SEMESTER V

Code	Course of Study	L	T	P	C
EC301	Statistical Theory of Communication	3	1	0	4
EC303	Digital Signal Processor and Application	3	0	0	3
EC305	Communication Theory	3	1	0	4
EC307	Antennas and Propagation	3	0	0	3
EC309	Analog Integrated Circuits	3	0	0	3
EC311	Advanced Microprocessors	3	0	0	3
EC313	Analog Integrated Circuits Laboratory	0	0	3	2
EC315	Digital Signal Processing Laboratory	0	0	3	2
	TOTAL	**18**	**0**	**6**	**24**

SEMESTER V

EC301STATISTICAL THEORY OF COMMUNICATION (3-1-0)4

Pre-Requisite:MA206

Objective:

The subject aims to make the students to understand the statistical theory of telecommunication, which are the basics to learn analog and digital tele-communication.

Topics Covered:

Unit - 1: Introduction

Information measure.Discrete entropy.Joint and conditional entropies. Uniquely decipherable and instantaneous codes.Kraft-Mcmillan inequality. Noiseless coding theorem. Construction of optimal codes.

Unit - 2: Fundamental Limits in Information Theory

Discrete Memoryless Channels. Mutual information and channel capacity. Shannon's fundamental theorem. Entropy in the continuous case.Shannon-Hartley law.

Unit -3:Parameter Estimation

Binary hypothesis testing.Baye's, minimax and Neyman-Pearson tests. Random parameter estimation-MMSE,MMAE and MAP estimates. Nonrandom parameters – ML estimation.

Unit -4: Coherent signal detection

Coherent signal detection in the presence of additive white and non-white Gaussian noise. Matched filter.

Unit -5: Filters used in Communication systems

Discrete optimum linear filtering. Orthogonality principle.Spectral factorization. FIR and IIR Wiener filters.

Course Outcomes:

Students are able to

1. Show how the information is measured and able to use it for effective coding.
2. Summarize how the channel capacity is computed for various channels.
3. Use various techniques involved in basic detection and estimation theory to solve the problem.

4. Summarize the applications of detection theory in telecommunication.
5. Summarize the application of estimation theory in telecommunication.

Text Books:

1. R.B. Ash, Information Theory, Wiley, 1965.
2. M.D. Srinath, P.K. Rajasekaran & R. Viswanathan, Statistical Signal Processing with Applications, PHI 1999.

Reference Books:

1. H.V. Poor : An Introduction to Signal Detection and Estimation,(2/e), Spring Verlag.1994.
2. M. Mansuripur : Introduction to Information Theory, Prentice Hall.1987.
3. J.G. Proakis et al : Digital Signal Processing, (4/e), Pearson Education, 2007.

EC303 DIGITAL SIGNAL PROCESSORS AND APPLICATIONS (3-0-0)3

Pre-Requisite:EC202

Objective:

To give an exposure to the various fixed point & a floating point DSP architectures and to develop applications using these processors.

Topics Covered:

Unit-1: Introduction
Difference between DSP and other microprocessor architectures-An overview of Motorola and Analog Device DSPs.

Unit-2: Fixed and Floating Point DSP
TMS320C54X fixed point architecture- TMS320C3X floating point DSP architecture- CPU- memory- buses and peripherals- Addressing mode.

Unit-3: Programming Concepts
Instruction set- Repeat operations - Pipeline operation-Pipeline conflicts- Interrupts.

Unit-4: Interfacing
Interfacing- serial interface- parallel interface- DMA operations- A/D and D/A converter interfaces.

Unit-5: Applications
DSP tools-DSP applications-MAC- filter design- implementation of DFT- echo cancellation- spectrum analyzer.

Course Outcomes:

Students are able to

1. Recognize the fundamentals of fixed and floating point architectures of various DSPs.
2. Learn the architecture details and instruction sets of fixed and floating point DSPs

3. Infer about the control instructions, interrupts, and pipeline operations.
4. Illustrate the features of on-chip peripheral devices and its interfacing along with its programming details.
5. Analyze and learn to implement the signal processing algorithms in DSPs
6. Learn the DSP programming tools and use them for applications

Text Books:

1. B. Venkataramani& M. Bhaskar, Digital Signal Processor, Architecture, Programming and Applications,(2/e), McGraw- Hill,2010
2. S. Srinivasan &Avtar Singh, Digital Signal Processing, Implementations using DSP Microprocessors with Examples from TMS320C54X, Brooks/Cole, 2004.

Reference Books:

1. Sen M. Kuo&Woon-Seng S. Gan, Digital Signal Processors: Architectures, Implementations, and Applications, Prentice Hall, 2004
2. C. Marven& G. Ewers: A Simple approach to digital signal processing, Wiley Inter science, 1996.
3. R.A. Haddad & T.W. Parson: Digital Signal Processing: Theory, Applications and Hardware, Computer Science Press NY, 1991.

EC305COMMUNICATION THEORY(3-1-0)4

Pre-Requisite:EC201&MA206

Objective:

To develop a fundamental understanding on communication systems with emphasis on analog modulation techniques.

Topics Covered:

Unit -1: Amplitude Modulation.

Basic blocks of Communication System. AM, Linear Modulation - DSB-SC, SSB and VSB. Frequency Translation, Frequency-Division Multiplexing, Methods of generation and detection.

Unit -2: Angle Modulation

Frequency and Phase modulation. Transmission Bandwidth of FM signals, Methods of generation and detection, FM Stereo Multiplexing, Super heterodyne receiver.

Unit -3: Tuner amplifiers

Design of Class A, B, AB, C, D, S and E power amplifiers. Use of power amplifiers in Transmission.

Unit - 4: Circuits for Modulation and Demodulation

Circuits for generation and detection of AM, DSBSC, SSBSC, FM signal.

Unit - 5: Noise in Communication systems.

Noise in CW modulation systems - SNR calculations for synchronous detection of DSB and SSB and envelope detection of AM.SNR calculations for angle modulation system. Pre-emphasis and de-emphasis.Threshold effect. Noise in Communication subsystems - Internal and external noise.

Course Outcomes:

Students are able to

1. Apply the basic knowledge of signals and systems and understand the basics of communication system and analog modulation techniques.
2. Apply the basic knowledge of transistor and describe the power amplifiers.
3. Evaluate the communication system performance in the presence of noise and summarize the merits and demerits of all the conventional analog modulation system.
4. Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for modulators ,demodulator and communication systems using CAD tool.

Text Book:

1. S. Haykins, "Communication Systems" (4/e), Wiley, 2001.
2. B. Carlson, "Introduction to Communication Systems" (4/e), McGraw-Hill, 2009.

Reference Books:

1. Kennedy, Davis, "Electronic Communication Systems" (4/e), McGraw Hill, 1999.
2. J. Smith, Modern,"Communication Circuits" (2/e), McGraw Hill, 1997.
3. J.S. Beasley & G.M. Miler, "Modern Electronic Communication" (9/e), Prentice-Hall, 2008.

EC307 ANTENNAS AND PROPAGATION (3-0-0)3

Pre-Requisite: EC205

Objective:

To impart knowledge on fundamentals of antenna theory and to analyze and design a state of art antenna for wireless communications.

Topics Covered :

Unit-1: Radiation fundamentals-1

Potential theory - Helmholtz integrals - Radiation from a current element - Basic antenna parameters - Radiation field of an arbitrary current distribution - Small loop antennas.

Unit-2: Radiation fundamentals-2
Receiving antenna - Reciprocity relations - Receiving cross section, and its relation to gain - Reception of completely polarized waves - Linear antennas - Current distribution - Radiation field of a thin dipole - Folded dipole - Feeding methods - Baluns.

Unit-3: Antenna array
Array factorization - Array parameters - Broad side and end fire arrays - Yagi-Uda arrays - Log-periodic arrays - Phased Array Antenna – Sectoral Antenna

Unit-4: Antennas types
Fields as sources of radiation - Horn antennas - Babinet's principle - Parabolic reflector antenna - Lens Antenna -Microstrip antennas.

Unit-5: Wave Propagation
Propagation in free space - Propagation around the earth, surface wave propagation - structure of the ionosphere - propagation of plane waves in ionized medium - Determination of critical frequency – MUF – Fading - tropospheric propagation - Super refraction.

Course Outcome:

Students are able to

1. Select the appropriate portion of electromagnetic theory and its application to antennas.
2. Distinguish the receiving antennas from transmitting antennas, analyze and justify their characteristics.
3. Assess the need for antenna arrays and mathematically analyze the types of antenna arrays.
4. Distinguish primary from secondary antennas and analyze their characteristics by applying optics and acoustics principles.
5. Outline the factors involved in the propagation of radio waves using practical antennas.

Text Books:

1. Balanis, "Antenna Theory", 3rd edition, Wiley Publishers, 2012.
2. R.E. Collin, "Antennas and Radio Wave Propagation", McGraw - Hill,1985.
3. W.L. Stutzman& G.A. Thiele : Antenna Theory and Design, 3rd edition, Wiley Publishers, 2012

Reference Books:

1. K.F. Lee, Principles of Antenna Theory, Wiley,1984.
2. Frederick Emmons Terman , Electronic Radio Engineering (4/e). McGraw Hill.
3. J.R. James etal, Microstrip Antenna Theory and Design, IEE, 1981.

EC309 ANALOG INTEGRATED CIRCUITS (3 -0 - 0) 3

Pre-Requisite: EC206

Objectives:

This subject introduces the theoretical & circuit aspects of Op-amp, which is the backbone for the basics of Linear integrated circuits.

Topics Covered:

Unit-1:Operational Amplifiers

Ideal conditions, IC Packages, DC and AC characteristics.Applications-Inverting and Non Inverting amplifiers, Differentiators and Integrators, Summing and Difference amplifier, Voltage to current converters, Precision rectifiers.Log and antilog amplifiers.Four quadrant multipliers.Instrumentation amplifier.

Unit-2:Active filters.

Filter classification. Standard approximations. Butterworth, Chebyshev and Bessel filters. Switched capacitor filter.

Unit-3:Oscillators using opamps

Schmitt trigger, Astable, Monostable and BistableMultivibrators using opamps and 555 timer. Triggering circuits for bistable and monostablemultivibrators. Programmable timer.

Unit-4:Data converters.

Analog multiplexer .A/D and D/A converters and its type.PLL-Applications of PLL.Frequencysynthesizers.Coherent synthesizers using PLL.Direct digital synthesis. Phase noise in oscillators.

Unit-5:Voltage regulators.

Regulators using opamps. ICregulators. Protectioncircuits. Foldback current limiting. Current boosting of IC regulators.Switching regulators.

Course Outcomes:

The expected outcome after learning this course are that a student must be able to design a op amp based circuits as per requirements.

Text Books:

1. S.Franco, Design with Operational Amplifiers and Analog Integrated Circuits (3/e) TMH, 2003
2. R.Gayakwad, Op-amps and Linear Integrated Circuits (4/e), PHI

Reference Books:

1. D.A.Bell, Solidstate Pulse Circuits (4/e), PHI
2. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000

EC311ADVANCED MICROPROCESSORS (3-0-0)3

Pre-Requisite:EC208

Objective:

To make the students to learn the advanced techniques in designing the advanced Microprocessors and give exposure to the cache organization, memory management, multitasking and bus interfacing.

Topics Covered:

Unit-1: Introduction
Software model for Pentium-Real and protected mode of operation- Instruction set-Addressing modes- Interrupts.

Unit-2: Hardware details of Pentium
Signal description- Pipelining-Branch prediction-.Cache memories-Floating point unit.

Unit-3: Memory Management
Segmentation-Memory management-Paging-Protection-Multitasking.Exceptions-Interrupts-Virtual 8086 mode-Protected mode applications.

Unit-4: Special Processors
Introduction-Power PC architecture –Organization-.Programming model- Instruction set.

Unit-5: Bus Interface
Introduction-ISA bus-Extended ISA and VESA local bus-PCI bus-USB bus-Serial bus standards-Parallel printer interface standards.

Course Outcomes:

Students are able to

1. Ability to design a high speed & high performance microprocessors.
2. Analyze and design the cache memory and pipelining structures.
3. Identify and apply various protected mode concepts like paging, multitasking etc. in high speed processors.
4. Recognize the need for recent Bus standards like PCI Express, USB etc.

Text Books:

1. John P Hayes, Computer Architecture and organization, McGraw-Hill 1998.
2. James L. Antonakos, The Pentium Microprocessor, (2/e), Pearson, 2002.

Reference Books:

1. John L. Hennessy & David A. Patterson Computer Architecture (3/e), Elsevier, 2003.
2. Barry B. Brey, The Intel Microprocessors, (7/e), Eastern Economy Edition , 2006.
3. A.K. Ray & K.M. Bhurchandi, Advanced Microprocessors and Peripherals, (2/e), Tata McGraw Hill, 2007.

EC313ANALOG INTEGRATED CIRCUITS LABORATORY (0 - 0 - 3-2)

List of Experiments:

1. Differential amplifier
2. Measurement of Op-Amp parameters
3. Inverting non-inverting amplifiers, Integrator, Differentiator, Adder, Subtractor
4. Instrumentation Amplifier using Op-amps
5. Op-amp in comparator application
6. Waveform Generators –Sine, square, Triangular and Ramp
7. Astable and Monostable Multivibrators using op-amp and 555IC
8. Low Pass Filter and High Pass Filter realizations using op-amps
9. Band Pass Filter and Band Stop Filter realizations using op-amps

EC315 DIGITAL SIGNAL PROCESSING LABORATORY (0-0-3-2)

List of Experiments:

MATLAB Experiments

1. Generation of various discrete time signals.
2. Study of linear and circular convolution.
3. Study of auto and cross correlation.
4. Finding DFT and IDFT using FFT algorithm
5. Spectrum analysis using FFT
6. Design of FIR filter using window method.
7. Design of FIR filter using frequency sampling method
8. Design of IIR filter using bilinear and impulse invariance method.
9. Study of up sampler and down sampler
10. Study of equalizers.