layout verification.

Practical Realities and Ground Rules: Further thoughts on floor plans/layout, floor plan layout of the four bit processors, input/output (I/O) pads, "Real estate", further thoughts on system delays, ground rules for successful design, scaling of MOS circuits.

TEXT BOOK:

1. Application Specific Integrated Circuits by J.S. Smith, Addison Wesley, 1997.

REFERENCE BOOKS:

1. Basic VLSI Design : Systems and Circuits, Doublas A. Puckness & Kamran Eshraghian, Prentice Hall of India Private Ltd., New Delhi, 1989.
2. Principles of CMOS VLSI Design : A system perspective, N. Westle & K. Eshraghian, Addition – Wesley Pub. Co. 1985.
3. Introduction to VLSI System, C. Mead & L. Canway, Addison Wesley Pub Co. 1990.
4. The Design & Analysis of VLSI Circuits, L.A. Glassey & D.W. Dobbephl, Addison Wesley Pub Co. 1985.
5. Introduction to NMOS & VLSI System Design, A. Mukharjee, Prentice Hall, 1986.
6. VLSI Design Techniques for analog and digital circuits, R.L. Geiger, P.E. Allen & N.R. Streder, McGraw Hill Int. 1990.
7. Digital Integrated Circuits, A Design Perspective, Jan A. Rabey, Prentice Hall of India Pvt. Ltd., 1997.
8. Application specific integrated circuits, J.S. Smith, Addison Wesley, 1997.

Code: M16 CS 1210

MULTIMEDIA COMMUNICATION SYSTEMS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. Understanding the multimedia communications systems, application and basic principles,
2. Analysis of the multimedia streaming,
3. Performing and establishing multimedia communication terminals,
4. Presentation of multimedia communications

.

COURSE OUTCOMES:

1. On successful completion of this course, student should be able to
2. Describe technical characteristics and performance of multimedia system and terminals,
3. Design creative approach in application of multimedia devices, equipment and systems,
4. Carry out experiments and measurements on the multimedia systems in laboratory conditions on real components and equipment,
5. Interpret and analyze measurement results obtained on the multimedia system and components,
6. Describe the development process and applications of the multimedia systems,
7. Test multimedia communication systems and equipment in real conditions.

SYLLABUS

Introduction: Introduction to Multimedia - Multimedia Authoring and Tools. Graphics and Image Data Representations - Color in Image and Video- fundamental Concepts in Video

Audio Compression: Basic of Digital Audio - Basic Audio Compression Techniques - MPEG Audio compression

Lossy and Lossless Compression: Lossless Compression Algorithms - Lossy Compression Algorithms - Image Compression Standards

Video Compression: Basic Video Compression techniques- MPEG Video Coding I: MPEG 1 and 2 - MPEG Video Coding II: MPEG 4, 7 and beyond

Multimedia Networks: Computer and Multimedia Networks - Multimedia Network Communications and Applications- Wireless Networks- Content-Based Retrieval in Digital Libraries.

TEXT BOOKS:

1. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia", Pearson Edition, 2004
2. Fred Halsall, "Multimedia Systems", Pearson 3rd Edition, 2005

REFERENCE BOOKS:

1. Khalid Sayood, "Introduction to Data Compression" Morgan Kauffmann Publishers, Inc. California, 2000.
2. Multimedia Communication Systems: Techniques, Standards and Networks by Kamisetty Ram Mohan Rao, Z.S.Bojkovic, Dragorad A.Milovanovic,Prentice Hall PTR 2002.

Code: M16 CS 1211

WAVELET TRANSFORMS AND ITS APPLICATIONS

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. To understand the basics of different transforms and to make students understand the basic notion of joint time-frequency and time-scale representations of signals
2. To understand the mathematical basis of the Wavelet transform as a tool in signal and Image analysis.
3. To introduce Multi Resolution Analysis (MRA) framework
4. To explore connections between Multi-rate DSP, Filter banks and Wavelet Transform
5. Extension to 2D, Bi-orthogonal wavelets and Wavelet packets
6. To study and appreciate Wavelet applications in Signal compression and De-noising

COURSE OUTCOMES:

Upon completion of the course, the student will be able to
1. Understand the various transforms and their applications.
2. Understand the relationship between various versions of Wavelet transform.
3. Apply Wavelet transforms to different applications.

SYLLABUS

Continuous And Discrete Wavelet Transform: Continuous time ;wavelets transform (CWT): Definition, CWT as a correlation, Constant Q factor filtering interpretation and time frequency resolution, CWT as an operator, Inverse CWT, Discrete Wavelet Transform: Approximations of vectors in Nested Linear Vector Subspaces – Multiresolution analysis (MRA) with examples.

Orthonormal Wavelets And Filter Banks: Definition of an MRA- construction of a General Orthonormal MRA – Wavelet Basis for the MRA-Digital filtering Interpretation- Examples of orthonormal Basis – Generating Wavelets- Interpreting Orthonormal MRAs for Discrete – time Signals Miscellaneous Issues Related to PRQMF Filter Banks-Generating Scaling Functions and Wavelets from Filter Banks – Generating Scaling functions and Wavelets from Filter coefficients – Problems.

Alternative Wavelet Transforms: Biorthogonal Wavelet Bases – Filtering Relations for Orthogonal Filters-Examples of Biorthogonal Scaling Functions and Wavelets-Two Dimensional Wavelets-Nonseperable Multidimensional Wavelets- Wavelet Packets – Transform Coding – DTWT for Image Compression – Audio Compression – Video Coding Using Multiresolution Techniques.

Applications of Wavelet Transforms: Wavelet Denoising – Speckle Removing – Edge Detection and Object Isolation - Image Fusion-Object Detection by Wavelet Transforms of Projections – Communication Applications – Scaling Functions as signaling pulses, Discrete Wavelet Multitone Modulation.

TEXT BOOK:

1. Raghuveer M. Rao and Ajit S. Bopardikar, "Wavelet Transforms – Introduction to Theory and Applications" Addison Wesley Pearson Education Asia, 2000.

REFERENCE BOOKS:

1. C.Sidney Burrus, Ramesh A Gopinath, and Haitao Guo, "Introduction to Wavelets and Wavelet Transforms, A Primer " PH International Editions, 1998.
2. Wavelet Transforms and their Applications by Debnath, Lokenath, Shah,Firdous. Birkhauser Basel, 2015.

Code: M16 CS 1212

STATISTICAL SIGNAL PROCESSING

Theory	**: 4 Periods**	**Sessionals**	**: 30**
Exam	**: 3 Hrs.**	**Ext. Marks**	**: 70**
		Credits	**: 4**

COURSE OBJECTIVES:

1. Introduce the basic theory of signal detection and estimation.
2. Explain the Study of identifying the engineering problems that can be put into the frame of statistical signal processing.
3. Explain the Study of solving the identified problems using the standard techniques learned through this course.
4. Study the fundamental understanding of statistical signal processing that may help students study advanced topics and consequently make significant contributions to the theory and the practice of statistical signal processing.

COURSE OUTCOMES:

At the end of the course the student will have

1. Ability to characterize an estimator.
2. Ability to design statistical DSP algorithms to meet desired needs.
3. Ability to apply vector space methods to statistical signal processing problems.
4. Ability to understand Wiener filter theory and design discrete and continuous Wiener filters.
5. Ability to understand Kalman Filter theory and design discrete Kalman filters.

SYLLABUS

Estimating in Signal Processing: Mathematical Estimation Problem, Assessing Estimator Performance, Minimum Variance Unbiased Estimation: Unbiased Estimators, Minimum Variance Criterion, Existence of the Minimum Variance Unbiased Estimator, Finding the Minimum Variance Unbiased Estimator, Cramer Rao Lower Bound, Estimator Accuracy considerations, CRLB, CRLB for signals in White Gaussian Noise, Transformation of Parameters, Signal Processing Examples.

Maximum Likelihood Estimation: Introduction, Finding the MLE, Properties of the MLE, MLE for transformed parameters, Numerical Determination of the MLE, Asymptotic MLE, Signal Processing Examples, Least Squares Estimation: Introduction, Least Squares Approach, Linear Least Squares, Geometrical Interpretations, Order Recursive Least Squares, Signal Processing Examples.

Bayesian Estimation: Introduction, Prior Knowledge and Estimation, Choosing a prior PDF, Properties of the Gaussian PDF, Bayesian Linear Model, Nuisance Parameters, Bayesian Estimation for Deterministic Parameters, Derivation of Conditional Gaussian PDF.

Statistical Decision Theory: Neyman - Pearson Theorem, Receiver Operating Characteristics, Irrelevant Data, Minimum Probability of Error, Bayes Risk, Multiple Hypothesis Testing - Composite Hypothesis Testing, Composite Hypothesis Testing Approaches, Performance of GLRT, Multiple Hypothesis Testing.

Deterministic Signals, Matched Filters, Generalized Matched Filters, Multiple Signals, Linear Model, Signal Processing Examples, Random Signals, Estimator Correlator, Linear Model, Estimator Correlator for Large Data Records, General Gaussian Detection, Signal Processing Example.

TEXT BOOKS:

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume I Estimation Theory", Prentice Hall PTR, 1993.
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing Volume II Detection Theory", Prentice Hall PTR, 1998.

REFERENCE BOOKS:

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", Wiley, 1996.
2. An Introduction to Statistical Signal Processing by Robert M.Gray and Lee D.Davisson, Cambridge University Press 2004.

Code: M16 CS 1213

DIGITAL SIGNAL PROCESSING LAB

Lab	**: 4 Periods**	**Sessionals**	**: 50**
Exam	**: 3 Hrs.**	**Ext. marks**	**: 50**
		Credits	**: 2**

COURSE OBJECTIVES:

1. Use the Fast Fourier Transform in a variety of applications including: signal analysis, fast convolution, spectral and temporal interpolation, and filtering.
2. Quickly choose and design FIR and IIR digital filters
3. Estimate power spectral densities using a variety of techniques.
4. Perform the deconvolution of two signals
5. Construct & Simulate a simple digital communication system.
6. To learn LPC Speech coding, JPEG image compression, Image Encryption & Watermarking, apply convolutional coding & Viterbi algorithm

COURSE OUTCOMES:

1. Analyze signals using the discrete Fourier transform (DFT)
2. Understand circular convolution, its relationship to linear convolution, and how linear convolution can be achieved via the discrete Fourier transform.
3. Understand the Decimation in time and frequency FFT algorithms for efficient computation of the DFT.
4. Alter the sampling rate of a signal using decimation and interpolation.
5. Design digital IIR filters by designing prototypical analog filters and then applying analog to digital conversion techniques such as the bilinear transformation.
6. Design digital FIR filters using the window method.

LIST OF EXPERIMENTS:

1. Implementation of Edge Detection Techniques using DSP processor
2. Development of Digital Data Scrambler for speech signals
3. Development of Digital Data Descoraubler for speech an audio signal
4. Implementation of convolution encoder
5. Implementation of convolution veterbi decoder
6. Design and implementation of Digital Filters
7. Implementation of Digital filters for real time applications
8. Implementation JP&G algorithm for image compression
9. Implementation of Adaptive filters
10. Implementation real time system for biomedical signal using DSP processors
11. Application Development using DSP processor for Multi channel telephony system
12. Application Development for voice recognizing systems using DSP processors

REFERENCE BOOKS:

1. Digital Signal Processing using MATLab by Vinay k.Ingle, John G.Proakis, Vikas Publishing House Pvt. Ltd.
2. Digital Signal Processing - A Computer based approach by Sanjit K.Mitra 3rd edition,TMH.
3. Contemporary Communication Systems using MATLab and Simulink by John G. Proakis, Masoud Salehi, Gerhard Bauch 2nd edition, Thomson Brooks/Cole.
4. Digital Image Processing using MATLab by Rafael C.Gozalez, Richard E.Woods, Steven L.Eddins 2nd edition, TMH.

Code: M16 CS 1214

SEMINAR-II

Lab : 3 Periods **Sessionals : 100**
Exam : 3 Hrs. **Credits : 2**

The viva-voce for the seminar shall be held with the faculty member, PG coordinator, and Head of the Department. The marks shall be awarded in the ratio of 40, 20 and 40 percent by the members respectively.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.TECH (COMMUNICATION SYSTEMS)

Scheme of Instruction and Examination
(Regulation:R16)
(with effect from **2016-2017** admitted batch onwards)

III – SEMESTER

Course Code	Course Title	Credits	Scheme of Examination	Exam Marks	Total Marks
M16 CS 2101	Thesis Work - Preliminary	10	Review	100	100

1. Candidates can do their thesis work within the department or in any industry/research organization for two semesters (i.e. 3rd and 4th semesters). In case of thesis done in an industry/research organization, one advisor (Guide) should be from the department and one advisor (CO-Guide) should be from the industry/research organization.
2. The Thesis Work -Preliminary should be submitted at the end of 3rd semester and it will be evaluated through Review by a committee consisting of Head of the Department, External Examiner, PG coordinator and guide. The marks shall be awarded in the ratio of 20, 40, 20 and 20 percent by the members respectively.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M.TECH (COMMUNICATION SYSTEMS)

Scheme of Instruction and Examination
(Regulation:R16)
(with effect from **2016-2017** admitted batch onwards)

IV – SEMESTER

Course Code	Course Title	Credits	Scheme of Examination	Exam Marks	Total Marks
M16 CS 2201	Thesis Work-Final	14	Viva-voce	100	100

1. A publication of a paper on the thesis work in a National/International Journal at the end of 4th semester is mandatory for the submission of thesis work.
2. The Thesis should be submitted at the end of 4th semester and it will be evaluated through Viva–Voce examination by a committee consisting of Head of the Department, External Examiner, PG coordinator and thesis guide. The marks shall be awarded in the ratio of 20, 40, 20 and 20 percent by the members respectively.