B.Tech. III Year I Semester

III Year-I Semester	ANALOG & DIGITAL IC APPLICATIONS	L	T	P	C
		3	0	0	3

Course Outcomes:

- Analyze and design various configurations of operational amplifiers, and applications such as instrumentation amplifiers, voltage regulators, comparators, and waveform generators.
- Design and implement active filters and waveform generators using op-amps, IC-555, and IC-565, and evaluate their performance for signal processing applications
- Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications.
- Apply combinational logic ICs such as multiplexers, de-multiplexers, encoders, decoders, and arithmetic circuits to solve complex digital design problems.
- Develop sequential circuits using flip-flops, counters, and shift registers, and analyze their use in digital memory systems, including ROM, RAM, and their variants

UNIT–I: Operational Amplifier

Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, ACAmplifier, Differentiatorsand Integrators, Comparators, SchmittTrigger, Introduction to Voltage Regulators.

UNIT-II: Op-Amp, IC-555 & IC565 Applications

Introduction to Active Filters, Characteristics of Bandpass, Bandreject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT-III: Data Converters

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT-IV: Combinational Logic ICs

Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V: Sequential Logic IC's and Memories

Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXTBOOKS:

1. RamakanthA.Gayakwad-Op-Amps&LinearICs,PHI,2003.
2. FloydandJain – DigitalFundamentals,8thEd.,PearsonEducation,2005.

REFERENCEBOOKS:

1. D.RoyChowdhury–LinearIntegratedCircuits,NewAgeInternational(p)Ltd,2ndEd.,2003.
2. John.F.Wakerly–DigitalDesignPrinciplesandPractices,3rdEd.,Pearson,,2009.
3. SalivahanaLinearIntegratedCircuitsandApplications,TMH,2008.
4. WilliamD.Stanley-OperationalAmplifierswithLinearIntegratedCircuits,4thEd.,Pearson

Education India, 2009

III Year-I Semester	DIGITAL COMMUNICATIONS	L	T	P	C
		3	0	0	3

Course Outcomes:

- Describe basic components of Digital Communication Systems and to determine the performance of different pulse digital modulation techniques
- Determine the performance of digital modulation techniques for the generation and digital representation of the signals.
- Design optimum receiver for Digital Modulation techniques and to determine the probability of error for various digital modulation schemes
- Compute and analyze error detecting and error correction codes block codes, cyclic codes.
- Compute and analyze convolution codes and Turbo codes.

UNIT I

PULSE DIGITAL MODULATION: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems.Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems.

UNIT II

DIGITAL MODULATION TECHNIQUES: Introduction, ASK, FSK, PSK, DPSK, QPSK, M-ary PSK, M-ary FSK.

UNIT III

DATA TRANSMISSION: Base band signal receiver, probability of error, the optimum filter, matched filter, probability of error using matched filter, coherent reception, non-coherent detection of FSK, calculation of error probability of ASK, BPSK, BFSK, QPSK.

UNIT IV

INFORMATION THEORY: Discrete messages, amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.
SOURCE CODING: Introductions, Advantages, Shannon'stheorem, Shanon-Fanocoding, Huffman coding, efficiency calculations, channel capacity of discrete channel, capacity of a Gaussian channel, bandwidth–S/N tradeoff.

UNIT V

LINEAR BLOCK CODES: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes.
CONVOLUTION CODES: Introduction, encoding of convolution codes, time domain approach, transform domain approach.

TEXT BOOKS:

1. Digital communications - Simon Haykin, John Wiley, 2005
2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003
3. Digital Communications- J.Das, S.K.Mullick, P.K.Chatterjee, John willy & sons, 1986.

RERFERENCES:

1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.
2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog & Digital – Singh & Sapre, TMH, 2004
3. Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition, 2004.

III Year-I Semester	ANTENNAS AND WAVE PROPAGATION	L	T	P	C
		3	0	0	3

Course Outcomes:

- Identify basic antenna parameters.
- Quantify the fields radiated by various types of antennas
- Design and analyze antenna arrays
- Design and analyze wire antennas, loop antennas, reflector antennas, lens antennas, horn antennas and micro-strip antennas
- Analyze antenna measurements to assess antenna's performance

UNIT-I: ANTENNA FUNDAMENTALS

Introduction, Radiation Mechanism – Single Wire, 2-Wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Field Regions, Main Lobe and Side Lobes, Beamwidth, Radiation Intensity, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.

UNIT-II:THIN LINEAR WIRE ANTENNAS

Retarded Potentials, Radiation from Small Electric Dipole, Quarter wave Monopole and Half-Wave Dipole – Current Distributions, Evaluation of Field Components, Power Radiated, Radiation Resistance, Radiation Efficiency, Beamwidth, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Centre-fed Antennas of different lengths, Antenna Theorems – Applicability and Proofs for equivalence of directional characteristics, Loop Antennas: Small Loops - Field Components, Comparison of far fields of small loop and short dipole.

UNIT-III:ANTENNA ARRAYS

2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, Derivation of their characteristics and comparison. Directivity Relations (no derivations), Related Problems. Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations Arrays with Parasitic Elements, Yagi-Uda Arrays, Folded Dipoles and their characteristics

UNIT-IV:

BROADBAND ANTENNAS: Helical Antennas – Significance, Geometry, basic properties; Design considerations for monofilar helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).

UHF AND MICROWAVE ANTENNAS:

Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns;**Paraboloidal Reflectors**: – Geometry, characteristics, types of feeds, F/D Ratio, Spill Over, Back Lobes, Aperture Blocking, Off-set Feeds, Cassegrain Feeds, Lens antenna.

Microstrip Antennas-Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas –Geometry and Parameters.

UNIT-V: ANTENNA MEASUREMENTS

FRIIS Transmission Equation, Patterns Required, Set Up, Distance Criterion, Directivity and Gain Measurements (Comparison, Absolute and 3-Antenna Methods).

WAVE PROPAGATION: Types of propagations.Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance; Space Wave Propagation – Mechanism, LOS and Radio Horizon, illustrated Problems.

TEXT BOOKS:

1. Antenna Theory: Analysis And Design- Constantine A. Balanis, 3rd Edition, A John Wiley & Sons, Inc., Publication
2. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.
3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

REFERENCES:

1. Antennas andWave Propagation-G.S.N. Raju, Pearson publications, 2006.
2. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, StandardPublishers Distributors, Delhi.
3. Antennas – John D. Kraus, McGraw-Hill, 2nd Edition, 1988.

III Year-I Semester	DIGITAL SYSTEM DESIGN THROUGH HDL (PE-I)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the language constructs and programming fundamentals of Verilog HDL.
- Choose the suitable abstraction level for a particular digital design
- Construct Combinational and sequential circuits in different modelling styles using Verilog HDL
- Design and synthesize combinational and sequential logic circuits
- Analyze and Verify the functionality of digital circuits/systems using test benches.

UNIT-I: Introduction to Verilog HDL and Gate Level Modelling:
Verilog as HDL, Levels of Design Description Basics of Concepts of Verilog, Data Types, System Task, Compiler directives, modules and ports. AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flipflops with Gate Primitives, Delay.

UNIT-II: Behavioural Modelling:
Introduction, structured processors, procedural assignments, timing controls, conditional statements, multi-way branching, loops, sequential and parallel blocks, generate blocks, Design of Decoders, Multiplexers, Flip-flops, Registers & Counters in Behavioral model.

UNIT-III: Modelling at Data flow Level:
Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators, Design of Decoders, Multiplexers, Flip-flops, Registers & Counters in dataflow model, Switch Level Modelling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitive delays.

UNIT-IV: FSM Design:
Functions,Tasks, User-defined,Primitives:Introduction,Function,Tasks,User-Defined Primitives (UDP), FSM Design (Moore and Mealy Machines), Encoding Style: From Binary to One Hot. Introduction to Synthesis, Synthesis of combinational logic, Synthesis of sequential logic with latches and flip-flops, Synthesis of Explicit and Implicit State Machines

UNIT-V: Components Test and Verification:
Test Bench – Combinational Circuits Testing, Sequential Circuits Testing, Test Bench Techniques, Design Verification, Assertion Verification

Text Books:

1. Samir Palnitkar, “Verilog HDL A Guide to Digital and Synthesis” ,2nd Edition, Pearson Education,2006.

2. Michael, D. Ciletti, “Advanced digital design with the Verilog HDL”, Pearson Education India,2005.

Reference Books:

1. Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016
2. S. Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rdEdision 2014.
3. J. Bhasker, A Verilog HDL Primer 2nd edition, BS Publications, 2001.

III Year-I Semester	OPTICALCOMMUNICATIONS (PE-I)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Choose necessary components required in modern optical communications systems.
- Design and build optical fiber experiments in the laboratory, and learn how to calculate electromagnetic modes in waveguides, the amount of light lost going through an optical system, dispersion of optical fibers.
- Use different types of photo detectors and optical test equipment to analyze optical fiber and light wave systems.
- Choose the optical cables for better communication with minimum losses
- Design, build, and demonstrate optical fiber experiments in the laboratory.

UNITI

Overview of optical fiber communication - Historical development, The general system, advantages of optical fibercommunications.Opticalfiber waveguides-Introduction,Ray theory transmission,TotalInternalReflection,Acceptance angle, Numerical Aperture, Skew rays, Cylindricalfibers- Modes, V-number, Mode coupling, StepIndexfibers,GradedIndexfibers,Singlemodefibers- Cutoffwavelength,ModeFieldDiameter,EffectiveRefractiveIndex, Related problems.

UNITII

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in opticalfibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacitydetermination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Modedispersion,Intermodal dispersion, Pulsebroadeningin Gradedindexfiber,Relatedproblems.

UNITIII

Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing-Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, singlemodefiberjoints.

UNITIV

Optical sources-LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product.Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations,Resonant frequencies, Reliability of LED&ILD, Optical detectors- Physical principles of PIN and APD, Detectorresponsetime, Comparison ofPhoto detectors, Related problems.

UNITV

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium NumericalAperture, Laser diode to fiber coupling, Optical receiver operation-Fundamental receiver operation, Digital signaltransmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantumlimit, Analog

receivers.Optical system design - Point-to- point links- Component choice and considerations,

Linkpowerbudget,Risetimebudgetwithexamples,LinecodinginOpticallinks,WDM,Necessity, Principles,Measurementof Attenuation and Dispersion, Eyepattern.

TEXTBOOKS:

1. OpticalFiberCommunications–GerdKeiser,McGraw-HillInternationaledition,3rdEdition,2000.
2. FiberOptic Communications– JosephC.Palais, 4thEdition, Pearson Education, 2004.

RERFERENCES:

1. FiberOpticCommunications–D.K.Mynbaev,S.C.GuptaandLowell L.Scheiner,PearsonEducation,2005.
2. TextBookonOpticalFiberCommunicationanditsApplications–S.C.Gupta,PHI,2005.
3. FiberOpticCommunicationSystems–GovindP.Agarwal ,JohnWiley,3rdEdiition,2004.

III Year-I Semester	ELECTRONIC MEASUREMENTS AND INSTRUMENTATION (PE-I)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the various Analog and Digital measuring Instruments
- Aware of the principles and operations of various oscilloscopes
- Learn measurements using various bridges
- Familiarize different Signal Generators and function generators
- Learn various transducers and Intelligent sensors

UNIT I

Measuring Instruments: Introduction, Errors in Measurement, Accuracy, Precision, Resolution and Significant figures, Basic PMMC Meter- construction and working, DC and AC Voltmeters- Multirange, Range extension, DC Ammeter, Multimeter for Voltage, Current and resistance measurements.

Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V–T, V–F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multimeters, Digital frequency meters, Digital measurement of time.

UNIT II

Oscilloscopes: Introduction, Block diagram of CRO, Basic principle of CRT, CRT Construction and features, vertical amplifiers, horizontal deflection system- sweep, trigger pulse, delay line, sync selector circuits. Dual beam and dual trace CROs, Sampling and Digital storage oscilloscopes.

UNIT III

Bridges: DC Bridges for Measurement of resistance - Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wien Bridge, Errors and precautions in using bridges.

UNIT IV

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.

UNIT V

Transducers: Introduction, Types of Transducers, Electrical transducers, Selecting a transducer, Resistive transducer, Strain gauges, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Temperature transducers-RTD, LVDT.

Intelligent Sensors: definition of intelligent instrumentation, types of instruments, Classification, Smart sensors, Cogent Sensors, Soft or Virtual sensors, Self-Adaptive Sensors, Self-Validating Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor, Indirect Sensing. (**Text Book 3**)

TEXT BOOKS

1. H. S. Kalsi, "Electronic Instrumentation", Third edition, Tata McGraw Hill, 2010.

2. A. D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 6th Edition, 2010.

3. Manabendra Bhuyan, ―Intelligent Instrumentation: Principles and Applications CRC Press, 2011.

REFERENCE BOOKS

1. A.K. Sawhney, DhanpatRai& Co., "A course in Electrical and Electronic Measurements and Instrumentation", 9th Edition, 2010.
2. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2006.

III Year-I Semester	COMPUTER ORGANIZATION AND ARCHITECTURE (PE-1)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the representation of data, the register transfer language and Micro operations.
- Know the basic computer organization and design, programming the basic computer and design the micro programmer control unit.
- Know the development of central processing unit and explain various algorithms for computer arithmetic operations.
- Interface various Peripheral devices and various data transfer operations.

UNIT-1

Introduction: Digital Computers, Von Neumann computers, Basic organization of a computer.

Data Representation: Data types, Complements, Fixed-point representation, Conversion of fractions, Floating-point representation.

Register Transfer and Microoperations: Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

UNIT-2

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference instructions, Input-Output and Interrupt, Complete Computer Description, Design of Basic computer.

Programming the Basic Computer: Introduction, Machine Language, Assembly language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations.

UNIT-3

Central Processing Unit: Introduction, General Register Organization, Stack organization, Instruction Formats, Addressing Modes, Data transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-Point Arithmetic Operations, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

UNIT – 4

Input-Output organization : Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA), Input-Output Processor (IOP), Serial Communication.

UNIT– 5

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

- Study the memory Hierarchy and different types of memories.

Text Book

1. M.Morris Mano," Computer System Architecture," Pearson Publishers, Revised Third Edition

Reference Books

1. John P Hayes, "Computer Architecture and Organization,"Mc-Graw Hill Publishers, Third Edition
2. Carl Hamacher, "Computer Organization," Tata Mc-Graw Hill Publishers, Fifth Edition.

III Year-I Semester	ELECTRONIC DEVICES AND CIRCUITS (OE-1)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Apply the basic concepts of semiconductor physics.
- Understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation.
- Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
- Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
- Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

UNIT-I:

Review of Semi Conductor Physics: Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

Junction Diode Characteristics :energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics.

Rectifiers and Filters: Basic Rectifier setup**,** half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristicsμ, g_m, $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV: Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''),

Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.

III Year-I Semester	SIGNALS AND SYSTEMS (OE-1)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Differentiate the various classifications of signals and systems
- Analyze the frequency domain representation of signals using Fourier concepts
- Classify the systems based on their properties and determine the response of LTI Systems.
- Know the sampling process and various types of sampling techniques.
- Apply Laplace and z-transforms to analyze signals and Systems(continuous & discrete).

UNIT- I: INTRODUCTION: Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems, Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function.

UNIT–II: FOURIER SERIES AND FOURIER TRANSFORM:
Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Related problems

UNIT-III:
CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation.
SAMPLING THEOREM: Graphical and analytical proof or Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Aliasing, Related problems.

UNIT–IV:
LAPLACE TRANSFORMS: Introduction**,** Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

UNIT–V:

Z–TRANSFORMS: Concept of Z-Transform of a discrete sequence. Region of convergence in Z- Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms, Distinction between Laplace, Fourier and Z transforms.

TEXT BOOKS:

1. Signals, Systems & Communications-B.P.Lathi,BSPublications,2003.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab,PHI,2ndEdn,1997
3. Signals & Systems-SimonHaykinandVanVeen,Wiley,2ndEdition,2007

REFERENCE BOOKS:

1. PrinciplesofLinearSystemsandSignals– BPLathi,OxfordUniversityPress,2015
2. Signals and Systems–TK Rawat, Oxford University press,2011.

III Year-I Semester	PROBABILITY THEORY AND RANDOM VARIABLES (OE-1)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Mathematically model the random phenomena and solve simple probabilistic problems
- Identify different types of random variables and compute statistical averages of these random variables.
- Characterize the random processes in the time and frequency domains.
- Analyze the LTI systems with random inputs

UNIT I

THE RANDOM VARIABLE: Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

UNIT II

OPERATION ON ONE RANDOM VARIABLE - EXPECTATIONS: Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable: Monotonic Transformations for a Continuous Random Variable, Non-monotonic Transformations of Continuous Random Variable.

UNIT III

MULTIPLE RANDOM VARIABLES: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem: Unequal Distribution, Equal Distributions.

OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variables case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT IV

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, N^{th}-order and Strict -Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and its

Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT V

RANDOM PROCESSES - SPECTRAL CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

LINEAR SYSTEMS WITH RANDOM INPUTS: Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectra of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4th Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4th Edition, 2002.
3. Probability Theory and Stochastic Processes – B. PrabhakaraRao, BS Publications.

REFERENCE BOOKS:

1. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3rd Edition.
2. Schaum's Outline of Probability, Random Variables, and Random Processes.
3. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
4. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

III Year - I Semester	NETWORK ANALYSIS (OE-1)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Gain the knowledge on basic network elements.
- Will analyze the RLC circuit's behavior in detailed.
- Analyze the performance of periodic waveforms
- Gain the knowledge in characteristics of two port network parameters (Z,Y,ABCD,h& g).
- Analyze the filter design concepts in real world applications.

UNIT – I

Introduction to Electrical Circuits : Network elements classification, Electric charge and current, Electric energyand potential, Resistance parameter – series and parallel combination, Inductance parameter – series and parallel combination, Capacitance parameter – series and parallel combination. Energy sources: Ideal, Non-ideal, Independent and dependent sources, Source transformation, Kirchoff's laws, Mesh analysis and Nodal analysis problem solving with resistances only including dependent sources also.

Definitions of terms associated with periodic functions: Time period,Angular velocity and frequency, RMS value, Average value, Form factor and peak factor- problem solving, Phase angle, Phasor representation, Addition and subtraction of phasors, mathematical representation of sinusoidal quantities, explanation with relevant theory, problem solving. Principal of Duality with examples

Definitions of branch, node, tree, planar, non-planar graph, incidence matrix, basic tie set schedule, basic cut set schedule.

UNIT – II

Transients : First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DCexcitation, Evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Solutions using Laplace transform method.

UNIT – III

Steady State Analysis of A.C Circuits: Impedance concept, phase angle, series R-L, R-C, R-L-C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving.

Coupled Circuits : Coupled Circuits: Self inductance, Mutual inductance, Coefficient of coupling, analysis ofcoupled circuits, Natural current, Dot rule of coupled circuits, Conductively coupled equivalent circuits- problem solving.

UNIT – IVResonance: Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance,Condition for maximum impedance, current in anti resonance,

Bandwidth of parallel resonance, general case-resistance present in both branches, anti resonance at all frequencies.

Network Theorems: Thevinin's, Norton's, Milliman's, Reciprocity, Compensation, Substitution, Superposition,Max Power Transfer, Tellegens- problem solving using dependent sources also

UNIT – VTwo-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Inverse h-parameters, Inverse Transmission line parameters, Relationship between parameter sets, Parallel connection of two port networks, Cascading of two port networks, series connection of two port networks, problem solving including dependent sources also.

TEXT BOOKS:

1.Network Analysis – ME Van Valkenburg, Prentice Hall of India, 3rd Edition, 2000.
2. Network Analysis by K.Satya Prasad and S Sivanagaraju, Cengage Learning
3. Electric Circuit Analysis by Hayt and Kimmarle, TMH

REFERENCES:

1. Network lines and Fields by John. D. Ryder 2nd edition, Asia publishing house.
2. Basic Circuit Analysis by DR Cunninghan, Jaico Publishers.
3.Network Analysis and Filter Design by Chadha, Umesh Publications.

III Year-I Semester	ANALOG AND DIGITAL IC APPLICATIONS LAB	L	T	P	C
		0	0	3	1.5

PART-A: (Minimum **SIX** Experiments to be conducted):

1. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
2. Integrator and Differentiator Circuits using IC 741.
3. Active Filter Applications – LPF, HPF (first order)
4. Active Filter Applications – BPF, Band Reject (Wideband) and Notch Filters.
5. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
6. Function Generator using OP AMPs.
7. IC 555 Timer – Astable & Mono-stable Operation Circuit.
8. Schmitt Trigger Circuits – using IC 741 and IC 555.
9. IC 565 – PLL Applications.
10. IC 566 – VCO Applications.
11. 4 bit DAC using OP AMP.

Equipment required for Laboratories:
1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. IC Trainer Kits (Optional)
6. Bread Boards
7. Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 etc.
8. Analog IC Tester

PART-B: (Minimum **SIX** Experiments to be conducted):

The students are required to design and draw the internal structure of the following Digital Integrated Circuits and to develop HDL(VHDL, Verilog HDL) source code, perform simulation using relevant simulator and analyze the obtained simulation results using appropriate synthesizer. Further, it is required to verify the logic with necessary hardware.

List of Experiments:

1. Realization of Logic Gates
2. 3 to 8 Decoder- 74138
3. 8*1 Multiplexer-74151 and 2*1 De-multiplexer-74155
4. 4-Bit Comparator-7485.
5. D Flip-Flop- 7474
6. Decade Counter- 7490
7. Universal shift register-74194/195
8. RAM (16*4)-74189 (read and write operations)

Equipment Required:
1.Xilinix Vivado/Equivalent Standard IDE
2. Personal computer with necessary peripherals
3.Hardware kits- Various FPGA families.

IIIYear-ISemester	ANALOG AND DIGITAL COMMUNICATIONS LAB	L	T	P	C
		0	0	3	1.5

ListofExperiments:
(Fourteen experimentstobedone-**Thestudentshavetocalculatetherelevantparameters**)–
(a. Hardware, b. MATLAB Simulink c. MATLAB Communication toolbox)

Part-A
1. AmplitudeModulation-Modulation&Demodulation
2. AM-DSBSC-Modulation&Demodulation
3. DiodeDetector
4. Pre-emphasis&De-emphasis
5. FrequencyModulation-Modulation&Demodulation
6. VerificationofSamplingTheorem
7. PulseAmplitudeModulation&Demodulation
8. PWM,PPM–Modulation&Demodulation

Part-B
1. Timedivisionmultiplexing.
2. FrequencyDivisionMultiplexing
3. Pulsecodemodulation.
4. Differentialpulsecode modulation.
5. Deltamodulation.
6. Frequencyshiftkeying.
7. Phaseshift keying.
8. Differentialphaseshiftkeying.
9. Companding
10. SourceEncoderand Decoder
11. LinearBlockCode-Encoderand Decoder and BinaryCyclicCode–EncoderandDecoder
12. ConvolutionCode–Encoderand Decoder

Note: All the above experiments are to be executed/completed using hardware boards and also to be simulated on Mat lab.

Equipment&Softw
are required:
Software:
i) ComputerSystemswithlatestspecifications
ii) ConnectedinLAN(Optional)
iii) Operatingsystem(Windows/Linuxsoftware)
iv) Simulationssoftware(Simulink&MATLAB)

Equipment:
1. RPS -0 –30V
2. CRO -0–20MHz.

3. FunctionGenerators -0–1MHz
4. ComponentsandBreadboards
5. Multimetersandothermeters

III Year-I Semester	APPLICATIONS OF LAB VIEW FOR INSTRUMENTATION & COMMUNICATIONS	L	T	P	C
		0	1	2	2

Course Outcomes:

- Develop loops, case structures, arrays, and clusters.
- Realize real time applications using NI DAQ hardware
- Implement Coding techniques using LabVIEW
- Design automation and process control application
- Apply LabVIEW for data processing applications

Unit I:

Introduction to LabVIEW & Virtual Instrumentation: Overview of LabVIEW: Graphical programming paradigm, LabVIEW Environment: Front panel, block diagram, data flow programming, Creating simple Virtual Instruments (VIs), Debugging and troubleshooting techniques, Implementing loops, case structures, arrays, and clusters.

Unit II:

Data Acquisition & Signal Processing: Interfacing sensors (temperature, pressure, light, etc.) with LabVIEW, Real-time data acquisition using NI DAQ hardware, Signal generation: Sine, Square, Triangular waves, Fourier Transform (FFT) for frequency analysis, Filtering techniques: Low-pass, High-pass, Band-pass filters.

Unit III:

Communication System Implementation: AM and FM Modulation/Demodulation using LabVIEW, Simulation of Digital Modulation Schemes (ASK, PSK, FSK), Eye diagrams and constellation plots for digital signals, Error detection and correction: Parity, CRC, Hamming Code.

Unit IV: Instrumentation & Automation Applications:

Real-time data logging and file handling (Excel/CSV), PID Controller Design for automation and process control, Motor speed control using LabVIEW and DAQ, Signal visualization and user interface design.

Unit V: Advanced Applications:

Image Processing using LabVIEW, Wireless communication using Bluetooth & Wi-Fi in LabVIEW, IoT Integration-Cloud-based monitoring and remote data access, Project-based learning-

Textbooks & References

1. R. W. Larsen, LabVIEW for Engineers, 1st ed., Prentice Hall, 2011.
2. G. W. Johnson and R. Jennings, LabVIEW Graphical Programming, 4th ed., McGraw-Hill, 2017.
3. National Instruments, "LabVIEW Tutorials & Documentation," Available: https://www.ni.com.J. Jerome, Virtual Instrumentation Using LabVIEW, 1st ed., PHI Learning Pvt

III Year-I Semester	DESIGN OF PCB & ANTENNAS LAB	L	T	P	C
		0	0	2	1

Merits of PCB Machine:

1. CNC based for Better Accuracy and results.
2. Etching, Engraving and Drilling can be done with same Machine
3. Maintenance free machine compared to chemical method.
4. Compatible with multiple software Gerber / G code.
5. Reduction of time and Inventory.
6. Height mapping for bed level and depth sensing.
7. Surface mapping of bed
8. Power Optimized system ability to run on ups systems unlike other Machines.
9. High precision lead screw
10. 5umeter resolution, 0.001 repeatability, 2 layer with FR4
11. Scalability from a single prototype to a batch of 10-50 PCBs.

ANTENNAS LAB:

List of experiments: (Any Ten experiments using any simulation software)

1. Generation of EM-Wave
2. Impedance Matching using Smith Chart
3. Calculation of phase and group velocity calculation
4. Plot of Radiation pattern of dipole antenna
5. Plot of Radiation pattern of monopole antenna
6. Plot of Radiation pattern of Uniform Linear Array
7. Measurement of radiation pattern of all wired and aperture antennas
8. Measurement of radiation pattern of planar antennas
9. Measurement of radiation pattern of reflector antennas
10. Measurement of radiation pattern of array antennas
11. Analysis of co-polarization and cross polarization
12. Performance analysis of Yagi -Uda antenna
13. Performance analysis of Helix antenna

14. Radio wave propagation path loss calculations

III Year- II Semester	VLSI DESIGN	L	T	P	C
		3	0	0	3

Course Outcomes:

- Demonstrate a clear understanding of CMOS fabrication flow and technology scaling.
- Design MOSFET based logic circuit.
- Design basic building blocks in Analog IC design.
- Design various CMOS logic circuits for design of Combinational logic circuits.
- Analyze the behavior of static and dynamic logic circuits

UNIT-I:

INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS: VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology, MOS Layers, Stick Diagrams, Design Rules and Layout, Layout Diagrams for MOS circuits

UNIT-II:

BASIC CIRCUIT CONCEPTS: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers.

SCALING OF MOS CIRCUITS: Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density.

UNIT-III:

BASIC BUILDING BLOCKS OF ANALOG IC DESIGN: Regions of operation of MOSFET, Modelling of transistor, body bias effect, biasing styles, single stage amplifier with

resistive load, single stage amplifier with diode connected load, Common Source amplifier, Common Drain amplifier, Common Gate amplifier, current sources and sinks.

UNIT-IV:

CMOS COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUIT DESIGN:

Static CMOS Design: Complementary CMOS, Rationed Logic, Pass-Transistor Logic, design of Half adder, full adder, multiplexer, decoder.**Dynamic CMOS Design:** Dynamic Logic-Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates,–Design examples of sequential circuits: Cross coupled NAND and NOR flipflops, D flipflop, SR JK flip flop, SR Master Slave flip flop.

UNIT-V:

FPGA DESIGN: FPGA design flow, Basic FPGA architecture, FPGA Technologies, Introduction to FPGA Families.

INTRODUCTION TO ADVANCED TECHNOLOGIES: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology, FinFET, TFET.

TEXTBOOKS:

1. Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell
2. And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
3. Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 2003
4. Digital Integrated Circuits, Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, 2nd edition,2016.

REFERENCES:

1. “Introduction to VLSI Circuits and Systems”, John P. Uyemura, John Wiley & Sons, reprint 2009.
2. Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies Vinod Kumar Khanna, Springer India, 1st edition, 2016.
3. FinFETs and other multi-gate transistors, ColingeJP, Editor New York, Springer,2008.

		L	T	P	C
III Year - II Semester	**MICROPROCESSOR AND MICROCONTROLLERS**	**3**	**0**	**0**	**3**

- Understand the architecture of 8086 and its operation.
- Develop the students to compose the assembly language program for 8086.
- Applying 8086 processor to interface with necessary peripherals.
- Understand the architecture of 8051 and interfacing with necessary peripherals.
- Understand the introductory concepts of advanced processors, viz., ARM processors.

Course Outcomes:

Unit -I

Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, History and classifications of Microprocessor and Microcontroller.

8086 Architecture: register organization, internal architecture of 8086, pin description of 8086, minimum mode and maximum mode of 8086 operation and timing diagrams.

Unit -II

8086 Programming: instruction set, addressing modes, assembler directives, programming with an assembler, writing simple programs with an assembler, stack and stack structure, interrupts and interrupt service routines 8086 system,

Unit -III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

Unit -IV

Intel 8051 MICROCONTROLLER and Interfacing

Architecture, Hardware concepts, Input/output ports and circuits, external memory, counters/timers, serial data input/output, interrupts. Assembly language programming: Instructions, addressing modes, simple programs. Interfacing to 8051: A/D and D/A Convertors, Stepper motor interface, keyboard, LCD Interfacing, Traffic light control.

Unit -V

ARM Architectures and Processors:

Introduction to CISC and RISC architectures, ARM Architecture, ARM Processors Families,

ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, Instruction set summary, System address map, write buffer, bit-banding. Programmers Model – Modes of operation and execution, stack pointer, exceptions and interrupt handling.
ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller– functional description and NVIC programmers'model.

TEXTBOOKS:

1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011.
3. TheDefinitiveGuidetoARMCortex-M3andCortex-M4ProcessorsbyJosephYiu.,Newnes Third edition.

REFERENCEBOOKS:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm EducationMedia,2017.
2. Cortex-M3TechnicalReference Manual.

III Year - II Semester	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the concepts of discrete signals and discrete systems with its characteristics
- Calculate z-Transform, Fourier Transform, Discrete Fourier Transform of discrete signals.
- Understand the algorithms for the efficient computation of DFT coefficients of signals
- Design the FIR and IIR filters.
- Know the architectures of various DSP processors and its addressing modes, assembly language instructions.

UNIT-1:

Introduction: Signals, Systems, and Signal Processing, Classification of Signals, The Concept of Frequency in Continuous Time and Discrete Time Signals

Discrete Time Signals and Systems: Discrete Time Signals, Discrete Time Systems, Analysis of Discrete Time Linear Time Invariant Systems, Discrete Time Systems Described by Difference Equations, Implementation of Discrete Time Systems, Correlation of Discrete Time Signals.

Frequency Analysis of Signals: Frequency Analysis of Continuous Time Signals, Frequency Analysis of Discrete Time Signals, Frequency Domain and Time Domain Signal Properties, Properties of the Fourier Transform for Discrete Time Signals.**Frequency Domain Analysis of LTI Systems:**Frequency domain characteristics of LTI systems, Frequency response of LTI systems.

UNIT-2:

The z-Transform and Its Applications to the Analysis of LTI Systems: The z-Transform, Properties, Rational z Transforms, Inversion of the z-Transform, Analysis of Linear Time Invariant Systems in the z-Domain, The One sided z-Transform. (**Review only for entirez – Transform topic**).

The Discrete Fourier Transform: Its Properties and Applications: Frequency Domain Sampling: The Discrete Fourier Transform, Properties of the DFT, Linear Filtering Methods

Based on the DFT, Frequency Analysis of Signals Using DFT

UNIT-3:

Efficient Computation of the DFT: Fast Fourier Transform Algorithms: Direct Computation of the DFT, Radix-2 FFT Algorithms.

Implementation of Discrete Time Systems: Structures for the Realization of Discrete Time Systems, **Structures for FIR Systems**: Direct Form Structure, Cascade Form Structures, Frequency Sampling Structures.

Structures for IIR Systems: Discrete Form Structures, Signal Flow Graphs and Transposed Structures, Cascade Form Structures, Parallel Form Structures.

UNIT-4:

Design of Digital Filters: General Considerations: Causality and Its Implications, Characteristics of Practical Frequency Selective Filters.

Design of FIR Filters: Symmetric and Antisymmetric FIR Filters, Design of Linear Phase FIR Filters Using Windows, Design of Linear Phase FIR Filters by the Frequency Sampling Method.

Design of IIR Filters From Analog Filters: IIR Filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR Filter Design by the Bilinear Transformation.

Frequency Transformations: Frequency Transformations in the Analog Domain, Frequency Transformations in the Digital Domain.

UNIT-5:

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.

Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Auxiliary Register Compare Register, Block Move Address Register, Block Repeat Registers, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.TMS320C5X Assembly Language Instructions.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, DimitrisG.Manolakis, 4th Edition, Pearson Education, 2007.
2. Digital Signal Processors – Architecture, Programming and Applications,,B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.

Reference Books:

1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.
2. Digital Signal Processing-P. Ramesh Babu, 5th Edition, SCITECHPublishers.

III Year - II Semester	ANALOG IC DESIGN (PE-II)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the concepts of MOS Devices and Modeling.
- Design and analyze any Analog Circuits in real time applications.
- Extend the Analog Circuit Design to Different Applications in Real Time.
- Understand of Open-Loop Comparators and Different Types of Oscillators

UNIT -I:

MOS Devices and Modelling: The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modelling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT -II:

Analog CMOS Sub-Circuits:

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference**.**

UNIT -III: CMOS Amplifiers:

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures. CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT -IV:

Comparators: Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete- Time Comparators.

UNIT -V:

Oscillators & Phase-Locked Loops: General Considerations, Ring Oscillators, LC Oscillators, Voltage Controlled Oscillators. Simple PLL, Charge Pump PLLs, Non-Ideal

Effects in PLLs, Delay Locked Loops, Applications.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition,SecondEdition.
2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition,2010.

REFERENCES:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition,2010.
2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn,2013.

III Year - II Semester	SATELLITE COMMUNICATION (PE-II)	L	T	P	C
		3	0	0	3

Course Outcomes:

- Understand the concepts, applications and subsystems of Satellite communications.
- Derive the expression for G/T ratio and to solve some analytical problems on satellite link design.
- Understandthevarioustypesofmultipleaccesstechniquesandarchitectureofearthstationdesign
- Understand the concepts of GPS and its architecture.

UNIT I

INTRODUCTION: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.**ORBITAL MECHANICS AND LAUNCHERS:** Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

UNIT II

SATELLITE SUBSYSTEMS: Attitude and orbit control system, telemetry, tracking, Command and monitoring system, power systems, communication subsystems, Satellite antennas, Equipment reliability and Space qualification.

UNIT III

SATELLITE LINK DESIGN: Basic transmission theory, link equation, C/N ratio, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

UNIT IV

MULTIPLE ACCESS: Frequency division multiple access (FDMA): Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA); Frame structure, Examples. Code Division Multiple access (CDMA): Spread spectrum transmission and reception.

EARTH STATION TECHNOLOGY: Introduction, basic architecture, Transmitters, Receivers, Antennas, Tracking systems, Terrestrial interface, Primary power test methods.

UNIT V

LOW EARTH ORBIT AND GEO-STATIONARY SATELLITE SYSTEMS: Orbit consideration, coverage and frequency considerations, Delay & Throughput considerations, System considerations, Operational NGSO constellation Designs**GLOBAL NAVIGATION SATELLITE SYSTEM(GNSS):**

Introduction, various GNSS: GPS, GLONASS, GALILEO, BeiDou, QZSS, IRNSS. GPS-location principle, GPS navigation message, GPS receiver operation, differential GPS; IRNSS-introduction, IRNSS satellites, IRNSS constellation, IRNSS configuration, IRNSS services, navigation data, applications of IRNSS; multi GNSS.

TEXT BOOKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 3RD Edition, 2020.
2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCES:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004
4. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

III Year - II Semester		L	T	P	C
		3	0	0	3
SMART AND WIRELESS INSTRUMENTATION (PE-II)					

Course Outcomes:

- Analyze Smart and Wireless Instrumentation with respect to various performance parameters.
- Design and develop Applications using WSN (Wireless sensor Network).
- Demonstration of various Node architectures.
- Demonstration of Fundamentals of wireless digital communication
- Analyze the power sources, Demonstrate an ability to design strategies as per needs and specifications

UNIT – 1: Introduction:
Smart Instrumentation(Materials, automation systems, ensign and Sensors, Sensor Classifications, Wireless Sensor Networks, History of Wireless Sensor networks (WSN), Communication in a WSN, important design constraints of a WSN like Energy, Self Management, Wireless Networking, Decentralized Management, Design Constraints, Security etc.

UNIT – 2: Node architecture: The sensing subsystem, Analog to Digital converter, the processor subsystem, architectural overview, microcontroller, digital signal processor, application specific integrated circuit, field programmable gate array (FPGA), comparison, communication interfaces, serial peripheral interface, inter integrated circuit, the IMote node architecture, The XYZ node architecture, the Hog throb node architecture.

UNIT – 3: Fundamentals of Wireless Digital Communication: Basic components, source encoding, the efficiency of a source encoder, pulse code modulation and delta modulation, channel encoding, types of channels, information transmission over a channel, error recognition and correction, modulation, modulation types, quadratic amplitude modulation, signal propagation.

UNIT – 4: Frequency of Wireless Communication: Development of Wireless Sensor Network based on Microcontroller and communication device-Zigbee Communication device. Power sources- Energy Harvesting Solar and Lead acid batteries-RF Energy /Harvesting-Energy Harvesting from vibration Thermal Energy Harvesting-Energy Management Techniques Calculation for Battery Selection.

UNIT – 5: Applications:
Structural health monitoring - sensing seismic events, single damage detection using natural frequencies, multiple damage detection using natural frequencies, multiple damage detection using mode shapes, coherence, piezoelectric effect, traffic control, health care - available sensors, pipeline monitoring, precision agriculture, active volcano, underground mining.

Text Books:

1. Fundamentals of wireless sensor networks : theory and practice - WaltenegusDargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.
2. Smart Sensors, Measurement and Instrumentation ,Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013.
3. Wireless Sensors and Instruments: Networks, Design and Applications, HalitEren, CRC Press, Taylor and Francis Group, 2006.

Reference Books:

1. UvaisQidwai, Smart Instrumentation: A data flow approach to Interfacing“, Chapman & Hall; 1st Edn, December 2013.
2. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr. and Ed gar H. Callaway.

III Year - II Semester		L	T	P	C
		3	0	0	3
MACHINE LEARNING (PE-II)					

Course Outcomes:

- Define machine learning and its different types and understand their applications.
- Explain the various techniques involved in pre-processing of data for Data Analysis
- Apply various supervised learning algorithms including decision trees and k-nearest neighbours (k-NN) etc.
- Implement unsupervised learning techniques, viz., K-means clustering etc.
- Learn about various performance metrics and explore them in various applications of implementing Machine learning Algorithms.

UNIT-I: Introduction to Machine Learning:

What is Machine Learning?, Traditional programming approach vs Machine learning approach, History and Evolution of Machine Learning, Learning by Rote vs Learning by Induction, **Paradigms for ML** - Supervised ML, Unsupervised ML, Reinforcement ML, **Datatypes in ML** - Quantitative data (Continuous, Discrete), Qualitative data (Structured, Semi structured, Unstructured), Nominal data, Ordinal data, Interval data, Ratio data, Stages involved in Machine Learning, Main challenges of ML, Applications of Machine Learning, **IDE's for ML Programming** - Jupyter Notebook, Spyder, PyCharm, Google Colab, R Studio, VS Code, **Basic packages to deal with ML** - Numpy, Scipy, Pandas, Scikit-learn, Matplotlib, Seaborn, **Programming Languages for Machine Learning** - Python, Java, R, JavaScript, C++

UNIT - II: Explorative Data Analysis (EDA):

What is EDA? Why EDA is important?, **Types of EDA** - Univariate Analysis, Bivariate Analysis, Multivariate Analysis, **Data Cleaning** - Data Acquisition,Analyzing the data Dealing with duplicate data, Dealing with missing values, Dealing with outliers **Scaling and Transformations** - Feature Scaling and Transformation, Univariate nonlinear Transformations, **Dimensionality Reduction** - Principal Component Analysis (PCA), **Feature Engineering** - Handling Categorical attributes (One-Hot-Encoding), **Feature Expansion** - Interactions and Polynomials, **Automatic Feature Selection** - Univariate Statistics, Model-Based Feature Selection, Iterative Feature Selection

UNIT-III: Supervised Machine Learning:

What is Supervised Machine Learning?, General architecture of Supervised ML, **Types of Supervised ML** - Classification and Regression, **Different Classification Algorithms** - K-Nearest Neighbor (KNN) Classifier, Linear Models, Logistic Regression, Naive Bayes Classifiers, Decision Tree Classifier, **Ensemble learning and Decision Trees** - Voting, Bagging and pasting, Random Forests, AdaBoost, Gradient Boosting, Stacking, Support

Vector Classifier (SVC)Neural Networks, **Different Regression Algorithms** - K-Neighbors Regressor, Linear Regression, Ridge Regression, Lasso Regression, Polynomial Regression, Support Vector Regressor (SVR), Decision Tree Regressor, Random Forest Regressor

UNIT-IV: Unsupervised Machine Learning –

What is Unsupervised Machine Learning?, General architecture of Unsupervised Machine Learning, Challenges in Unsupervised ML, **Clustering** - Introduction to Clustering, Soft clustering vs Hard Clustering, K-Means Clustering algorithm, Centroid-based clustering algorithm, Divisive Clustering and Agglomerative Clustering, DBSCAN

UNIT V- Model Evaluation metrics, Fine tuning the model and Visualizations - **Evaluation Metrics for Classification** - Confusion Matrices, Accuracy, Precision, Recall, F1-Score, Precision-recall curves, ROC (Receiver Operating Characteristics) curves, Confusion Matrix, **Evaluation Metrics for Regression** - R^2, Mean Squared Error (MSE), Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), **Evaluation Metrics for clustering** - Adjusted Random Index (ARI), Normalized Mutual Information (NMI), **Cross Validation** - Cross-Validation in scikit-learn, benefits of cross-validation, stratified k-fold cross validation, **Grid Search**- Simple Grid search, Grid search with cross validation, Randomized search, **Visualization** - Univariate Analysis (Bar plot, Box plot, Count plot, Density plot, Histogram, Pieplot), Bivariate Analysis (Pair plot, Scatter plot, Bar plot, Stacked barplot, Multivariate Analysis (Heat Maps)

Text Books:

1. "Introduction to Machine Learning with Python", Andreas C.Muller&Sarah Guido, O'Reilly Publications
2. "Hands-on Machine Learning with Scikit-Learn, Keras& TensorFlow", Aurelien Geron, O'Reilly Publications
3. "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

Reference Books:

1. "Machine Learning", Tom M. Mitchell, McGraw-Hill Publication, 2017
2. "Machine Learning in Action",Peter Harrington, DreamTech
3. "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7th Edition, 2019.

III Year - II Semester		L	T	P	C
		3	0	0	3
BIO-MEDICAL INSTRUMENTATION (PE-III)					

Course Outcomes:

- Demonstrate a foundational understanding of the anatomy and physiology of the human body.
- Apply knowledge of different techniques used for measuring various physiological parameters.
- Explain modern imaging techniques employed in medical diagnosis and identify the diverse therapeutic equipment utilized in the biomedical field.
- Understandand applybio-telemetry principles for transmitting bioelectrical variables.
- Analyze patient safety measures and evaluate recent advancements in the medical field.

UNIT – 1:Introduction: Factors to be considered in the design of medical instrumentation systems,Basic objectives of medical instrumentation system,Physiological systems of human body,Sources of Bioelectric potentials: Resisting and Action Potentials, Propagationof Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio PotentialElectrodes, Biochemical Transducers, Introduction to bio-medical signals.

UNIT – 2: The Cardiovascular System: The Heart and Cardiovascular System, The Heart, Blood Pressure,Characteristics of Blood Flow, Heart Sounds, Cardio Vascular Measurements,Electrocardiography, Measurement of Blood Pressure, Measurement of Blood Flow and Cardiacoutput, Plethysmography, Measurement of Heart Sounds, Event detection, PQRS & T-Waves inECG, the first & second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotidpulse detection of events and waves, analysis of exercise ECG, analysis of event relatedpotentials, correlation analysis of EEG channels, correlation of muscular contraction.

UNIT – 3: Patient Care & Monitory and Measurements in Respiratory System: The elements ofIntensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoringequipment, other instrumentation for monitoring patients, pace makers, defibrillators, thephysiology of respiratory system, tests and instrumentation for mechanics of breathing,respiratory theory equipment, analysis of respiration.

UNIT – 4: Bio telemetry and Instrumentation for the Clinical Laboratory, Introduction to bio telemetry,Physiological parameters adaptable to bio telemetry, the components of bio telemetry system,implantable units, applications of telemetry in patient care – The blood, tests on blood cells,chemical test, automation of chemical tests.

UNIT – 5: X-ray and radioisotope instrumentation and electrical safety of medical equipment: Generation of Ionizing radiation, instrumentation for diagnostic X-rays, special techniques,instrumentation for the medical use of radioisotopes, radiation therapy - Physiological effects ofelectrical current, shock Hazards from electrical equipment, Methods of accident prevention,Modern Imaging Systems: Tomography, Magnetic Resonance Imaging System, UltrasonicImagingSystem, Medical Thermography.

Text Books:

1. Biomedical Instrumentation and Measurements C.Cromwell,F.J.Weibell,E.A.Pfeiffer – Pearson education.
2. Biomedical Signal Analysis – Rangaraj, M. Rangayya – Wiley Inter Science – JohnWilley & Sons Inc.

Reference Books:

1. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, TMH.
2. Introduction to Bio-Medical Engineering – Domach, Pearson.
3. Introduction to Bio-Medical Equipment Technology – Cart, Pearson.

III Year - II Semester		L	T	P	C
		3	0	0	3
MICROWAVE ENGINEERING (PE-III)					

Course Outcomes:

- Design different mode sin waveguide structures
- Calculate S-matrix for various waveguide components and splitting the microwave energy in a desired direction
- Distinguish between Microwave tubes and Solid State Devices, calculation of efficiency of devices.
- Measure various microwave parameters using a Micro wave test bench

UNIT-I

MICROWAVE TRANSMISSION LINES: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations; Power Transmission and Power Losses in Rectangular Guide. Related Problems.MICROSTRIP LINES– Introduction, Zo Relations, Effective Dielectric Constant, Losses, Q factor

UNIT II

MICROWAVE TUBES : Limitations and Losses of conventional tubes at microwave frequencies. Microwave tubes – O type and M type classifications. O-type tubes : 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for o/p Power and Efficiency. Reflex Klystrons – Structure, Applegate Diagram and Principle of working, Mathematical Theory of Bunching, Power Output, Efficiency, Electronic Admittance; Oscillating Modes and o/p Characteristics, Electronic and Mechanical Tuning.Applications.

UNIT-III

HELIX TWTS: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Nature of the four Propagation Constants, Gain Considerations(qualitative treatment).**M-type Tubes**

Introduction, Cross-field effects, Magnetrons – Different Types, 8-Cavity Cylindrical Travelling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics.

UNIT-IV

WAVEGUIDE COMPONENTS AND APPLICATIONS : Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide irises, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Resistive Card, Rotary Vane types; Waveguide Phase Shifters – Dielectric, Rotary Vane types, Scattering Matrix– Significance, Formulation and Properties, S-Matrix Calculations for – 2,3,4 port Junctions: E-plane and H-plane Tees, Magic Tee, Hybrid Ring; Directional Couplers – 2Hole, Bethe Hole types,S-

Matrix Calculations Ferrite Components– Faraday Rotation, Gyrator, Isolator, Circulator, Related Problems.

UNIT-V

MICROWAVE SOLID STATE DEVICES: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, RWH Theory, Characteristics, Basic Modes of Operation, Oscillation Modes

MICROWAVE MEASUREMENTS: Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method. Measurement of Attenuation, Frequency, Q- factor, Phase shift, VSWR, Impedance Measurement

TEXT BOOKS:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw Hill Education, 3rd Edition.

REFERENCES:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.
2. Microwave Engineering – G S N Raju , I K International
3. Microwave and Radar Engineering-M.Kulkarni, Umesh Publications, 3rd Edition

III Year - II Semester		L	T	P	C
		3	0	0	3
EMBEDDED SYSTEMS (PE-III)					

Course Outcomes:

- Know basics of embeddedsystem,classification,memories,different communication interface and what embedded firmware is and its role in embedded system, different system components.
- Distinguish all communication devices in embedded system, other peripheral device.
- DistinguishconceptsofCversusembeddedCandcompilerversuscross-compiler.
- Choose an operating system, and learn how to choosean RTOS

Unit-I:

Introduction: EmbeddedSystem-Definition,History,Classification,applicationareasandpurpose of embedded systems, The typical embedded system-Core of the embedded system,Memory,SensorsandActuators,CommunicationInterface,Embeddedfirmware,PCBand passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements ofembeddedsystem, hardwareand softwarepartitions.

Unit-II:

EmbeddedHardwareDesign: Analoganddigitalelectroniccomponents,I/Otypesandexamples, Serial communication devices, Parallel device ports, Wireless devices, Timer andcountingdevices, Watchdogtimer, Real timeclock.

Unit-III:

Embedded Firmware Design: Embedded Firmware design approaches, Embedded Firmwaredevelopment languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and CompilerversusCross-compiler.

Unit-IV:

Real Time Operating System: Operating system basics, Types of operating systems, Tasks,Process and Threads, Multiprocessing and Multitasking, Threads, Processes and Scheduling,Task Scheduling, Communication, Synchronization, Device Drivers, How to choose an RTOS.ElectronicsandCommunication Engineering

HardwareSoftwareCo-Design: FundamentalIssuesinHardwareSoftwareCo-Design,Computationalmodelsinembeddeddesign,HardwaresoftwareTrade-offs,IntegrationofHardwareand Firmware,ICE.

Unit-V:

EmbeddedSystemDevelopment: The integrated development environment, Types of filesgeneratedoncross-compilation, Dissembler/De-

compiler,Simulators,EmulatorsandDebugging,Targethardwaredebugging,BoundaryScan,EmbeddedSoftwaredevelopmentprocessand tools.

Embedded System Implementation And Testing: The main software utility tool, CAD and thehardware,Translationtools-Pre-processors,Interpreters,CompilersandLinkers,Debuggingtools,Qualityassuranceandtestingofthedesign,Testingonhostmachine,Simulators,LaboratoryTools. Test andevolution of anembedded systems(Build inselftest etc).

Casestudy-typicalembedded systemdesignflow withanexample.

TextBooks:

1. EmbeddedSystems ArchitectureByTammyNoergaard,Elsevier Publications,2005
2. EmbeddedSystemDesign, FrankVahid,TonyGivargis,John WileyPublications.

References:

1. Embeddingsystembuildingblocks ByLabrosse,CMP publishers.

III Year - II Semester		L	T	P	C
		3	0	0	3
ARTIFICIAL INTELLIGENCE (PE-III)					

Course Outcomes:

- Understand the concepts of computational intelligence like machine learning
- Ability to get the skill to apply machine learning techniques to address the real time Problems in different areas
- Understand the Neural Networks and its usage in machine learning application.
- Apply principles and algorithms evaluate models generated from data
- Apply the algorithms to a real world problems

UNIT-1

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System, Characteristics And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

UNIT-2

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

UNIT-3

Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays' Theorem, Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory

UNIT-4

Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

UNIT-5

Game Playing: Overview, And Example Domain: Overview, Mini Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI

Text Books:

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.

2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

III Year - II Semester		L	T	P	C
		3	0	0	3
LINEARANDDIGITALICAPPLICATIONS (OE-II)					

Course Outcomes:

- Analyze and design various configurations of operational amplifiers, and applications such as instrumentation amplifiers, voltage regulators, comparators, and waveform generators.
- Design and implement active filters and waveform generators using op-amps, IC-555, and IC-565, and evaluate their performance for signal processing applications
- Compare different data conversion techniques (DAC and ADC) and implement digital-to-analog and analog-to-digital conversion circuits in real-time applications.
- Apply combinational logic ICs such as multiplexers, de-multiplexers, encoders, decoders, and arithmetic circuits to solve complex digital design problems.
- Develop sequential circuits using flip-flops, counters, and shift registers, and analyze their use in digital memory systems, including ROM, RAM, and their variants

UNIT–I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Modes of Operation-Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-II

Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Bandpass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer-Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL-Block Schematic, principle and Applications.

UNIT-III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT-IV

Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, LED & LCD Decoders with Drivers, Encoders, Priority

Encoders, Multiplexers, De-multiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT-V

Sequential Logic IC's and Memories: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

TEXTBOOKS:

1. RamakanthA.Gayakwad-Op-Amps&LinearICs,PHI,2003.
2. FloydandJain-DigitalFundamentals,8th Ed.,PearsonEducation,2005.

REFERENCEBOOKS:

1. D.RoyChowdhury– LinearIntegratedCircuits,NewAgeInternational(p)Ltd,2nd Ed.,2003.
2. John.F.Wakerly–DigitalDesignPrinciplesandPractices,3rd Ed.,Pearson,,2009.
3. Salivahana-LinearIntegratedCircuitsandApplications,TMH,2008.
4. WilliamD.Stanley- OperationalAmplifierswithLinearIntegratedCircuits,4th Ed.,Pearson Education India, 2009

III Year - II Semester		L	T	P	C
		3	0	0	3

PRINCIPLES OF COMMUNICATIONS

(OE-2)

Course Outcomes:

- Analyze the performance of analog modulation schemes in time and frequency domains.
- Analyze the performance of angle modulated signals.
- Characterize analog signals in time domain as random processes and noise
- Characterize the influence of channel on analog modulated signals
- Determine the performance of analog communication systems in terms of SNR
- Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems.

UNIT1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index.

UNIT2 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver,Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT 3 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT 4 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,**Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT 5: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

TEXTBOOKS:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc

2. Fundamentals of Wireless Communication by David Tse

III Year - II Semester		L	T	P	C
		3	0	0	3

PRINCIPLESOFSIGNALPROCESSING
(OE-2)

1.

Course Outcomes:

- Acquire the knowledge in signals and systems.
- Get familiarized with various transforms to analyze continuous time signals.
- Understand sampling theorem and z-transform.
- Get familiarized with the transforms of discrete time signals.
- Design the digital filter design

Unit- I: Introduction:

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, Amplitude - scaling. Problems on classification and characteristics of Signals and Systems.Complex exponential and sinusoidal signals, impulse Function, step function, signum function and ramp function. Introduction, Linear system, impulse response, Linear time invariant (LTI) system, Linear time invariant(LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems.

Unit-II: Analysis of continuous time signals

Fourier Series and Fourier Transform:

Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series,. Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, Related problems.

Laplace Transforms:

Introduction, Concept of region of convergence (ROC) for Laplace transforms, Properties of L.T's, Inverse Laplace transform, Relation between Laplace Transform and Fourier Transform of a signal.

Unit III:

Sampling Theorem: Graphical and analytical proof or Band Limited Signals, impulse sampling, Reconstruction of signal from its samples, Aliasing

Z–Transforms: Concept of Z-Transform of a discrete sequence. Region of convergence in Z-Transform, Inverse Z-transform, properties of Z-transforms

Unit IV:

Fourier Transforms of discrete signal: Fourier Transform of Discrete Signal, Properties, and Inverse Fourier Transforms, related problems

Discrete Fourier Transforms: Definition, Properties, Inverse DFT, related problems.

Fast Fourier Transform: Decimation in Time domain and Decimation in Frequency Algorithms.

Unit V:

Digital Filters:**Structures of IIR filters and FIR filters**:Director form–1 and Direct form 2; cascade form; parallel form**Analog filter design** LPF, BPF, HPF and BEF filter design using Butterworth **Frequency Transformations:** Analog to Analog; Digital and Digital**IIR Filter Design:** IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation.**FIR Filter Design:** Filter design using windowing techniques.Rectangular Window, Hamming Window, Hanning Window

Text Books:

1. Signals, Systems & Communications - B. P. Lathi, BS Publications, 2003.
2. Digital Signal Processing - P. Ramesh Babu, 5th Edition, SCITECH Publishers.

Reference Books:

1. Signals & Systems – Simon Haykin and VanVeen, Wiley, 2nd Edition, 2007.
2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2ndEdn, 1997.
3. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.

III Year - II Semester		L	T	P	C
		3	0	0	3

MICROPROCESSORS&MICROCONTROLLERS
(OE-2)

Course Outcomes:

- Understand the architecture of 8086 and its operation.
- Develop the students to compose the assembly language program for 8086.
- Applying 8086 processor to interface with necessary peripherals.
- Understand the architecture of 8051 and interfacing with necessary peripherals.
- Understand the introductory concepts of advanced processors, viz., ARM processors.

UNIT-1:

Introduction: Microprocessor based system, Origin of microprocessors, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit.

8086 Architecture: internal architecture of 8086 microprocessor, register organization, physical memory organization, general bus operation.

UNIT-2:

8086 Programming: instruction set, addressing modes, assembler directives, programming with assembler, writing simple programs with an assembler, stack and stack structure, interrupts and interrupt service routines, interrupt cycle of 8086.

UNIT-3:

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, Intel 8251 USART architecture and interfacing, stepper motor, A/D and D/A converters

UNIT-4:

Intel 8051 MICROCONTROLLER and Interfacing

Introduction to microcontrollers, internal architecture of 8051 microcontroller, I/O ports and memory organization, MCS51 addressing modes and instruction set, assembly language programming, simple programs, counters/timers, serial data input/output, interrupts. Interfacing to 8051: A/D and D/A Convertors, keyboard, LCD Interfacing.

UNIT-5:

ARM Architectures and Processors: introduction to CISC and RISC architectures, ARM Architecture, ARM Processors Families, Introduction to 16/32 bit processors, ARM7 architecture and organization, Thumb instructions, ARM Cortex-M3 Processor Functional Description.

TEXTBOOKS:

1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e
2. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011.
3. Microprocessors and Microcontrollers by N. Senthil Kumar, M. Saravanan and S. Jeevanathan Oxford higher education

REFERENCEBOOKS:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm

2. EducationMedia,2017.
3. Cortex-M3TechnicalReference Manual.
4. TheDefinitiveGuidetoARMCortex-M3andCortex-M4ProcessorsbyJosephYiu.,Newnes Third edition

III Year-II Semester		L	T	P	C
		0	0	3	1.5
VLSI DESIGN LAB					

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using CMOS 130nm Technology with necessary EDA tools (Mentor Graphics/Tanner)

List of Experiments:

1. Design and implementation of an inverter
2. Design and implementation of universal gates
3. Design and implementation of full adder
4. Design and implementation of full subtractor
5. Design and implementation of RS-latch
6. Design and implementation of D-latch
7. Design and implementation asynchronous counter
8. Design and Implementation of static RAM cell
9. Design and Implementation of differential amplifier
10. Design and Implementation of ring oscillator

Equipment Required:

1. Mentor Graphics/Tanner software-latest version
2. Personal computer with necessary peripherals.

III Year-II Semester		L	T	P	C
		0	0	3	1.5
MICROPROCESSOR AND MICROCONTROLLERS LAB					

List of Experiments:

PART- A: (Minimum of 5 Experiments has to be performed) 8086 Assembly Language Programming and Interfacing

1. Programs for 16 -bit arithmetic operations (using Various Addressing Modes).
   a. Addition and subtraction of n-BCD numbers.
   b. Multiplication and Division operations.
   c. Addition of an array of numbers with overflow detection.
2. Program for sorting an array.
3. Program for Factorial of given n-numbers.
4. Interfacing ADC to8086
5. Interfacing DAC to8086.
6. Interfacing stepper motor to8086.
7. Interfacing Seven-Segment display to 8086
8. Keyboard interface with 8086

PART-B: (Minimum of 5 Experiments has to be performed) 8051 Assembly Language Programming and Interfacing

1. Finding number of 1's and number of 0's in a given 8-bit number
2. Average of n-numbers.
3. Program and verify Timer/ Counter in8051.
4. Interfacing Traffic Light Controller to8051.
5. UART operation in8051
6. Interfacing LCD to8051.
7. Interfacing temperature sensor (LM 35) with 8051
8. Stepper motor control with 8051

PART-C (Minimum of 2 Experiments has to be performed) Conduct the following experiments using ARM CORTEX M3 PROCESSOR USING KEIL MDK ARM

1. Write an assembly program to multiply of 2 16-bit binary numbers.
2. Write an assembly program to find the sum of first 10 integers numbers.
3. Write a program to toggle LED every second using timer interrupt.
4. PWM signal generation
5. Analog signal measurement (ADC)
6. Interfacing with serial communication (UART)

Equipment Required:

1. Regulated Power supplies
2. Analog/Digital Storage Oscilloscopes
3. 8086 Microprocessor kits
4. 8051 microcontroller kits
5. ADC module, DAC module
6. Stepper motor module

7. Key board module
8. LED, 7-SegemtUnits, LCD display modules
9. Temperature sensor module
10. Digital Multimeters

11. ROM/RAM Interface module
12. Bread Board etc.
13. ARM CORTEX M3
14. KEIL MDKARM, Digital Multi-meters

III Year-II Semester		L	T	P	C
		0	1	2	2
MACHINE LEARNING LAB					

Course Outcomes:

- Understand the need for simulation/implementation for the verification of mathematical functions
- Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.
- Implement simple mathematical functions/equations in numerical computing environment such as SCILAB
- Interpret and visualize simple mathematical functions and operations thereon using plots/display
- Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools&Develop graphs by running Scilab programs

UNIT-1:

The Fundamentals of Machine Learning,Learning from experience,Machine learning tasks,Training data and test data,Performance measures, bias, and variance,An introduction to scikit-learn ,Installing scikit-learn **,Installing scikit-learn on Windows,Installing scikit-learn on Linux ,Installing scikit-learn on OS X,Verifying the installation,**Installing pandas and matplotlib

Linear Regression:Simple linear regression,**Evaluating the fitness of a model with a cost function ,Solving ordinary least squares for simple linear regression,**Evaluating the model,Multiple linear regression,Polynomialregression,Regularization,Applying linear regression,**Exploring the data,Fitting and evaluating the model,**Fitting models with gradient descent

UNIT-2:

Extracting features from categorical variables,Extracting features from text,The bag-of-words representation,Stop-word filtering, Stemming and lemmatization,Extending bag-of-words with TF-IDF weights,Space-efficient feature vectorizing with the hashing trick,Extracting features from images,Extracting features from pixel intensities,Extracting points of interest as features ,SIFT and SURF,Data standardization

Binary classification with logistic regression,Spamfiltering,Binary classification performance metrics,Accuracy,Precision and recall ,Calculating the F1 measure,ROCAUC,Tuning models with grid search,Multi-class classification,Multi-class classification performance metrics,Multi-label classification and problem transformation**,**Multi-label classification performance metrics

UNIT-3:

Decision trees ,Training decision trees,Selecting the questions,Informationgain,Giniimpurity,Decision trees with scikit-learn,Treeensembles,The advantages and disadvantages of decision trees

Clustering with the K-Means algorithm,Localoptima,The elbow method,Evaluatingclusters,Imagequantization,Clustering to learn features

UNIT-4:

An overview of PCA ,Performing Principal Component Analysis,Variance, Covariance, and Covariance Matrices,Eigenvectors and eigenvalues,Dimensionality reduction with Principal Component Analysis ,Using PCA to visualize high-dimensional data,Face recognition with PCA

UNIT-5:

Kernels and the kernel trick,Maximum margin classification and support vectors,Classifying characters in scikit-learn,Classifying handwritten digits,Classifying characters in natural images

Nonlinear decision boundaries,Feedforward and feedback artificial neural networks,Multilayerperceptron,Minimizing the cost function,Forwardpropagation,Backpropagation,Approximating XOR with Multilayer perceptron,Classifying handwritten digits

TEXT BOOKS

1. Mastering Machine Learning with scikit-learn, Gavin Hackeling,Packt Publishing

REFERENCE BOOKS

1. Hands-On Machine Learning with Scikit-Learn and TensorFlow, Aurélien Géron

III Year-II Semester		L	T	P	C
		2	0	0	0
RESEARCH METHODOLOGY AND IPR					

Course Outcomes:

- Understand research problem formulation.
- Analyze research related information, Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research

work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit 1 :
Meaningof research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2:
Effective literature studies approaches, analysis Plagiarism , Research ethics,Effective technical writing, how to write report, PaperDeveloping a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 3:
Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

Unit 4:
Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.

Unit 5:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems,Computer Software etc, Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science&engineeringstudents’”.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

REFERENCE BOOKS

1. RanjitKumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd,2007.
3. Mayall , “Industrial Design”, McGraw Hill,1992.