III YEAR
I SEMESTER

ANALOG & DIGITAL IC APPLICATIONS

Subject Code : UGEC5T0123	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisite :

- Basic Electrical and Electronics Engineering
- Network Analysis
- Electronic Devices and Circuits
- Switching Theory and Logic Design
- Electronic Circuit Analysis

Course Objectives

This course aims to provide a comprehensive understanding of analog and digital integrated circuits and their practical applications. It covers the operational principles, characteristics, and configurations of operational amplifiers, as well as waveform generation, filtering, and voltage regulation techniques. The course also introduces data converters (DACs and ADCs), combinational and sequential logic ICs, and memory devices, and enabling students to design and implement basic electronic systems using standard ICs.

Course Outcomes

CO 1. Apply the fundamental principles and characteristics of operational amplifiers to design and analyze various analog integrated circuit (IC) applications.

CO 2. Apply the concepts of Op-Amps, IC 555, and IC 565 to design and analyze active filters Waveform generators, multivibrators, and phase-locked loop applications.

CO 3. Analyze the architecture and performance of various DAC and ADC techniques for digital-to-analog and analog-to-digital conversions.

CO 4. Analyze the principles of combinational logic to design and implement digital circuits using standard logic ICs for encoding, decoding, data selection, and arithmetic operations.

CO 5. Analyze the concepts of sequential logic and memory organization to design and implement counters, shift registers, and memory-based digital systems using standard logic ICs.

Syllabus

UNIT–I **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

Op-Amp, IC-555 & IC565 Applications: Introduction to Active Filters, Characteristics of Band pass, 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 **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

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.

Mapping of COs to POs

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3										
CO2	3	3	3										
CO3	3	3	3										
CO4	3	3	3	3								3	
CO5	3	3	3	3								3	

TEXT BOOKS

T1. Ramakanth A. Gayakwad – Op – Amps & Linear ICs, PHI, 2003.

T2. Floydand Jain - DigitalFundamentals, 8th Ed., Pearson Education,2005.

REFERENCE BOOKS:

R1. D.Roy Chowdhury–Linear Integrated Circuits, New Age International(p) Ltd,2nd Ed.,2003.

R2. John.F.Wakerly–Digital Design Principles and Practices, 3rd Ed., Pearson,, 2009.

R3. Salivahana-Linear Integrated Circuits and Applications,TMH,2008.

R4. WilliamD.Stanley-Operational Amplifiers with Linear Integrated Circuits, 4th Ed., Pearson Education India, 2009

DIGITAL COMMUNICATIONS

Subject Code : UGEC5T0223	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisite :

- Probability Theory and stochastic Processes
- Analog Communication

Course Objectives: The objectives of this course are

- To introduce the fundamental concepts and techniques associated with the Digital Communication systems.
- To familiarize with concepts of Digital Modulation techniques and probability of errors associated with the digital transmission

Course Outcomes: Upon completion of the course, students will be able to:

CO 1. Analyze the elements and functioning of various digital modulation techniques

CO 2. Evaluate error probabilities and receiver performance using matched filter concepts

CO 3. Design and analyze linear block codes and convolution codes to detect and correct errors in digital communication systems.

CO 4. To compute and analyze convolution codes and Turbo codes.

Syllabus

UNIT I **[10 Hrs + 6 Hrs SL]**

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, noise in PCM and DM systems, Time division multiplexing, Frequency division multiplexing.

UNIT II **[8 Hrs + 6 Hrs SL]**

DIGITAL MODULATION TECHNIQUES: Introduction, ASK, FSK, PSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, FSK, similarity of BFSK and BPSK.

UNIT III **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

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, Algebraic structure, encoding, syndrome calculation, BCH codes

UNIT V **[10 Hrs + 6 Hrs SL]**

CONVOLUTION CODES: Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm, Turbo Codes.

Mapping of COs to POs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3											2	
CO2	3	3											
CO3	3	3											
CO4	3	3											

TEXT BOOKS

T1. Digital communications - Simon Haykin, John Wiley, 2005

T2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003

RERFERENCES

R1. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.

R2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog & Digital – Singh & Sapre, TMH, 2004

R3. Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition, 2004.

ANTENNAS AND WAVE PROPAGATION

Subject Code : UGEC5T0323	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites: Students should have prior knowledge of

- Electromagnetic Waves and Transmission Lines

Course Objective: To provide an understanding of

- To understand and develop various applications involving electromagnetic fields
- Basic terminology and concepts of Antennas in the antenna design process
- The analysis from electric and magnetic field emission, knowledge on antenna operation and types as well as their usage in real time field

Course Outcomes : Upon completion of the course, students will be able to

CO 1. Explain the concepts of antenna parameters and make use of mathematical expressions to observe the radiation Phenomena of wire antennas.
CO 2. Analyse antenna array concepts
CO 3. Outline the concepts of various antennas from HF to SHF applications
CO 4. Summarize measurement procedures for antenna parameters.
CO 5. Interpret the effect of nature on EM wave in different propagation modes.

Syllabus

UNIT-I **[10 Hrs + 6 Hrs SL]**

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, Beam width, Radiation Intensity, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Beam Area and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.

UNIT-II **[12 Hrs + 6 Hrs SL]**

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**, Beam width, Directivity, Effective Area and Effective Height. Natural current distributions, fields and patterns of Thin Linear Center-fed Antennas of different lengths, Radiation Resistance at a point which is not current maximum, 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, Concept of short magnetic dipole, D and R_r relations for small loops

UNIT-III **[10 Hrs + 6 Hrs SL]**

ANTENNA ARRAYS : 2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison; Concept of

Scanning Arrays. 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 **[12 Hrs + 6 Hrs SL]**

BROADBAND ANTENNAS: Log periodic antenna, Basic principle, 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, Case grain Feeds.

Microstrip Antennas-Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas –Geometry and Parameters, Impact of different parameters on characteristics, illustrated Problems.

UNIT-V **[12 Hrs + 6 Hrs SL]**

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, Field strength equation, illustrated Problems.

Mapping of COs to POs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3									3	
CO2	3	3	3									3	
CO3	3	2	3									3	
CO4		3	3										
CO5	2	2											

TEXT BOOKS

T1. Antenna Theory: Analysis And Design- Constantine A. Balanis, 3rd Edition, A John Wiley & Sons, Inc., Publication

T2. Antennas for All Applications – John D. Kraus and Ronald J. Marhefka, 3rd Edition, TMH, 2003.

REFERENCES

R1. Antennas and Wave Propagation-G.S.N. Raju, Pearson publications, 2006.

R2. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5, Standard Publishers Distributors, Delhi.

R3. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.

DIGITAL SYSTEM DESIGN THROUGH HDL
(Professional Elective -I)

Subject Code : UGEC5T0423	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites
- Fundamentals of Analog Electronics
- Digital Logic Design.

Course Objectives
- To use a computer-aided design tool (Verilog HDL) for development of complex digital logic circuits.
- To design and Synthesize programmable logics using Verilog HDL.

Course Outcomes : Upon completion of the course, students will be able to

CO 1. Understand the fundamental concepts of Verilog HDL including gate-level, dataflow, and behavioural modelling techniques. (K2:Understanding)

CO 2. Apply Verilog constructs to design and simulate combinational and sequential digital circuits such as multiplexers, decoders, flip-flops, and counters.(K3:Apply)

CO 3. Analyze Finite State Machines (FSMs) using Verilog and evaluate different state encoding styles for optimized synthesis. (K4:Analze)

CO 4. Develop test benches and verify the functionality of digital designs using assertion-based verification and simulation techniques.(VI:Create)

Syllabus

UNIT-I **[10 Hrs + 8 Hrs SL]**

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 **[10 Hrs + 8 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 8 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

Components Test and Verification:

Test Bench – Combinational Circuits Testing, Sequential Circuits Testing, Test Bench Techniques, Design Verification, Assertion Verification

Mapping of Cos to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3											3
CO 2	3		3		3								3
CO 3		3	3	3							3		3
CO 4				3	3				3				3

Text Books:

T1. Samir Palnitkar, "Verilog HDL A Guide to Digital and Synthesis" ,2nd Edition, Pearson Education,2006.

T2. Michael, D. Ciletti, "Advanced digital design with the Verilog HDL", Pearson Education India,2005.

Reference Books:

R1. Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016

R2. S. Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rdEdision 2014.

R3. J. Bhasker, A Verilog HDL Primer 2nd edition, BS Publications, 2001.

OPTICAL COMMUNICATIONS
(Professional Elective -I)

Subject Code : UGEC5T0523	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Pre requisites: To take this course the students should have the knowledge of

- Analog Communications
- Digital Communications

Course Objectives: This course provides a full understanding of

1. The components and the design and operation of optical fiber communication systems. The principles of wavelength division multiplexed (WDM) systems.
2. The characteristics and limitations of system components like laser diodes, external modulators, optical fiber, optical amplifiers and optical receivers
3. The factors affecting the performance of both analog and digital transmission systems are studied.

Course Outcomes:

CO 1. Understand the principles of Optical fiber wave guide, Modes and Transmission mechanisms.

CO 2. Analyze fibre materials and signal distortions due to attenuation and dispersion effects.

CO 3. Asses fiber slicing and connector technologies to improve system reliability.

CO 4. Compare optical sources and detectors based on performance matrices for diverse communication scenarios

CO 5. Design efficient point-to-point optical links with appropriate component selection, power budgeting and WDM integration.

Syllabus

UNIT I **[12 Hrs + 6 Hrs SL]**

Overview of optical fiber communication - Historical development, The general system, advantages of optical fiber communications. Optical fiber waveguides-Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers-Cutoff wave length, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT II **[10 Hrs + 6 Hrs SL]**

Fiber materials:- Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. Signal distortion in optical fibers-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion:- Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, Pulse broadening in Graded index fiber, Related problems.

UNIT III **[10 Hrs + 6 Hrs SL]**

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, single mode fiber joints.

UNIT IV **[12 Hrs + 6 Hrs SL]**

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, Detector response time, Comparison of Photo detectors, Related problems.

UNIT V **[12 Hrs + 6 Hrs SL]**

Source to fiber power launching - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of Error, Quantum limit, Analog receivers. Optical system design - Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, Line coding in Optical links, WDM, Necessity, Principles, Measurement of Attenuation and Dispersion, Eye pattern.

Mapping of COs to POs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2											
CO2	3	3	2										
CO3	3	3	2										
CO4	3	2											
CO5	3	3	3										

TEXTBOOKS:

T1. Optical Fiber Communications–GerdKeiser, McGraw-Hill International edition, 3rdEdition, 2000.

T2. Fiber Optic Communications– JosephC.Palais, 4thEdition, Pearson Education, 2004.

RERFERENCES:

R1. Fiber Optic Communications–D.K.Mynbaev ,S.C.Gupta and Lowell L.Scheiner, Pearson Education,2005.

R2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI,2005.

R3. Fiber Optic Communication Systems–Govind P.Agarwal ,JohnWiley,3rdEdiition,2004.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION
(Professional Elective -I)

Subject Code : UGEC5T0623	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites:

- Basic Electrical & Electronics Engineering
- Network Analysis
- Engineering Physics
- Electronic Devices and Circuits

Course Objectives:

- To outline different electronic instruments used for measurement of various electrical parameters.
- To list various bridges used for measuring the various measurements.
- To demonstrate the process of data acquisition.

Course Outcomes:

CO 1. Understand the principles of measurement systems, including accuracy, precision, types of errors, and the construction and operation of analog and digital measuring instruments.

CO 2. Analyze the working and applications of various electronic instruments such as voltmeters, ammeters, multimeters, frequency meters, and digital time measurement devices.

CO 3. Explain the operation and internal structure of cathode ray oscilloscopes and their advanced types, including dual trace, sampling, and digital storage oscilloscopes.

CO 4. Apply bridge circuits for the precise measurement of resistance, inductance, and capacitance, and evaluate the performance of signal generators for waveform synthesis.

CO 5. Identify and integrate various transducers and intelligent sensors in instrumentation systems.

Syllabus

UNIT I **[10 Hrs + 6 Hrs SL]**

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 **[8 Hrs + 6 Hrs SL]**

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 **[8 Hrs + 6 Hrs SL]**

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 **[6 Hrs + 6 Hrs SL]**

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 **[10 Hrs + 8 Hrs SL]**

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**)

Mapping of COs to POs:

Pos / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	-	-	1	-	-	-	-	-	-	-	1
CO2	3	3	-	2	2	-	-	-	-	-	-	2	1
CO3	3	2	-	2	3	-	-	-	-	-	-	2	-
CO4	3	3	2	3	1	-	-	-	-	-	-	3	1
CO5	3	2	3	2	3	1	-	-	1	1	2	3	2

TEXT BOOKS

T1. H. S. Kalsi, "Electronic Instrumentation", Third edition, Tata McGraw Hill, 2010.

T2. Helfrick A D and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 6th Edition, 2010.

T3. Manabendra Bhuyan, —Intelligent Instrumentation: Principles and Applications CRC Press, 2011.

REFERENCE BOOKS

R1. A.K. Sawhney, DhanpatRai& Co., "A course in Electrical and Electronic Measurements and Instrumentation", 9th Edition, 2010.

R2. David A. Bell, "Electronic Instrumentation & Measurements", PHI, 2nd Edition, 2006.

COMPUTER ORGANIZATION AND ARCHITECTURE
(Professional Elective -I)

Subject Code : UGEC5T0723	**L**	**T**	**P**	**C**
III Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites:

- Basic Programming Skills
- Basic Mathematics
- Switching Theory & Logic Design

Course Objectives

- To introduce the fundamental structure of digital computers and the Von Neumann architecture.
- To know the basic organization and control of a simple computer.
- To develop a deep understanding of CPU architecture and its functional units.
- To describe the hierarchical memory system of computers.

Course Outcomes: Upon completion of the course, the students can be able to

CO 1. Understand the basic structure and organization of digital computers, data representation formats, and micro-operations in a register transfer language.

CO 2. Describe the architecture and instruction cycle of a basic computer, including machine-level programming and micro programmed control design.

CO 3. Analyze CPU design aspects such as instruction formats, addressing modes, arithmetic and logic operations, and distinguish between CISC and RISC architectures.

CO 4. Explain the I/O system, including modes of data transfer, interrupt mechanisms, DMA, and I/O processor functionality.

CO 5. Evaluate various memory organization techniques, including cache, virtual, associative, and hierarchical memory systems, and their impact on system performance.

Syllabus

Unit I **[10 Hrs + 6 Hrs SL]**

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 Micro operations: Register transfer language, Register transfer, Bus and Memory transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

Unit II **[10 Hrs + 6 Hrs SL]**

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
Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit (**Preferably from Reference Book 2**).

Unit III **[8 Hrs + 6 Hrs SL]**
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 IV **[10 Hrs + 6 Hrs SL]**
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 V: Advanced Applications **[8 Hrs + 8 Hrs SL]**
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Mapping of COs to POs:

Pos / COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2
CO1	3	2	-	-	2	-	-	-	-	-	2	2	3
CO2	3	3	2	-	2	-	-	-	-	-	2	2	3
CO3	3	3	3	2	3	-	-	-	-	-	2	2	3
CO4	3	2	2	2	3	-	-	-	-	-	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	2	2	3

Text Books:

T1. M.Morris Mano," Computer System Architecture," Pearson Publishers, Revised 3rd Edition.

Reference Books:

R1. John P Hayes, "Computer Architecture and Organization,"Mc-Graw Hill Publishers, 3rd Edition.
R2. Carl Hamacher, "Computer Organization," Tata Mc-Graw Hill Publishers, 5th Edition.

ANALOG AND DIGITAL IC APPLICATIONS LAB

Subject Code : UGEC5P0823	**L**	**T**	**P**	**C**
III Year/ I Semester	**0**	**0**	**3**	**1.5**

Laboratory Objectives :

- Enable students to design, implement, and analyze analog and digital circuits using standard integrated circuits (ICs), enhancing their practical skills in signal processing, waveform generation, and digital system design.

Laboratory Outcomes : Upon completion of the Lab, students will be able to

CO 1	Demonstrate the operational characteristics of OPAMP-based circuits like adders, subtractors, comparators, integrators, and differentiators. (K2: understanding)
CO 2	Design and analyze analog circuits such as filters, oscillators, function generators, and waveform shaping circuits using IC 741, 555, 565, and 566. (K3: Apply)
CO 3	Analyze the frequency response and signal behavior of analog circuits using CRO and other lab instruments. (K4: Analyze)
CO 4	Implement basic combinational and sequential circuits using standard digital ICs and understand their functional behavior. (K2: understanding)
CO 5	Develop HDL (VHDL/Verilog) code for digital circuits like decoders, multiplexers, counters, and flip-flops, and simulate them using industry-standard tools. (K3: Apply)
CO 6	Design and verify the performance of digital circuits through simulation and hardware implementation using FPGA kits. (K6: Create)

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:

- RPS, CRO, Function Generator, Multi Meters, Bread Boards
- IC Trainer Kits (Optional), Analog IC Tester
- Components:- IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912 etc.

PART-B:

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: (Minimum **SIX** Experiments to be conducted):

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:

- Xilinix Vivado/Equivalent Standard IDE
- Personal computer with necessary peripherals
- Hardware kits- Various FPGA families.

Mapping of COs to POs:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3											3	
CO2	3	3	3									3	
CO3				3	3								3
CO4	3	3										3	
CO5			3		3								3
CO6			3		3				3			3	3

ANALOG AND DIGITAL COMMUNICATIONS LAB

Subject Code : UGEC5P0923	**L**	**T**	**P**	**C**
III Year/ I Semester	**0**	**0**	**3**	**1.5**

Course Objectives :

- To impart hands-on experience in the implementation and analysis of analog and digital modulation and demodulation techniques.
- To develop practical skills in time and frequency division multiplexing and signal encoding/decoding.
- To enable students to measure and calculate key performance parameters such as bandwidth, signal-to-noise ratio, and bit error rate (BER).

Course Outcomes : Upon completion of the course, students will be able to:

CO 1. Implement and analyze various analog modulation and demodulation schemes such as AM, FM, DSBSC, and their detectors using hardware and MATLAB tools.

CO 2. Simulate and evaluate the performance of sampling techniques and pulse modulation methods including PAM, PWM, and PPM.

CO 3. Design and analyze multiplexing systems such as TDM and FDM, and digital communication systems including PCM, DPCM, and delta modulation.

CO 4. Implement digital modulation schemes such as FSK, PSK, and DPSK, and assess their spectral efficiency and error performance using simulation.

CO 5. Analyze and design source and channel coding schemes including block codes, cyclic codes, convolutional codes, and companding using MATLAB Communication Toolbox.

List of Experiments

(Fourteen experiments to be done-**The students have to calculate the relevant parameters**) – a. Hardware, b. MATLAB Simulink c. MATLAB Communication toolbox)

Part-A

1. Amplitude Modulation-Modulation & Demodulation
2. AM-DSBSC-Modulation & Demodulation
3. Diode Detector
4. Pre-emphasis & De-emphasis
5. Frequency Modulation-Modulation & Demodulation
6. Verification of Sampling Theorem
7. Pulse Amplitude Modulation & Demodulation
8. PWM,PPM–Modulation & Demodulation

Part-B

1. Time division multiplexing.
2. Frequency Division Multiplexing
3. Pulse code modulation.

4. Differential pulse code modulation.
5. Delta modulation.
6. Frequency shift keying.
7. Phase shift keying.
8. Differential phase shift keying.
9. Companding
10. Source Encoder and Decoder
11. Linear Block Code-Encoder and Decoder and Binary Cyclic Code–Encoder and Decoder
12. Convolution Code–Encoder and Decoder

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

Equipment & Software required: Software:

i) Computer Systems with latest specifications
ii) Connected in LAN(Optional)
iii) Operating system(Windows/Linux software)
iv) Simulations software(Simulink &MATLAB)

Equipment:

1. RPS -0 –30V
2. CRO -0–20MHz.
3. Function Generators -0–1MHz
4. Components and Breadboards
5. Multi meters and other meters

Mapping of COs to POs:

Pos / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3		3								
CO2	3		3		3								
CO3	3	3	3	3	3								
CO4	3	3	3	3	3								
CO5	3	3	3	3	3						2		

APPLICATIONS OF LAB VIEW FOR INSTRUMENTATION & COMMUNICATIONS

Subject Code : UGEC5K1023	**L**	**T**	**P**	**C**
III Year/ I Semester	**0**	**1**	**2**	**2**

Course Objectives:

- To enable students to design and implement basic programming constructs such as loops, case structures, arrays, and clusters in LabVIEW.
- To provide hands-on experience in real-time sensor interfacing and data acquisition using NI DAQ hardware.
- To develop the ability to implement modulation, coding, and digital signal processing techniques using LabVIEW.
- To apply LabVIEW in designing automation systems, including PID control and motor speed regulation.
- To use LabVIEW for advanced data processing tasks such as logging, visualization, image processing, and IoT integration.

Course Outcomes:

CO 1. Develop loops, case structures, arrays, and clusters.
CO 2. Realize real time applications using NI DAQ hardware
CO 3. Implement Coding techniques using LabVIEW
CO 4. Design automation and process control application
CO 5. Apply LabVIEW for data processing applications

Syllabus

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.

Mapping of COs to POs:

Pos / COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	–	2	3	–	–	–	2	–	2	–	2
CO2	3	3	2	3	3	–	–	1	2	2	2	2	3
CO3	2	2	2	2	3	–	–	–	2	–	2	1	2
CO4	3	3	3	3	3	2	–	2	2	2	2	3	3
CO5	2	2	–	2	3	–	–	–	2	–	2	2	2

Textbooks &

T1. R. W. Larsen, LabVIEW for Engineers, 1st ed., Prentice Hall, 2011.

T2. G. W. Johnson and R. Jennings, LabVIEW Graphical Programming, 4th ed., McGraw-Hill, 2017.

References

R1. National Instruments, "LabVIEW Tutorials & Documentation," https://www.ni.com.J. Jerome, Virtual Instrumentation Using LabVIEW, 1st ed., PHI Learning Pvt

DESIGN OF PCB /ANTENNAS LAB

Subject Code : UGEC5P1123	**L**	**T**	**P**	**C**
III Year/ I Semester	**0**	**0**	**2**	**1**

Course Objectives :

1. To enable students to design and simulate electronic circuits and translate them into printed circuit board (PCB) layouts.
2. To provide hands-on experience in PCB fabrication techniques, including etching, drilling, and component placement.
3. To familiarize students with electromagnetic wave generation and antenna theory through simulation and measurement.
4. To develop the ability to analyze and interpret radiation patterns of various antennas using simulation tools.
5. To understand practical challenges in antenna design, including impedance matching, polarization, and propagation losses.

Course Outcomes : Upon completion of this course, the students will be able to:

CO 1. Design, simulate, and fabricate printed circuit boards (PCBs) for basic electronic circuits using standard EDA tools.

CO 2. Demonstrate proficiency in PCB fabrication processes, including layout design, etching, and component soldering.

CO 3. Analyze the radiation characteristics of various types of antennas (dipole, monopole, arrays, planar, reflector, etc.) using simulation tools.

CO 4. Apply concepts of electromagnetic wave propagation, impedance matching, and polarization in antenna analysis and design.

CO 5. Evaluate antenna performance parameters such as gain, bandwidth, and efficiency for specific applications and propagation environments.

Design of PCB

List of experiments: : (Any Two experiments)

1. Schematic Creation and simulation of an electronic circuit
2. Create PCB Layout of an Electronic Circuit.
3. Create PCB layout of an amplifier design.
4. Printing on PCB.
5. Etching and Drilling of PCB.

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

Mapping of COs to POs:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3		2		3			3	3	3	3		
CO2	3		2		3			3	3	3	3		
CO3	3	3	2	2	3	2		3	3	3	3	3	
CO4	3	3	2	2	3	2		3	3	3	3	3	
CO5	3	3	2	2	3	2		3	3	3	3	3	

III Year
II Semester

VLSI Design

Subject Code: UGEC6T0123	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Fundamentals of Analog Electronics
- Digital Logic Design.

Course Objectives

This course aims to provide a foundational understanding of VLSI design, covering MOS transistor operation, CMOS circuit design, layout techniques, and scaling principles. It introduces analog building blocks, combinational and sequential logic circuits, and FPGA-based digital design. The course also offers insights into advanced technologies like FinFETs, TFETs, and high-k metal gate solutions.

Course Outcomes : Upon completion of the course, students will be able to

CO 1. Understand the fabrication process, electrical properties, and layout design rules of MOS circuits. (K2: Understanding)

CO 2. Analyze the delay, resistance, and capacitance characteristics in MOS-based circuit designs and the limitations of scaling. (K4:Analze)

CO 3. Design and evaluate analog and digital CMOS circuits including combinational and sequential logic using different design styles. (K3: Apply)

CO 4. Demonstrate knowledge of FPGA design flow and emerging technologies like FinFET, TFET, and high-k metal gate to address modern VLSI challenges..(K2: Understand)

SYLLABUS

UNIT-I **[12 Hrs + 10 Hrs SL]**

INTRODUCTION AND BASIC ELECTRICAL PROPERTIES OF MOS CIRCUITS: VLSI Design Flow, Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds 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 **[10 Hrs + 6 Hrs SL]**

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 **[10 Hrs+6 Hrs SL]**

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 **[12 Hrs +8 Hrs SL]**

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 **[10 Hrs + 6 Hrs SL]**

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.

Mapping of Cos to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3											3
CO 2	3	3		3									3
CO 3	3		3		3								3
CO 4	3				3						3		3

Text Books

- **T1** Essentials of VLSI Circuits and Systems - Kamran Eshraghian, Douglas and A. Pucknell
- **T2** And Sholeh Eshraghian, Prentice-Hall of India Private Limited, 2005 Edition.
- **T3** Design of Analog CMOS Integrated Circuits by Behzad Razavi, McGraw Hill, 2003

Reference Books

- **R1.** “Introduction to VLSI Circuits and Systems”, John P. Uyemura, John Wiley & Sons, reprint 2009.
- **R2.** Integrated Nanoelectronics: Nanoscale CMOS, Post-CMOS and Allied Nanotechnologies
- **R3.** FinFETs and other multi-gate transistors, ColingeJP, Editor New York, Springer,2008.

MICROPROCESSORS & MICROCONTROLLERS

Subject Code: UGEC6T0223	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Programming Fundamentals
- Basic Mathematics
- Electronic Devices and Circuits
- Switching Theory & Logic Design
- Computer Organization and Architecture

Course Objectives

To introduce the concepts of Microprocessors & Microcontrollers related to programming.

- To develop the assembly language programming using 8086 processors & 8051 controllers.
- To understand technical overview of Arm Cortex-M Processor.

Course Outcomes

CO 1. Introduce the fundamentals of microprocessor-based systems, including the evolution of microprocessors and comparison of Harvard and Von Neumann architectures.

CO 2. Provide a comprehensive understanding of the 8086 microprocessor architecture, instruction set, programming techniques, and its interrupt handling mechanism.

CO 3. Develop the ability to interface 8086 with various peripheral devices such as memory, I/O components, and communication interfaces like 8255 and 8251.

CO 4. Explain the internal architecture, programming, and interfacing capabilities of the Intel 8051 microcontroller, including timers, serial communication, and peripheral interfacing.

CO 5. Introduce students to modern processor architectures, including RISC vs. CISC, ARM processor families, and the organization and features of ARM7 and Cortex-M3 processors.

Syllabus

Unit I **[10 Hrs+6 Hrs SL]**

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 II **[12 Hrs+6 Hrs SL]**

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 III **[10 Hrs+8 Hrs SL]**

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 IV **[12 Hrs+6 Hrs SL]**

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 V: Advanced Applications **[10 Hrs+6 Hrs SL]**

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.

Mapping of COs to POs:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	2	1	2
CO2	3	2	-	2	2	-	-	-	-	-	2	1	3
CO3	3	3	2	2	3	-	-	-	-	1	2	2	3
CO4	3	2	2	2	3	-	-	-	-	1	2	3	3
CO5	3	2	2	2	3	-	-	-	1	2	3	3	3

Text Books

T1. Advanced microprocessors and peripherals by K. M. Bhurchandi, A. K. Ray 3e.

T2. 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition,2011.

Reference Books

R1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm EducationMedia,2017.

R2. Definitive Guideto ARM Cortex-M3 and Cortex - M4 Processors by JosephYiu., Newnes 3rd Edition.

DIGITAL SIGNAL PROCESSING

Subject Code : UGEC6T0323	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisite

- Signals and Systems

Course Objectives

1. Introduce the concepts of Digital Signal Processing and its applications
2. Understand Discrete Fourier Transforms and its properties
3. Use Z-Transform for Realization of Digital Filters
4. Design and Implement Digital IIR and FIR Filters

Course Outcomes

CO 1. Outline the concepts of discrete signals and discrete systems with its characteristics

CO 2. Apply z-Transform, DFT and FFT for various classes of discrete sequences.

CO 3. Design the FIR and IIR filters for real-world signal processing applications.

CO 4. Outline the architectures of various DSP processors and its addressing modes, assembly language instructions.

Syllabus

UNIT-I **[10 Hrs+6 Hrs SL]**

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-II **[12 Hrs+6 Hrs SL]**

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 entire z – 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-III **[10 Hrs+8 Hrs SL]**

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-IV **[12 Hrs+6 Hrs SL]**

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-V **[10 Hrs+8 Hrs SL]**

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi ported 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.

Mapping of COs to POs:

POs/ COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3											
CO2	3	3	3	3									
CO3	3	3	3	3									
CO4	3	3	3		3								

TEXT BOOKS:

T1. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing, 3rd Edition, Pearson, 2014.

T2. P. Ramesh Babu, Digital Signal Processing, 5th Edition, SCITECHPublishers.

REFERENCE BOOKS:

R1. L. R. Rabiner and B. Gold, “Theory and Application of Digital Signal Processing”, PHl, 1992

R2. Digital Signal Processing Using MATLAB, 3rd ed. Vinay K. Ingle John G. Proakis.

ANALOG IC DESIGN
(Professional Elective -II)

Subject Code: UGEC6T0423	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites
- Fundamentals of Analog Electronics

Course Objectives
This course aims to provide a strong foundation in analog VLSI circuit design by introducing the modeling and operation of MOS devices, analog sub-circuits, and amplifier architectures. It focuses on the design and analysis of CMOS operational amplifiers, comparators, oscillators, and phase-locked loops, enabling students to understand key performance metrics and real-world applications using modern analog design techniques.

Course Outcomes : Upon completion of the course, students will be able to

CO 1. Outline the concepts of MOS Devices and Modeling.
CO 2. Design and analyze any Analog Circuits in real time applications.
CO 3. Extend the Analog Circuit Design to Different Applications in Real Time.
CO 4. Outline of Open-Loop Comparators and Different Types of Oscillators

SYLLABUS

UNIT-I **[12 Hrs + 8 Hrs (SL)]**
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 **[10 Hrs +8 Hrs (SL)]**
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 **[10 Hrs +8 Hrs (SL)]**
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 **[12 Hrs + +8 Hrs (SL)]**
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 **[10 Hrs +6 Hrs (SL)]**

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.

Mapping of Cos to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3											3
CO 2	3	3		3									3
CO 3	3		3		3								3
CO 4	3				3						3		3

Text Books

T1. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, Second Edition.

T2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition,2010.

Reference Books

R1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition,2010.

R2. Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn,2013.

SATELLITE COMMUNICATION

(Professional Elective -II)

Subject Code: UGEC6T0523	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Analog Communications
- Digital Communications
- Antennas and Wave Propagation

Course Outcomes:

CO 1. Outline the concepts, applications and subsystems of Satellite communications.

CO 2. Derive the expression for G/T ratio and to solve some analytical problems on satellite link design.

CO 3. Understand the various types of multiple access techniques and architecture of earth station design

CO 4. Understand the concepts of GPS and its architecture.

UNIT I **[12 Hrs +6 Hrs (SL)]**

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 **[10 Hrs +6 Hrs (SL)]**

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 **[12 Hrs +8 Hrs (SL)]**

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 **[12 Hrs +8 Hrs (SL)]**

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 **[10 Hrs +6 Hrs (SL)]**

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.

Mapping of Cos to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	3	3	3									
CO 2	3	3	3	3									
CO 3	3	3	2										
CO 4	3	3	2										

TEXT BOOKS

T1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 3RD Edition, 2020.

T2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCES

R1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.

R2. Satellite Communication - D.C Agarwal, Khanna Publications, 5th Ed.

SMART AND WIRELESS INSTRUMENTATION

(Professional Elective -II)

Subject Code: UGEC6T0623	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Electronic Measurements and Instrumentation

Course Outcomes:

CO 1. Analyze Smart and Wireless Instrumentation with respect to various performance parameters.
CO 2. Design and develop Applications using WSN (Wireless sensor Network).
CO 3. Demonstration of various Node architectures.
CO 4. Demonstration of Fundamentals of wireless digital communication
CO 5. Analyze the power sources, Demonstrate an ability to design strategies as per needs and specifications

Syllabus

UNIT I **[(10 Hrs + 6 HRs)SL)]**

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 II **[(10 Hrs + 8 HRs)SL)]**

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 III **[(10 Hrs + 8 HRs)SL)]**

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 IV **[(12 Hrs + 8 HRs)SL)]**

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 V **[(12 Hrs + 8 HRs)SL)]**

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

T1. Fundamentals of wireless sensor networks : theory and practice - Waltenegus Dargie, Christian Poellabauer, A John Wiley and Sons, Ltd., Publication.

T2. Smart Sensors, Measurement and Instrumentation , Subhas Chandra Mukhopadhyay, Springer Heidelberg, New York, Dordrecht London, 2013.

T3. Wireless Sensors and Instruments: Networks, Design and Applications, HalitEren, CRC Press, Taylor and Francis Group, 2006.

Reference Books:

R1. Uvais Qidwai, Smart Instrumentation: A data flow approach to Interfacing", Chapman & Hall; 1st Edn, December 2013.

R2. Wireless Sensor Networks: Architectures and Protocols, Edgar H. Callaway Jr. and Ed gar H. Callaway.

MACHINE LEARNING
(Professional Elective -II)

Subject Code : UGEC6T0723	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisite

- Linear Algebra & Calculus
- Data Structures Using Python

Course Objectives

1. To introduce foundational concepts, paradigms, and tools in Machine Learning.
2. To equip students with practical skills in Exploratory Data Analysis, feature engineering, and implementation of supervised and unsupervised learning algorithms for classification, regression, and clustering tasks.
3. To develop proficiency in model evaluation, optimization, and visualization techniques

Course Outcomes

CO 1. Outline different types of machine learning techniques and various techniques involved in pre-processing of data.
CO 2. Apply various supervised learning algorithms for classification and regression.
CO 3. Apply various unsupervised learning techniques for clustering.
CO 4. Analyze various performance metrics and explore them in various applications of implementing Machine learning Algorithms.

Syllabus

UNIT I **[(10 Hrs + 8 HRs) SL)]**

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 **[(10 Hrs + 8 HRs) SL)]**

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 **[(10 Hrs + 6 HRs) SL)]**

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 **[(10 Hrs + 6 HRs) SL)]**

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 **[(12 Hrs + 8 HRs) SL)]**

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 - R2, 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)

Mapping of COs to POs:

POs/ COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3			3								
CO2	3	3	3	3	3								
CO3	3	3	3	3	3								
CO4	3	3			3								

TEXT BOOKS:

T1. Andreas C.Muller&Sarah Guido - Introduction to Machine Learning with Python, O'Reilly Publications, First Edition, 2016.

T2. M N Murthy, V S Ananthanarayana, - Machine Learning Theory and Practice, Universities Press (India), 2024.

REFERENCE BOOKS:

R1. Tom M. Mitchell- Machine Learning, McGraw-Hill Publication, 2017.

R2. Pang-Ning Tan, Michel Stenbach, Vipin Kumar - Introduction to Data Mining, 2nd Edition, Pearson Publications, 2021.

BIO-MEDICAL INSTRUMENTATION
(Professional Elective -III)

Subject Code : UGEC6T0823	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisite

- Electronic Measurements and Instrumentation

Course Outcomes:

CO 1. Demonstrate a foundational understanding of the anatomy and physiology of the human body.

CO 2. Apply knowledge of different techniques used for measuring various physiological parameters.

CO 3. Explain modern imaging techniques employed in medical diagnosis and identify the diverse therapeutic equipment utilized in the biomedical field.

CO 4. Understand and apply bio-telemetry principles for transmitting bioelectrical variables.

CO 5. Analyze patient safety measures and evaluate recent advancements in the medical field.

Syllabus

UNIT I **[(10 Hrs + 6 HRs) SL)]**

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, Propagation of Action Potentials, The Bioelectric Potentials. Electrodes: Electrode theory, Bio Potential Electrodes, Biochemical Transducers, Introduction to bio-medical signals.

UNIT II **[(10 Hrs + 8 HRs) SL)]**

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 Cardiac output, Plethysmo graphy, Measurement of Heart Sounds, Event detection, PQRS & T-Waves inECG, the first & second Heart beats, ECG rhythm analysis, the di-crotic notch in the carotid pulse detection of events and waves, analysis of exercise ECG, analysis of event related potentials, correlation analysis of EEG channels, correlation of muscular contraction.

UNIT III **[(10 Hrs + 8 HRs) SL)]**

Patient Care & Monitory and Measurements in Respiratory System: The elements of Intensive Care Monitory, Diagnosis, Calibration and reparability of Patient Monitoring equipment, other instrumentation for monitoring patients, pace makers, defibrillators, the physiology of respiratory system, tests and instrumentation for mechanics of breathing, respiratory theory equipment, analysis of respiration.

UNIT IV **[(10 Hrs + 6 HRs) SL)]**

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 V **[(10 Hrs + 6 HRs) SL)]**

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 of electrical current, shock Hazards from electrical equipment, Methods of accident prevention, Modern Imaging Systems: Tomography, Magnetic Resonance Imaging System, Ultrasonic Imaging System, Medical Thermography.

Mapping of COs to POs:

POs/ COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1													
CO2													
CO3													
CO4													

Text Books:

T1. Biomedical Instrumentation and Measurements C.Cromwell, F.J.Weibell, E.A. Pfeiffer – Pearson education.

T2. Biomedical Signal Analysis – Rangaraj, M. Rangayya – Wiley Inter Science – John Willey & Sons Inc.

Reference Books:

R1. Hand Book of Bio-Medical Instrumentation – R.S. Khandpur, TMH.

R2. Introduction to Bio-Medical Engineering – Domach, Pearson.

R3. Introduction to Bio-Medical Equipment Technology – Cart, Pearson.

MICROWAVE ENGINEERING

(Professional Elective -III)

Subject Code : UGEC6T0923	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites : Students should have prior knowledge of

- Engineering Electromagnetics
- Electromagnetic Waves.

Course Objective

- The student should gain proficiency in using s-parameters in designing passive and active microwave circuits.
- The student should understand the function, design, and integration of the major components oscillator, modulator, power amplifier, antenna, low-noise amplifier, filter, and mixer.

Course Outcomes : Upon Completing the course, student will be able to

CO 1. Examine the different propagation modes of EM waves in guided structures

CO 2. Analyze network parameters of microwave passive components.

CO 3. Distinguish between Microwave tubes and Solid State Devices, calculation of efficiency of devices.

CO 4. Measure the characteristics of microwave components

Syllabus

UNIT-I **[(12 Hrs + 8 HRs) SL)]**

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 **[(10 Hrs + 8 HRs) SL)]**

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 **[(10 Hrs + 8 HRs) SL)]**

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-typeTubes

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 **[(10 Hrs + 6 HRs) SL)]**

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 **[(8 Hrs + 6 HRs) SL)]**

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

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO 1	3	3											
CO 2	3	3											
CO 3	3												
CO 4	3	3										3	

TEXT BOOKS:

T1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.

T2. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994.

REFERENCES:

R1. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw Hill Education, 3rd Edition.

R2. Microwave Engineering – G S N Raju , I K International

EMBEDDED SYSTEMS
(Professional Elective -III)

Subject Code : UGEC6T1023	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Corequisites :
- Microprocessors & Microcontrollers

Course Outcomes:

CO 1. Know basics of embedded system, classification, memories, different communication interface and what embedded firmware is and its role in embedded system, different system components.

CO 2. Distinguish all communication devices in embedded system, other peripheral device.

CO 3. DistinguishconceptsofCversusembeddedCandcompilerversuscross-compiler.

CO 4. Choose an operating system, and learn how to choose an RTOS

Syllabus

Unit-I **[(10 Hrs + 6 HRs) SL)]**

Introduction: Embedded System-Definition, History, Classification, application areas and purpose of embedded systems, The typical embedded system-Core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, PCB and passive components. Characteristics, Quality attributes of an Embedded systems, Application-specific and Domain-Specific examples of an embedded system, Main processing elements of embedded system, hardware and software partitions.

Unit-II **[(10 Hrs + 6 HRs) SL)]**

Embedded Hardware Design: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watch dog timer, Real time clock.

Unit-III **[(10 Hrs + 6 HRs) SL)]**

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

Unit-IV **[(12 Hrs + 8 HRs) SL)]**

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. Electronics and Communication Engineering

Hardware Software Co-Design: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hard ware and Firm ware, ICE.

Unit-V **[(12 Hrs + 8 HRs) SL)]**

Embedded System Development: The integrated development environment, Types of files generated on cross-compilation, Dissembler/De-compiler, Simulators, Emulators and Debugging, Target hardware debugging, Boundary Scan, Embedded Software development process and tools.

Embedded System Implementation And Testing: The main software utility tool, CAD and the hardware, Translation tools-Pre-processors, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on hostmachine, Simulators, Laboratory Tools. Test and evolution of an embedded systems (Build in self test etc).

Case study-typical embedded system design flow with an example.

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	PSO1	PSO2
CO 1	3	3											
CO 2	3	3											
CO 3	3												
CO 4	3	3											

Text Books:

T1. Embedded Systems Architecture By Tammy Noergaard, Elsevier Publications,2005

T2. Embedded System Design, Frank Vahid,Tony Givargis, John Wiley Publications.

References:

R1. Embedding system building blocks By Labrosse, CMP publishers.

ARTIFICIAL INTELLIGENCE
(Professional Elective -III)

Subject Code : UGEC6T1123	**L**	**T**	**P**	**C**
III Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisite

- Linear Algebra & Calculus
- Data Structures Using Python

Course Objectives

- To introduce the foundational principles, models, and problem-solving strategies of Artificial Intelligence.
- To equip students with the ability to design and apply AI algorithms for solving real-world problems in domains such as game playing, planning, and natural language processing.
- To develop analytical and practical skills for implementing and evaluating AI systems using computational intelligence approaches.

Course Outcomes

CO 1. Outline the fundamental concepts of Artificial Intelligence, including search strategies, knowledge representation, and reasoning under uncertainty.

CO 2. Apply AI algorithms and techniques, such as machine learning, fuzzy logic, and neural networks, to solve real-world problems across diverse domains.

CO 3. Analyze and evaluate AI models using appropriate computational intelligence methods and performance metrics.

CO 4. Design and implement AI-based solutions for applications in natural language processing, game playing, planning, and decision-making systems.

Syllabus

UNIT-I **[(10 Hrs + 6 HRs) SL)]**

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-II **[(10 Hrs + 8 HRs) SL)]**

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-III **[(10 Hrs + 8 HRs) SL)]**

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-IV **[(8 Hrs + 6 HRs) SL)]**

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

UNIT-V **[(12 Hrs + 8 HRs) SL)]**

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

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3		3									
CO2	3	3	3	3									
CO3	3	3	3	3	3								
CO4	3	3	3	3	3								

TEXT BOOKS

T1. Elaine Rich and Kevin Knight - Artificial Intelligence, 2nd Edition, Tata Mcgraw-Hill, 2005.

T2. Stuart Russel and Peter Norvig - Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.

REFERENCE BOOKS:

R1. Saptarsi Goswami, Amit Kumar Das, Amlan Chakrabarti – AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), 1st Edition, Pearson, 2024.

R2. Reema Thareja – Artificial Intelligence: Beyond Classical AI, 1st Edition, Pearson, 2023.

VLSI DESIGN LAB

Subject Code: UGEC6P1223	**L**	**T**	**P**	**C**
III Year/ II Semester	**0**	**0**	**3**	**1.5**

Prerequisites:

- Digital Logic Design.
- VLSI Design

Laboratory Objectives:

The objective of this laboratory course is to enable students to design, simulate, and implement CMOS-based digital and analog circuits using industry-standard Electronic Design Automation (EDA) tools. Students are expected to develop a comprehensive understanding of schematic capture, layout design, and verification methodologies as per current CMOS technology standards.

Laboratory Outcomes: completion of the Lab, students will be able to

CO 1. Design and simulate CMOS logic circuits such as inverters, universal gates, and arithmetic units using professional EDA tools. (K3: Apply)

CO 2. Implement and analyze sequential circuits like latches, flip-flops, and counters to understand their timing behavior and functionality. (K4: Analyze)

CO 3. Design analog circuits such as differential amplifiers and ring oscillators and verify their performance through simulation. (K3: Apply)

CO 4. Demonstrate proficiency in using industry-standard EDA tools for layout generation, simulation, and design verification of VLSI circuits. (K5: Evaluate)

List of Experiments

Students shall design the schematic diagrams using CMOS logic, generate corresponding layout diagrams, and perform simulation and analysis using the latest CMOS process technology with the aid of professional-grade **EDA** tools (Cadence/Synopsys/Mentor Graphics/Tanner/Microwind or any Industry Standard EDA Tools).

The following experiments shall be carried out:

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. Cadence/Synopsys/Mentor Graphics/Tanner/Microwind or any Industry Standard EDA Tools
2. Personal computer with necessary peripherals.

Mapping of COs to POs:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	3			3								3
CO 2	3	3		3									3
CO 3	3		3		3								3
CO 4	3	3											3

MICROPROCESSOR AND MICROCONTROLLERS LAB

Subject Code: UGEC6P1323	**L**	**T**	**P**	**C**
III Year/ II Semester	**0**	**0**	**3**	**1.5**

Prerequisites:

- Microprocessors and Microcontrollers

Course Outcomes

CO 1. Apply the concepts of assembly language programming using 8086 microprocessor for arithmetic operations, array manipulation, and interfacing various input/output devices.

CO 2. Develop and implement 8051 microcontroller programs for performing data processing and controlling peripherals such as timers, LCD, UART, and stepper motors.

CO 3. Utilize ARM Cortex M3 processor and KEIL MDK-ARM tools to design and implement basic embedded programs, including LED control, PWM, ADC, and serial communication.

CO 4. Demonstrate the ability to interface and control various real-time hardware modules using appropriate microprocessor/microcontroller programming techniques and tools.

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

Mapping of COs to POs:

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO 1	3	2	2	2	3							3	3
CO 2	3	2	2	2	3							3	3
CO 3	3	2	3	2	3							3	3
CO 4	3	2	3	2	3							3	3

MACHINE LEARNING LAB

Subject Code : UGEC6K1423	L	T	P	C
III Year/ II Semester	0	1	2	2

Prerequisite

- Data Structures Using Python
- Machine Learning (Co-requisite)

Course Objectives

- To introduce core machine learning concepts and implement basic models using Python libraries.
- To extract and process features from text, images, and categorical data for effective model building.
- To train, evaluate, and tune classification, regression, and clustering models using real-world datasets.

Course Outcomes

CO 1. Implement fundamental machine learning models such as linear regression, logistic regression, and decision trees using Python and Scikit-learn.

CO 2. Apply suitable techniques to extract and preprocess features from categorical, text, and image data for effective learning.

CO 3. Apply clustering, dimensionality reduction, and ensemble learning techniques to solve and analyze unsupervised learning problems.

CO 4. Apply appropriate performance metrics and optimization techniques to evaluate and fine-tune machine learning models for real-world applications.

Syllabus

UNIT-I

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, Polynomial regression, Regularization, Applying linear regression, Exploring the data, Fitting and evaluating the model, Fitting models with gradient descent

UNIT-II

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, Spam filtering, 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-III

Decision trees ,Training decision trees, Selecting the questions, Information gain, Giniimpurity, Decision trees with scikit-learn, Tree ensembles, The advantages and disadvantages of decision trees Clustering with the K-Means algorithm, Local optima, The elbow method, Evaluating clusters, Image quantization, Clustering to learn features

UNIT-IV

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

UNIT-V

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, Feed forward and feedback artificial neural networks, Multi layer perceptron, Minimizing the cost function, Forward propagation, Back propagation, Approximating XOR with Multilayer perceptron, Classifying handwritten digits

Mapping of COs to POs:

POs/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	3	3	3	3								
CO2	3	3	3	3	3								
CO3	3	3	3	3	3								
CO4	3	3	3	3	3								

TEXT BOOKS:

T1. Gavin Hackeling - Mastering Machine Learning with scikit-learn, Packt Publishing, 2017.

T2. Andreas C.Muller & Sarah Guido - Introduction to Machine Learning with Python, O'Reilly Publications, First Edition, 2016.

REFERENCE BOOKS:

R1. Aurélien Géron- Hands-On Machine Learning with Scikit-Learn and TensorFlow, O'Reilly Publisher, Third edition, 2022.

R2. Joel Grus – Data Science From Scratch: First Principles with Python, Second Edition, O'Reilly publisher, 2019.

RESEARCH METHODOLOGY AND IPR

Subject Code :	**L**	**T**	**P**	**C**
III Year/ II Semester	**2**	**0**	**0**	**0**

Course Outcomes:

- **CO 1.** Understand research problem formulation.
- **CO 2.** Analyze research related information, Follow research ethics
- **CO 3.** Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- **CO 4.** Understanding that when IPR would take such important place in growth of individuals and nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general and engineering in particular.
- **CO 5.** Understand that IPR protection provides an incentive to inventors for further research work and investment in R and D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Unit I

Meaning of 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 II

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

Unit III

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 IV

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

Unit V

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

- T1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science and engineering students'".
- T2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

REFERENCE BOOKS

- **R1.** Ranjit Kumar, 2nd Edition, "Research Methodology: A Step-by-Step Guide for beginners"
- **R2.** Halbert, "Resisting Intellectual Property", Taylor and Francis Ltd,2007.

OPEN ELECTIVES

ELECTRONIC DEVICES AND CIRCUITS

Subject Code : UGEC0T0123	L	T	P	C
	3	0	0	3

Course Outcomes:

- **CO 1.** Apply the basic concepts of semiconductor physics.
- **CO 2.** 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.
- **CO 3.** Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
- **CO 4.** Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
- **CO 5.** Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

Syllabus

UNIT-I

Review of Semi Conductor Physics: Hall effect, 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, temperature dependence on V-I characteristics.

UNIT-II

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode.

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

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through.

FET: FET types, construction, operation, characteristics μ, 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, Thermal runaway.

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

BJT: Two port network, Transistor hybrid model, determination of 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, , comparison of FET amplifiers.

CO-PO Mapping

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	2	-
CO2	3	2	2	1	2	-	-	-	-	-	-	2	-
CO3	3	3	3	2	2	-	-	-	-	-	-	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	2	-
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2

Text Books:

T1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition,2007

T2. Electronic Devices and Circuits by David A. Bell, Oxford University Press

T3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

R1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009

R2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.

MICROPROCESSORS & MICROCONTROLLERS

Subject Code : UGEC0T0123

L	T	P	C
3	0	0	3

Course Outcomes

- **CO 1.** Understand the architecture of 8086 and its operation
- **CO 2.** Develop the students to compose the assembly language program for 8086.
- **CO 3.** Applying 8086 processor to interface with necessary peripherals
- **CO 4.** Understand the architecture of 8051 and interfacing with necessary peripherals.
- **CO 5.** Understand the introductory concepts of advanced processors, viz., ARM processors

Syllabus

UNIT I

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 II

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 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, stepper motor, A/D and D/A converters

UNIT IV

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 V

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.

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	3	-
CO2	3	3	3	2	2	-	-	-	-	-	-	3	-
CO3	3	3	3	2	3	-	-	-	-	-	-	3	2
CO4	3	3	3	2	3	-	-	-	-	-	-	3	2
CO5	3	2	2	2	2	-	-	-	-	-	-	-	-

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

HONORS

ADVANCED COMMUNICATIONS

Subject Code : UGEC0H0123

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- **CO 1.** Learn 5G Technology advances and their benefits
- **CO 2.** Learn the key MIMO,SDR changes required to support 5G
- **CO 3.** Learn Device to device communication with Wireless Networks
- **CO 4.** Implementation options for 5G

Syllabus

UNIT I

SPREAD SPECTRUM AND MULTIPLE ACCESS TECHNIQUES: Introduction, Pseudo noise sequence, DS spread spectrum with coherent binary PSK, processing gain, FH spread spectrum, multiple access techniques wireless communication, TDMA and CDMA in wireless communication systems, source coding of speech for wireless communications.

UNIT II

Wireless channel modeling (microwave, mmWave, and teraHertz): Propagation mechanism, reflection, refraction, diffraction and scattering. Fading channels- Multipath and small-scale fading Doppler shift, statistical multipath channel models, narrowband and wideband fading models, coherence bandwidth, and coherence time.

UNIT III

Multiple-Input, Multiple-Output (MIMO) wireless communication: Basic MIMO model, MIMO capacity in fading channels, Diversity multiplexing trade off, Space-time code for MIMO wireless communication.

Software Define Radio (SDR): Characteristics and benefits of a software radio, design principles of software radio, enhanced flexibility with software radios, receiver design challenges.

UNIT IV

Wireless Networks Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, HiperLan, WLL

UNIT V:

5G Communication: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies. 5G CHANNEL MODEL: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios and challenges in the 5G modeling. 5G USE CASES AND SYSTEM CONCEPT: Use cases and requirements, 5G system concept.5G waveforms, OFDM, OTFS, OFDMA, carrier aggregation, dual connectivity. Beyond 5G key enablers: Intelligent reflecting surfaces (IRS), wireless energy harvesting, SWIPT, integrated sensing and communication

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	2	-	-	1	-	3	-
CO2	3	3	3	2	3	-	2	-	-	2	-	3	2
CO3	3	3	3	2	3	-	2	-	-	2	-	3	2
CO4	3	3	3	3	3	-	2	-	-	2	-	3	3

Text Books

T1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
T2. S. Haykin and M. Moher, Modern Wireless Communication, Pearson Education, 2005.
T3. Jeffrey H. Reed, Software Radio: A Modern Approach to Radio Engineering, Prentice Hall, May 2002

References Books:

R1. C. Oestges and B. Clerckx, MMIO Wireless Communications, 1st Ed, 2007.
R2. Paul Burns, Software Defined Radio for 3G, Artech House Inc., 2003.
R3. Afif Osseiran, Jose F Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology", Cambridge University Press, 2016
R4. Wireless Sensor Networks: An Information Processing Approach, 1st edition, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009

EMI/EMC

Subject Code : UGEC0H0223

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- **CO 1.** Discuss effects of EMI and counter measures by EMC-techniques.
- **CO 2.** Apply the knowledge gained in selecting proper gadget/device/appliance/system, as per EMC- norms specified by regulating authorities.
- **CO 3.** Students shall choose career in the fields of EMI/EMC as an Engineer/Researcher/Entrepreneur in India/abroad.
- **CO 4.** Understand the various aspects of shielding & PCB Tracing, termination& Implementation
- **CO 5.** Identifying of EMI Hotspot and various techniques like grounding filtering soldering etc

Syllabus

UNIT – I

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

UNIT – II

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

UNIT – III

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

UNIT – IV

ESD, Grounding, shielding, bonding and EMI filters: Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design. ESD, Electrical fast transients / bursts, electrical surges.

UNIT – V

Cables, connectors, components: Introduction, EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, Transient and Surge Suppression Devices.

EMC standards- National / International: Introduction, Standards for EMI and EMC, MIL-Standards, IEEE/ANSI standards, CISPR/IEC standards, FCC regulations, EMI/EMC standards in JAPAN, Conclusions.

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	-	--	-	-	1	-	3	-
CO2	3	3	3	2	3	-	--	-	-	2	2	3	2
CO3	2	2	2	2	2	-	-	-	-	2	3	2	3
CO4	3	2	3	2	3	-	-	-	-	1	-	3	2
CO5	3	3	3	2	3	-	-	-	-	2	-	3	3

Text Books:

T1. Engineering Electromagnetic Compatibility by Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.

References Books:

R1. Introduction to Electromagnetic Compatibility, NY, John Wiley, 1992, by C.R. Pal.

R2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi.

VLSI SIGNAL PROCESSING

Subject Code : UGEC0H0323

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO 1. Understand Pipelining, and parallel processing.
CO 2. Use VLSI design for digital filters
CO 3. Optimize VLSI architectures for basic DSP algorithms
CO 4. Analyze various parallel processing algorithms
CO 5. Be familiar with VLSI algorithms and architectures for DSP.
CO 6. Be able to implement basic architectures for DSP using CAD tools

Syllabus

UNIT-I

Introduction to DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms. **Pipelining and Parallel Processing:** Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power. **Retiming:** Introduction – Definitions and Properties – Solving System of Inequalities – Retiming Techniques

UNIT-II

Folding: Introduction -Folding Transform - Register minimization Techniques – Register minimization in folded architectures – folding of multirate systems
Unfolding: Introduction – An Algorithm for Unfolding – Properties of Unfolding – critical Path, Unfolding and Retiming – Applications of Unfolding

UNIT-III

Systolic Architecture Design : Introduction – Systolic Array Design Methodology – FIR Systolic Arrays – Selection of Scheduling Vector – Matrix Multiplication and 2D Systolic Array Design – Systolic Design for Space Representations contain Delays

UNIT-IV

Fast Convolution : Introduction – Cook-Toom Algorithm – Winogard algorithm – Iterated Convolution – Cyclic Convolution – Design of Fast Convolution algorithm by Inspection

UNIT-V

Low Power Design : Scaling Vs Power Consumption –Power Analysis, Power Reduction techniques – Power Estimation Approaches Programmable DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing.

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	1	-	3	-
CO2	3	3	3	2	3	-	-	-	-	2	-	3	2
CO3	3	3	3	3	3	-	-	-	-	2	-	3	3
CO4	3	3	2	3	3	-	-	-	-	2	-	3	2
CO5	3	2	2	2	2	-	-	-	-	1	-	2	2
CO6	3	3	3	3	3	-	-	-	-	2	-	3	3

TEXT BOOKS

T1. VLSI Digital Signal Processing- System Design and Implementation – Keshab K. Parhi, 1998, Wiley Inter Science.

T2. VLSI and Modern Signal Processing – Kung S. Y, H. J. While House, T. Kailath, 1985, Prentice Hall.

REFERENCE BOOKS

R1. Design of Analog – Digital VLSI Circuits for Telecommunications and Signal Processing – Jose E. France, YannisTsividis, 1994, Prentice Hall.

R2. VLSI Digital Signal Processing – Medisetti V. K, 1995, IEEE Press (NY), USA.

CMOS MIXED SIGNAL DESIGN

Subject Code : UGEC0H0423

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO 1. Appreciate the fundamentals of data converters and also optimized their performances.
CO 2. Understand the design methodology for mixed signal IC design
CO 3. Analyze the design of PLL and operational amplifiers
CO 4. Design the CMOS digital circuits and implement its layout.
CO 5. Design the Switched Capacitor Circuits for different applications.

Syllabus

UNIT-I

Switched Capacitor Circuits : Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, biquad filters.

UNIT-II

Phased Lock Loop (PLL) : Basic PLL topology, Dynamics of simple PLL, Charge pumpPLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs- PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT-III

Data Converter Fundamentals : DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters

UNIT-IV

Nyquist Rate A/D Converters : Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D converters, Folding A/D converters, Pipelined A/D converters, Time-interleaved converters.

UNIT-V

Oversampling Converters : Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multibitquantizers, Delta sigma D/A

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	3	2	2	-	-	-	-	-	-	3	2
CO2	3	2	3	3	3	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3
CO5	3	2	3	2	2	-	-	-	-	-	-	3	2

TEXT BOOKS:

T1. Analog Integrated Circuit Design- David A. Johns,Ken Martin, Wiley Student Edition, 2016

T2. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

T3. Design of Analog CMOS Integrated Circuits- BehzadRazavi, TMH Edition, 2002

REFERENCE BOOKS:

R1. CMOS Integrated Analog-to- Digital and Digital-to-Analog converters-Rudy Van De Plassche, Kluwer Academic Publishers, 2003

R2. Understanding Delta-Sigma Data converters-Richard Schreier, Wiley Interscience, 2005.

R3. CMOS Mixed-Signal Circuit Design - R. Jacob Baker, Wiley Inter science, 2009.

ADAPTIVE SIGNAL PROCESSING

Subject Code : UGEC0H0523

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO 1. Review the Adaptive Systems and Understand the various measures to be opted for developing adaptive systems

CO 2. Understand different algorithms to develop the adaptive filtering

CO 3. Apply adaptive filter theory for different problems

CO 4. Perform RLS & Kalman Filtering

Syllabus

Unit -I

Introduction to Adaptive Systems: Adaptive Systems: Definitions, Characteristics, Applications, Example of an Adaptive System. The Adaptive Linear Combiner - Description, Weight Vectors, Desired Response, Performance function - Gradient & Mean Square Error.

Unit-II

Development of Adaptive Filter Theory & Searching the Performance surface: Introduction to Filtering - Smoothing and Prediction – Linear Optimum Filtering, Problem statement, Principle of Orthogonality - Minimum Mean Square Error, Wiener- Hopf equations, Error Performance surface Searching the performance surface – Methods & Ideas of Gradient Search methods, Gradient Searching Algorithm & its Solution, Stability& Rate of convergence , Learning Curve.

Unit-III

Steepest Descent Algorithms: Gradient Search by Newton's Method, Method of Steepest Descent, Comparison of Learning Curves.

Unit-IV

LMS Algorithm & Applications: Overview - LMS Adaptation algorithms, Stability &Performance analysis of LMS Algorithms - LMS Gradient & Stochastic algorithms - Convergence of LMS algorithm. Applications: Noise cancellation – Cancellation of Echoes inlong distance telephone circuits, Adaptive Beam forming.

Unit-V

RLS &Kalman Filtering: Introduction to RLS Algorithm, Statement of Kalman filtering problem, The Innovation Process, Estimation of State using the Innovation Process- Expression of Kalman Gain, Filtering Examples using Kalman filtering.

CO-PO Mapping

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	3	-
CO2	3	3	3	3	3	-	-	-	-	-	-	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3

Text Books

T1. Adaptive Signal Processing - Bernard Widrow, Samuel D. Strearns, 2005, PE.
T2. Adaptive Filter Theory - Simon Haykin-, 4th Ed., 2002, PE Asia.

Reference Books

R1. Optimum signal processing: An introduction – Sophocles .J. Orfamadis, 2nd Ed., 1988,McGraw-Hill, New York
R2. Adaptive signal processing-Theory and Applications - S.Thomas Alexander, 1986,Springer –Verlag.
R3. Signal analysis – Candy, McGraw Hill Int. Student Edition
R4. James V. Candy - Signal Processing: A Modern Approach, McGraw-Hill, International Edition, 1988

RTOS

Subject Code : UGEC0H0623

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO 1. List the mathematical model of the system and to develop real time algorithm for task scheduling.

CO 2. Categorize capabilities Handling Resource Sharing and dependencies among Real-time Tasks generate a high-level analysis for Scheduling Real-time tasks in multiprocessor and distributed systems

CO 3. Analyze the working of real time operating systems and real time database.

CO 4. Apply the fault tolerance techniques, evaluation of reliability.

Syllabus

UNIT-I

Introduction : OS Services, Process Management, Timer Functions, Event Functions, Memory Management, Device, File and IO Systems Management, Interrupt Routines in RTOS Environment and Handling of Interrupt Source Calls, Real-Time Operating Systems, Basic Design Using an RTOS, RTOS Task Scheduling Models, Interrupt Latency and Response of the Tasks as Performance Metrics, OS Security Issues.

UNIT-II

RTOS Programming : Basic Functions and Types of RTOS for Embedded Systems, RTOS mCOS-II, RTOS Vx Works, Programming concepts of above RTOS with relevant Examples, Programming concepts of RTOS Windows CE, RTOS Linux 2.6.x and RTOS RT Linux.

UNIT-III

Program Modeling – Case Studies : case study of digital camera hardware and software architecture, Case Study of Embedded System for an Adaptive Cruise Control (ACC) System in Car, Case Study of Embedded System for a Smart Card, Case Study of Embedded System of Mobile Phone Software for Key Inputs.

UNIT-IV

Target Image Creation & Programming in Linux : Operating System Software, Target Image Creation for Window XP Embedded, Porting RTOS on a Micro Controller based Development Board. Overview and programming concepts of Unix/Linux Programming, Shell Programming, System Programming

UNIT-V

Programming in RT Linux : Overview of RT Linux, Core RT Linux API, Program to display a message periodically, semaphore management, Mutex, Management, Case Study of Appliance Control by RT Linux System

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3
CO3	3	2	3	2	3	-	-	-	-	-	-	3	2
CO4	3	3	3	3	3	-	-	-	-	-	2	3	3

TEXT BOOKS:

T1. Rajkamal: "Embedded Systems-Architecture, Programming and Design", Tata McGraw Hill Publications, Second Edition, 2008.

T2. Dr. K.V.K.K. Prasad: "Embedded/Real-Time Systems" Dream Tech Publications, 2005 Edition, Black pad book.

REFERENCES:

R1. Labrosse, "Embedding system building blocks ", CMP publishers.

R2. Rob Williams," Real time Systems Development", Butterworth Heinemann Publications.

PC BASED DATA ACQUISITION SYSTEMS

Subject Code : UGEC0H0723

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- **CO 1.** Identify a data acquisition system, objectives and different configurations
- **CO 2.** Familiar with different methods of linear/Nonlinear Analog-to-Digital conversion and their role in real time applications
- **CO 3.** Familiar with different methods of linear/Nonlinear Digital to Analog Conversion. and their role in real time applications
- **CO 4.** Identify the type of interface used to get a digital signal/Analog signal into a microprocessor and familiar with Monolithic Converters
- **CO 5.** Familiar with different noise reduction techniques in DAS and case studies of Data Converter

Syllabus

UNIT-I

INTRODUCTION: Objective of a DAS, single channel DAS, Multi-channel DAS, Components used in DAS– Converter Characteristics-Resolution-Non-linearity, settling time, Monotonicity.

UNIT-II

ANALOG TO DIGITAL CONVERTERS (ADCS): Classification of A/D converters. Parallel feed back – Successive approximation – Ramp comparison – Dual slope integration – Voltage to frequency – Voltage to Time – Logarithmic types of ADCS.

NON-LINEAR DATA CONVERTERS (NDC): Basic NDC configurations – Some Common NDACS and NADCS – Programmable non-linear ADCS – NADC using optimal sized ROM –High speed hybrid NADC – PLS based NADC – Switched capacitor NDCS.

ADC APPLICATIONS: Data Acquisition systems – Digital signal processing systems –PCM voice communication systems –Test and measurement instruments – Electronic Weighing machines.

UNIT-III

DIGITAL TO ANALOG CONVERTERS (DACS): Principles and design of – Parallel R–2R, Weighted resistor, inverted ladder, D/A decoding – Codes other than ordinary binary.

DATA CONVERTER APPLICATIONS: DAC applications – Digitally programmable V/I sources – Arbitrary waveform generators – Digitally programmable gain amplifiers – Analog multipliers/ dividers – Analog delay lines.

UNIT-IV

Monolithic data converters: typical study of monolithic DACS and ADCS. Interfacing of DACS and ADCS to a µP.

UNIT-V

Error budget of DACS and ADCS: Error sources, error reduction and noise Reduction techniques in DAS. Error budget analysis of DAS, case study of a DAC and an ADC.

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3
CO4	3	2	2	2	3	-	-	-	-	-	-	3	3
CO5	3	2	3	3	3	-	-	-	-	-	-	3	3

TEXT BOOKS:

T1. Electronic data converters fundamentals and applications – Dinesh K. Anvekar, B.S. Sonde –Tata McGraw Hill.

REFERENCES:

R1. Electronic Analog/ Digital conversions – Hermann Schmid – Tata McGraw Hill.
R2. E.R. Hanateck, User's Handbook of D/A and A/D converters - Wiley
R3. Electronic instrumentation by HS Kalsi- TMH 2 ndEdition, 2004.
R4. Data converters by G.B. Clayton

DIGITAL CONTROL SYSTEMS

Subject Code : UGEC0H0823

L	T	P	C
3	0	0	3

Course Outcomes (COs):

- CO 1. Demonstrate an understanding of the fundamentals of Discrete-Time Control Systems.
- CO 2. Apply Z-transform techniques in the analysis and design of discrete-time control systems.
- CO 3. Design discrete-time control systems using various classical and modern approaches.
- CO 4. Analyze discrete-time systems using the State Space approach.
- CO 5. Understand and evaluate the concepts of controllability and observability in discrete-time control systems.

Syllabus

UNIT –I

Introduction to Discrete Time Control Systems: Introduction, Digital Control Systems, Quantizing and Quantization Error, Data Acquisition, Conversion, and Distribution Systems

UNIT-II

The Z – Transforms: Introduction, The Z Transform, Z-Transform of elementary functions, properties and theorems of Z-Transform, Inverse Z-Transform, Z-Transform method for solving difference equations

Z-Plane Analysis of Discrete-Time Control System: Introduction, Impulse Sampling and Data Hold, Obtaining the Z-Transform by the convolutional integral method, Reconstruction of original signals from sampled signals, Pulse transfer function, Realization of digital controllers and digital filters

UNIT –III

Design of Discrete Time Control Systems by Conventional Methods: Introduction, Mapping between the s plane and the z plane, stability analysis of closed loop systems in the z plane, transient and steady response analysis, design based on the Root-Locus method, design based on the frequency response method, Analytical design method.

UNIT-IV

State Space Analysis: Introduction, State Space Representation of discrete time systems, solving discrete time state space equations, Pulse Transfer function matrix, Discretization of continuous time state – space equations, Liapunov stability analysis

UNIT –V

Controllability and Observability: Introduction, Controllability, Observability, Useful Transformations in State Space Analysis and Design.

CO-PO Mapping

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO1	PSO2
CO1	3	2	2	1	2	–	–	–	–	–	–	3	–
CO2	3	3	2	2	2	–	–	–	–	–	–	3	–
CO3	3	2	3	3	3	–	–	–	–	–	–	3	2
CO4	3	3	3	3	2	–	–	–	–	–	–	3	2
CO5	3	3	3	2	2	–	–	–	–	–	–	3	2

TEXT BOOKS:

T1. K. Ogata - "Discrete-Time Control systems" - Pearson Education/PHI, 2nd Edition.

REFERENCE BOOKS:

R1. Kuo - "Digital Control Systems"- Oxford University Press, 2nd Edition, 2003.
R2. M. Gopal - "Digital Control and State Variable Methods"- TMH

MICROSTRIP ANTENNAS

Subject Code : UGEC0H0923	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Outcomes (COs):

- CO 1. Recall the fundamental concepts of antennas, particularly planar and microstrip configurations.
- CO 2. Explain the working principles and characteristics of microstrip patch antennas.
- CO 3. Design and analyze circularly polarized patch antennas and microstrip antenna arrays.
- CO 4. Evaluate the performance of planar slot, monopole, and electrically small antennas.
- CO 5. Investigate the use of planar antennas in specialized wireless communication applications**.**

UNIT –I

Planar Radiators: Introduction to antennas (radiation pattern, directivity, efficiency, gain, impedance, axial ratio etc.), different types of planar antennas, applications of planar antennas, Brief description of fabrication process of planar antennas.

UNIT –II

Microstrip Patch Antennas-I: Characteristics of microstrip patch antennas, radiation from microstrip antenna, field configurations, different types of feeding techniques. Design equations for rectangular and circular microstrip patches, analysis of microstrip antennas using transmission line model and cavity method. Broadband techniques using stacked patch antennas, proximity-coupled and aperture-coupled microstrip antennas, slot-loaded and slit-loaded microstrip antennas, microstrip antennas with shorted pin, effect of finite ground plane on the performance of microstrip antennas, principle of planar fractal antennas.

UNIT –III

Microstrip Patch Antennas-II: Methods of generating circular polarization in microstrip antennas using single feed and double feed, methods of generating multiple frequencies using microstrip antennas, miniaturization techniques for mcirostrip antennas. Design techniques of microstrip antenna arrays with feed network, effect of mutual coupling, microstrip phased array antenna design.

UNIT –IV

Planar Slot Antennas: Geometry and design of microstrip slot antenna, radiation pattern, CPW-fed slot antennas, design of folded slot antenna, annular slot antenna.

Planar Monopole Antennas: Feeding methods and characteristics of planar triangle monopole,
Sierpinski monopole, planar bi-conical monopole antenna and roll monopole antenna.

UNIT –V
Planar Antennas for Special Applications: Planar mobile handset antennas, planar laptop computer antennas, planar antennas for USB modem, planar antennas for WLAN and UWB communication.

CO-PO Mapping

Cos/ POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	1	–	–	–	–	–	–	–	–	3	–
CO2	3	3	2	2	2	–	–	–	–	–	–	3	–
CO3	3	2	3	3	3	–	–	–	–	–	–	3	2
CO4	3	3	3	3	2	–	–	–	–	–	–	3	3
CO5	2	2	3	2	3	–	–	–	–	–	–	3	3

Text books

T1. Balanis, Constantine A. Antenna Theory: Analysis and Design, 4th Edition Wiley, 2016
T2. Ramesh Garg, Prakash Bhartia, Inder Bahl, Apisak Ittipiboon Microstrip Antenna Design Handbook Artech House, 2001
T3. Girish Kumar and K.P. Ray Broadband Microstrip Antennas Artech House, 2003

Reference Books

R1. Kai Fong Lee, Kwai Man Luk Microstrip Antennas, Imperial College Press, 2011
R2. Zhi Ning Chen and Kwai Man Luk, Broadband Planar Antennas: Design and Applications, Wiley, 2005
R3. Debatosh Guha and Yahia M.M. Antar, Microstrip and Printed Antennas: New Trends, Techniques and Applications, Wiley, 2011

IMAGE & VIDEO PROCESSING

Subject Code : UGEC0H1023

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO 1. Describe the Image Processing system, scope of digital image processing and compare various image transforms.

CO 2. Apply filtering operations on images both in spatial and frequency domain; describe image restoration in presence of noise and degradation.

CO 3. Analyze various segmentation techniques and compression methods on digital images.

CO 4. Describe the fundamental of digital video, sampling and filtering of video signals.

CO 5. Explain various methods for two dimensional motion estimation and their applications in video processing

Unit – I

Introduction: Introduction to Image Processing, Examples of fields that use Digital Image Processing, Fundamental steps in digital image processing, components of an image processing system, Examples of the fields that use Digital Image Processing. Image sensing and acquisition, image sampling and quantization, Some basic relationships between pixels.

Image Transforms: Need for image transforms, Image transforms, Fourier Transform, 2D Discrete Fourier Transform and its properties, Walsh Transform, Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, Singular Value Decomposition.

Unit – II

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.
Filtering in frequency domain: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.
Image Restoration: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

Unit – III

Image segmentation: Fundamentals, point, line, edge detection, thresholding, and Region –based segmentation. Image compression: Fundamentals, Basic compression methods: Huffman coding, Golom bcoding, Arithmetic coding, LZW coding, Run-Length coding, Block Transform coding, Predictive coding.

Unit – IV

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

Unit – V

2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation

CO-PO Mapping

Cos/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2	1	2	–	–	–	–	–	–	3	–
CO2	3	3	3	2	3	–	–	–	–	–	–	3	2
CO3	3	3	3	2	3	–	–	–	–	–	–	3	3
CO4	3	2	2	2	2	–	–	–	–	–	–	3	2
CO5	3	3	3	3	3	–	–	–	–	–	–	3	3

TEXT BOOKS:

T1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.

T2. Digital Video Processing – M. Tekalp, Prentice Hall International.

T3. Video Processing and Communication – Yao Wang, JoemOstermann and Ya–quin Zhang. 1st Ed., PH Int.

REFRENCE BOOKS:

R1. Fundamentals of Digital Image Processing – Anil K. Jain, Prentice Hall of India, 9th Edition, Indian Reprint, 2002.

R2. Digital Image Processing –S. Jayaraman, S. Esakkirajan, and T. Veerakumar, McGraw-Hill Education, 2018.

ADVANCED COMMUNICATIONS LAB

Subject Code : UGEC0H1123 **L T P C**

0 0 0 1.5

COURSE OUTCOMES

CO 1. Implement and analyze linear block codes, cyclic codes, and convolutional codes for error detection and correction.
CO 2. Evaluate losses in optical fiber and study the characteristics of optical sources like LASER diodes.
CO 3. Demonstrate the working of satellite communication components and evaluate link performance parameters such as SNR and C/N ratio.
CO 4. Implement spread spectrum techniques including DS-SS, FH, and PN/Gold sequences for secure communication.
CO 5. Analyze wireless communication models such as Okumura, Hata, and free-space path loss, and study WLAN network configurations

List of Experiments :(Minimum of Twelve Experiments has to be performed)

1. Implementation of Linear Block Code Encoder and Decoder
2. Implementation of Binary Cyclic Codes Encoder and Decoder
3. Implementation of Convolution Encoder- Decoder
4. Determination of Losses in Optical Fiber
5. Characteristics of LASER Diode.
6. Study of Satellite Communication System, uplink transmitter, down link receiver and transponder
7. Signal to noise ratio and Link Failure operations in satellite communication
8. Carrier to Noise Ratio in Satellite Communication
9. Study of Direct Sequence Spread Spectrum Modulation & Demodulation using CDMA- DSS BER Trainer
10. Efficiency of DS Spread- Spectrum Technique
11. Simulation of Frequency Hopping (FH) system
12. Generation of PN sequence and Gold Sequence
13. Outdoor propagation model - Okumura model and Hata model
14. Free space propagation – path loss model
15. Study of WLAN / network topologies

CO-PO Mapping

Cos/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	2	–	–	–	–	–	–	3	2
CO2	3	2	3	2	2	–	–	–	–	–	–	3	2
CO3	3	3	3	2	3	–	–	–	–	–	–	3	3
CO4	3	3	3	3	3	–	–	–	–	–	–	3	3
CO5	3	3	3	2	3	–	–	–	–	–	–	3	3

CMOS MIXED SIGNAL DESIGN LAB

Subject Code : UGEC0H1223

L	T	P	C
0	0	0	1.5

COURSE OUTCOMES

- **CO 1.** Design and analyze compensated operational amplifiers for stability enhancement.
- **CO 2.** Implement and evaluate high-speed comparators and data converter circuits.
- **CO 3.** Design switched-capacitor circuits and analog building blocks such as PLLs and VCOs.
- **CO 4.** Develop and simulate physical layouts of analog/mixed-signal circuits, considering parasitic effects.

List of Experiments

Cycle 1

1. Fully compensated op-amp with resistor and miller compensation
2. High speed comparator design
   - i. Two stage cross coupled clamped comparator
   - ii. Strobed Flip-flop
3. Data converter

Cycle 2

1. Switched capacitor circuits i. Parasitic sensitive integrator ii. Parasitic insensitive integrator
2. Design of PLL
3. Design of VCO
4. Band gap reference circuit
5. Layouts of All the circuits Designed and Simulated

Lab Requirements:

Software: Mentor Graphics/ Cadence/ Tanner/Industry Equivalent Standard Software Tools

Hardware: Personal Computer with necessary peripherals, configuration and operating System.

CO-PO Mapping

CO \PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	-	-	-	-	-	-	3	2
CO2	3	3	3	2	3	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3
CO4	3	2	3	3	3	-	-	-	-	-	-	3	3

RTOS Lab

Subject Code : UGEC0H1323

L	T	P	C
0	0	0	1.5

COURSE OUTCOMES

CO 1. Understand and apply real-time operating system concepts such as task creation, scheduling, semaphores, mutexes, monitors, and deadlock prevention on ARM-based platforms.

CO 2. Demonstrate interrupt handling and resource sharing techniques in real-time embedded systems using ARM-926 and Perfect RTOS.

CO 3. Interface peripheral devices such as ADC, DAC, and display units with ARM-Cortex processors using open-source RTOS platforms.

CO 4. Develop and simulate real-time applications such as data loggers and serial communication systems using embedded development tools and hardware.

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

List of Experiments

Part-I: Experiments using ARM-926 with PERFECT RTOS

1. Register a new command in CLI.
2. Create a new Task.
3. Interrupt handling.
4. Allocate resource using semaphores.
5. Share resource using MUTEX.
6. Avoid deadlock using BANKER'S algorithm.
7. Synchronize two identical threads using MONITOR.
8. Reader's Writer's Problem for concurrent Tasks.

Part-II: Experiments on ARM-CORTEX processor using any open source RTOS. (Coo-Cox-Software-Platform)

1. Implement the interfacing of display with the ARM- CORTEX processor.
2. Interface ADC and DAC ports with the Input and Output sensitive devices.
3. Simulate the temperature DATA Logger with the SERIAL communication with PC.
4. Implement the developer board as a modem for data communication using serial Port communication between two PC's.

Lab Requirements:

Software:

- Eclipse IDE for C and C++ (YAGARTO Eclipse IDE), Perfect RTOS Library, COO-COX Software Platform, YAGARTO TOOLS, and TFTP SERVER.
- LINUX Environment for the compilation using Eclipse IDE & Java with latest version.

Hardware:

- The development kits of ARM-926 Developer Kits and ARM-Cortex Boards.
- Serial Cables, Network Cables and recommended power supply for the board.

CO-PO Mapping

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	3	–	–	–	1	2	–	3	–
CO2	3	2	3	2	3	–	–	–	2	2	–	3	–
CO3	2	3	3	3	3	–	–	–	2	2	–	3	2
CO4	3	3	3	3	3	–	–	–	2	3	–	3	2

DIGITAL CONTROL SYSTEMS LAB

Subject Code : UGEC0H1423

L	T	P	C
0	0	0	1.5

COURSE OUTCOMES

CO 1. Analyze and implement discrete-time and digital domain control systems using transfer functions, Z-transforms, and pole-zero mapping techniques.

CO 2. Design and simulate compensators (lead, lag) and evaluate their impact on time-domain performance specifications such as overshoot, stability, and accuracy.

CO 3. Model systems using state-space and transfer function approaches and examine system stability, eigenvalues, and the effect of nonlinearities on system behavior.

List of Experiments

1. To study
   a. Conversion of a transfer function from continuous domain to discrete domain.
   b. Conversion of a transfer function from the continuous domain to the digital domain.
   c. Pole Zero Map of a discrete transfer function
2. To determine
   a. Z transform of a discrete-time signal
   b. Inverse Z transform of a discrete-time signal
   c. Factored form and partial fraction form of a rational z function d. Pole zero map of a digital system
3. To study
   a. Closed loop response of a discrete-time system
   b. Comparison of time responses of continuous time and discrete time systems
   c. Effect of sampling time on system response and system parameters
4. To design a lead compensator to obtain system response with the desired accuracy, and less overshoot.
5. To design a lag compensator to meet performance specification parameters
6. To study a. The effect of variation in controller parameters on system response
7. To obtain
   a. Transfer function model from a state model
   b. State model from transfer function model
   c. Step response of a system represented by its state model
8. To determine
   a. Eigenvalues from state model
   b. Eigenvalues from transfer function model
   c. Stability of a system
9. To study the effect of common nonlinearities such as relay, dead zone, and saturation on the response of a 2nd order control system

Softwares Required

1. Matlab Software
2. Simulink Tool

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	2	-	3	2
CO2	3	3	3	3	3	-	-	-	-	2	-	3	3
CO3	3	3	3	3	3	-	-	-	-	2	-	3	3

ANTENNAS and MICROWAVE LAB

Subject Code : UGEC0H1523

L	T	P	C
0	0	0	1.5

Course Outcomes (COs)

CO 1. Calculate and analyze transmission line parameters and investigate wave behavior under various termination conditions using simulation tools.

CO 2. Interpret input impedance variations with line length and feeding positions using Smith charts and relevant plots.

CO 3. Evaluate the radiation characteristics and input impedance of different types of antennas including dipole, patch, and array configurations.

CO 4. Design and simulate microstrip patch antennas and analyze radiation patterns in 2D and 3D using simulation platforms.

LIST OF EXPERIMENTS : (Minimum of Ten Experiments has to be performed)

1. Calculation of transmission line parameters (R, L, G and C) for two wire line, coaxial line and Strip line.
2. Study on the standing wave pattern along a transmission line when the line is open-circuited, Short circuited and terminated by a resistive load at the load end.
3. Investigate the effect of length of transmission line on the input impedance at the sending end.
4. Familiarization of Smith chart on MATLAB platform.
5. Radiation resistance of electric and magnetic dipoles as a function of electrical size.
6. Feed (input terminal) impedance of an electric dipole as a function of antenna length.
7. 3D radiation pattern of a half-wavelength dipole antenna in both horizontal and vertical
   Orientations
8. Radiation patterns for electric dipoles of various electrical lengths.
9. Characteristics and radiation patterns of Linear array, Planar and Circular arrays.
10. Variation of normalized input impedance with Feeding position in Inset-Fed Microstrip patch Antenna
11. Design of Rectangular Microstrip Patch antenna.

CO-PO Mapping

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	–	–	–	1	1	–	3	2
CO2	3	2	2	2	3	–	–	–	1	1	–	3	3
CO3	3	3	3	3	3	–	–	–	2	1	–	3	3
CO4	3	3	3	3	3	–	–	–	2	2	–	3	3

IMAGE & VIDEO PROCESSING LAB

Subject Code : UGEC0H1623

L	T	P	C
0	0	0	1.5

Course Outcomes (COs)

CO 1. Apply basic image processing operations including enhancement, filtering, and histogram equalization in both spatial and frequency domains.

CO 2. Implement and analyze image compression techniques and evaluate performance using coding methods such as JPEG, Huffman, and predictive coding.

CO 3. Detect image features like edges using various operators and perform segmentation using thresholding methods.

CO 4. Perform basic video processing tasks including key frame extraction, motion estimation, and computation of optical flow in video sequences.

Note: In the first 10 experiments, at least 8 experiments, In the last three experiments, at least 2 experiments must be executed.

List of Experiments

1. Perform basic operations on images like addition, subtraction etc.
2. Perform Pixel based operations (Point based operations) for Image enhancement
3. Plot the histogram of an image and perform histogram equalization
4. Filtering in Spatial Domain
5. Computation of 2D-DFT and Perform filtering in Frequency domain
6. Implementation of Image Restoration methods
7. Implementation of JPEG compression Algorithm (Without using Library function)
8. Comparison of coding Techniques for image compression (Bit plane, Predictive, Arithmetic, Huffman coding).
9. Detections of edges in an image (Prewitt, Sobel, Krisch and Laplacian of Gaussian Operators, Canny operators) and compare
10. Image Segmentation based on thresholding.
11. Basic operations on Video, and identification of key frame
12. Computation of optical flow velocities for a moving object in a Video
13. Implementation of two dimensional motion estimation

CO-PO Mapping

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	-	-	-	1	2	-	3	2
CO2	3	3	2	2	3	-	-	-	1	2	-	3	3
CO3	3	2	2	2	3	-	-	-	1	1	-	3	2
CO4	3	3	3	2	3	-	-	-	1	2	-	3	3

MINORS

ELECTRONICS DEVICES AND BASIC CIRCUITS

Subject Code : UGEC0M0123

L	T	P	C
3	0	0	3

Course Outcomes

- **CO 1.** Apply the basic concepts of semiconductor physics.
- **CO 2.** 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.
- **CO 3.** Know the construction, working principle of rectifiers with and without filters with relevant expressions and necessary comparisons.
- **CO 4.** Understand the construction, principle of operation of transistors, BJT and FET with their V-I characteristics in different configurations.
- **CO 5.** Know the need of transistor biasing, various biasing techniques for BJT and FET and stabilization concepts with necessary expressions.

Syllabus

UNIT-I

Review of Semi Conductor Physics: Hall effect, 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, temperature dependence on V-I characteristics.

UNIT-II

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode.

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

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, punch through/ reach through.

FET: FET types, construction, operation, characteristics μ, 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, Thermal runaway.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:
BJT: Two port network, Transistor hybrid model, determination of 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, , comparison of FET amplifiers.

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	1	-	-	-	-	-	-	2	-
CO2	3	2	2	1	2	-	-	-	-	-	-	2	-
CO3	3	3	3	2	2	-	-	-	-	-	-	3	-
CO4	3	3	2	2	2	-	-	-	-	-	-	2	-
CO5	3	3	3	2	2	-	-	-	-	-	-	3	2

Text Books

T1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition,2007

T2. Electronic Devices and Circuits by David A. Bell, Oxford University Press

T3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References

R1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009

R2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016.

DIGITAL ELECTRONICS

Subject Code : UGEC0M0223

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO 1. Classify different number systems and apply to generate various codes.

CO 2. Use the concept of Boolean algebra in minimization of switching functions

CO 3. Design different types of combinational logic circuits.

CO 4. Apply knowledge of flip-flops in designing of Registers and counters

CO 5. The operation and design methodology for synchronous sequential circuits and algorithmic state machines.

CO 6. Produce innovative designs by modifying the traditional design techniques.

Syllabus

UNIT – I

REVIEW OF NUMBER SYSTEMS & CODES: Representation of numbers of different radix, conversation from one radix to another radix, r1's compliments and r's compliments of signed members. Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

UNIT – II

BOOLEAN THEOREMS AND LOGIC OPERATIONS: Boolean theorems, principle of complementation & duality, De-Morgan theorems. Logic operations ; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX-NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486.

MINIMIZATION TECHNIQUES: Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables)and tabular method(Quine-mcCluskey method) with only four variables and single function.

UNIT – III

COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4 bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.

COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI :

Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits .Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoder. Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154.

UNIT – IV

SEQUENTIAL CIRCUITS : Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip-flop. Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi directional shift register, universal shift, register.

UNIT-V

INTRODUCTION OF PLD's : PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table. ROM: Internal structure, Static RAM: Internal structure, Dynamic RAM: Internal structure.

CO-PO Mapping

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	3	2	2	-	-	-	-	-	-	3	2
CO4	3	3	3	2	2	-	-	-	-	-	-	3	2
CO5	3	3	3	2	2	-	-	-	-	-	-	3	3
CO6	3	3	3	2	3	-	-	-	-	-	-	3	3

TEXT BOOKS

T1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009

T2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition publication,2008 PHI

T3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

REFERENCES

R1. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers,2006

R2. Digital electronics by R S Sedha.S.Chand& company limited,2010

R3. Switching Theory and Logic Design by A. Anand Kumar, PHI Learning pvt ltd,2016.

PRINCIPLES OF COMMUNICATION

Subject Code : UGEC0M0323

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO 1. Analyze the performance of analog modulation schemes in time and frequency domains.
CO 2. Analyze the performance of angle modulated signals.
CO 3. Characterize analog signals in time domain as random processes and noise
CO 4. Characterize the influence of channel on analog modulated signals
CO 5. Determine the performance of analog communication systems in terms of SNR

Syllabus

UNIT I

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

UNIT II :

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 III

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 IV

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 V

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

CO-PO Mapping

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	3	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	1	-	-	-	-	-	-	3	3

TEXT BOOKS

T1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc

T2. Fundamentals of Wireless Communication by David Tse

References:

R1. Principles of Communication Systems – Simon Haykin, John Wiley, 2nd Edition.

R2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.

SIGNAL ANALYSYS

Subject Code : UGEC0M0423

L	T	P	C
3	0	0	3

COURSE OUTCOMES

- CO 1. To be able to determine if a given system is linear/causal/stable
- CO 2. Capable of determining the frequency components present in a deterministic signal
- CO 3. Capable of characterizing LTI systems in the time domain and frequency domain
- CO 4. To be able to compute the output of an LTI system in the time and frequency domains

Syllabus

UNIT I

CLASSIFICATION OF SIGNALS AND SYSTEMS : Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II

ANALYSIS OF CONTINUOUS TIME SIGNALS : Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

UNIT III

LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS : Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV

ANALYSIS OF DISCRETE TIME SIGNALS : Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

UNIT V

LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS : Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

CO-PO Mapping

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	1	-	-	-	-	-	-	-	2	2
CO2	3	3	-	2	-	-	-	-	-	-	-	3	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	1	-	-	-	-	-	-	3	3

TEXT BOOKS

T1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, ―Signals and Systems‖, Pearson, 2015

REFERENCES BOOKS

R1. B. P. Lathi, ―Principles of Linear Systems and Signals‖, Second Edition, Oxford, 2009.

R2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, ―Signals & Systems - Continuous and Discrete‖, Pearson,

R3. John Alan Stuller, ―An Introduction to Signals and Systems‖, Thomson, 2007.

MICROCONTROLLERS AND APPLICATIONS

Subject Code : UGEC0M0523

L	T	P	C
3	0	0	3

COURSE OUTCOMES

CO 1. Understand the architecture and operation of common microcontrollers.
CO 2. Write and debug assembly/C programs for microcontrollers.
CO 3. Interface microcontrollers with input/output devices.
CO 4. Interface microcontrollers with various advanced peripherals.
CO 5. Design and implement microcontroller-based applications.

Syllabus

Unit I

Introduction to Microcontrollers : Evolution of microcontrollers and comparison with microprocessors, Microcontroller families (8051, PIC, AVR, ARM), Architecture of 8051 microcontroller, Memory organization, registers, and flags, Overview of development tools (IDE, simulators, programmers)

Unit II

Programming of Microcontrollers : Instruction set of 8051, Assembly language programming, Introduction to Embedded C programming, Debugging and simulation tools

Unit III

Interfacing with Input/Output Devices : Basics of interfacing and role of GPIO, Interfacing LEDs, switches, and push buttons, Interfacing 7-segment displays and buzzers, Interfacing LCDs (16x2 and 20x4, Keypad interfacing for user inputs

Unit IV

Interfacing with Advanced Peripherals and Communication Devices : Interfacing sensors (temperature, light, and proximity sensors), Interfacing actuators (motors: DC, stepper, and servo). Communication interfaces:UART (serial communication with PC), SPI and I2C (interfacing EEPROM and sensors), ADC/DAC interfacing (e.g., analog sensors and audio signals). Interfacing wireless modules (Bluetooth, ZigBee, ESP8266/ESP32 for IoT applications)

Unit V

Advanced Microcontrollers : Introduction to ARM Cortex-M series, Comparison of ARM with 8051 and PIC, Overview of Arduino and Raspberry Pi platforms, Embedded IoT basics

Real-Time Applications and Case Studies: Microcontroller applications in robotics, automation, and consumer electronics, Designing energy-efficient systems with microcontrollers; Case studies: Home automation, Smart agriculture systems, Healthcare monitoring.

CO-PO Mapping

COs\ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	2	-	-	-	-	2	3	3

Textbook:

T1. Mazidi and Mazidi, The 8051 Microcontroller and Embedded Systems, 4th Impression, PHI, 2000.

T2. Raj Kamal, Microcontrollers Architecture, Programming, Interfacing and System Design, 2nd Edition, Pearson Education, 2005.

Reference Books:

R1. Kenneth J. Ayala, *The 8051 Microcontroller: Architecture, Programming, and Applications*, Cengage Learning.

R2. John Boxall, *Arduino Workshop: A Hands-On Introduction with 65 Projects*, No Starch Press.

EMBEDDED SYSTEM DESIGN

Subject Code : UGEC0M0623	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

COURSE OUTCOMES

CO 1. Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function.

CO 2. The hardware components required for an embedded system and the design approach of an embedded hardware.

CO 3. The various embedded firmware design approaches on embedded environment.

CO 4. Understand how to integrate hardware and firmware of an embedded system using real time operating system.

Syllabus

UNIT-I

INTRODUCTION: Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT-II

EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-III

EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-IV

REAL TIME OPERATING SYSTEM: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization.

HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co- Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware.

UNIT-V

EMBEDDED SYSTEM DEVELOPMENT, IMPLEMENTATION AND TESTING: The integrated development environment, Types of files generated on cross-compilation, Deassembler/ De-compiler, Simulators, Emulators and Debugging, Target hardware debugging, Embedded Software development process and tools, Interpreters, Compilers and Linkers, debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

CO-PO Mapping

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	3	2	2	-	2	-	-	-	-	-	-	3	2
CO2	3	2	3	2	3	-	-	-	-	-	-	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	2	2	-	3	3

Text Books

T1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.

T2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.

References

R1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.

R2. Embedded Systems-Lyla B.Das-Pearson Publications,2013.

INTERNET OF THINGS

Subject Code : UGEC0M0723

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

CO 1. Understand the new computing technologies

CO 2. Able to apply the latest computing technologies like cloud computing technology and Big Data

CO 3. Ability to introduce the concept of M2M (machine to machine) with necessary protocols

CO 4. Get the skill to program using python scripting language which is used in many IoT devices

Syllabus

Unit I

Introduction to Internet of Things : Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT Communication Models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle(Chap 1 and 2)

Unit II

IoT and M2M : Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANGNETCONF, YANG, SNMP NETOPEER(Chapter 3 and 4)

Unit III

IOT Platform design Methodology, Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib(Chapter 5 and 6)

Unit IV

IoT Physical Devices and Endpoints : Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins., other IOT Devices

Unit V

IoT Physical Servers and Cloud Offerings : Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API, Amazon web services for IOT, Skynet IOT messaging platform(Chapter 8)

CO-PO Mapping

COs\ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	2	2
CO2	3	3	3	2	3	-	-	-	-	-	-	3	3
CO3	3	2	2	2	3	-	-	-	-	-	-	3	2
CO4	3	3	3	2	3	-	-	-	2	2	-	3	3

Text Books

T1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547

T2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD),2014, ISBN: 9789350239759

Reference Books

R1. 1.The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).

R2. From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence, Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.

R3. Architecting the Internet of Things, Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.

R4. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, Michael Margolis, Arduino Cookbook and O’Reilly Media, 2011.

DIGITAL SIGNAL PROCESSING

Subject Code : UGEC0M0823	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

COURSE OUTCOMES

- CO 1. Understand the concepts of discrete signals and discrete systems with its characteristics
- CO 2. Calculate z-Transform, Fourier Transform, Discrete Fourier Transform of discrete signals.
- CO 3. Understand the algorithms for the efficient computation of DFT coefficients of signals
- CO 4. Know the various filter structures for FIR and IIR filters.
- CO 5. Design the FIR and IIR filters.

Syllabus

Unit -I

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.

Unit –II

Frequency Domain Analysis of LTI Systems: Frequency domain characteristics of LTI systems, Frequency response of LTI systems.

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.

Unit –III

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

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

Unit –IV

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

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

Unit –V

Design of Analog Filters: Butterworth filters… Low Pass Filter, High Pass filter, Band Pass Filter, Band Reject Filter. **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.

CO-PO Mapping

COs\ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	2	2	-	-	-	-	-	-	2	2
CO2	3	3	-	3	2	-	-	-	-	-	-	3	2
CO3	3	3	3	3	3	-	-	-	-	-	-	3	3
CO4	3	2	2	2	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	3

TEXT BOOKS

T1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, 4th Edition, Pearson Education, 2007.

Reference Books

R1. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, 3rd Edition, Pearson, 2014.

R2. Digital Signal Processing-P. Ramesh Babu, 5th Edition, SCITECH Publishers.

ELECTRONICS DEVICES AND BASIC CIRCUITS LAB

Subject Code : UGEC0M0923

L	T	P	C
0	0	3	1.5

Course Outcomes (COs)

CO 1. Analyze the characteristics of semiconductor diodes and apply them in rectifier and voltage regulation circuits.

CO 2. Examine the input-output characteristics of BJT and FET devices and their amplifier configurations.

CO 3. Design and evaluate basic transistor amplifier circuits and understand the role of biasing.

List of Experiments:(Minimum of Ten Experiments has to be performed)

1. P-N Junction Diode Characteristics

Part A: Germanium Diode (Forward bias& Reverse bias)

Part B: Silicon Diode (Forward Bias only)

2. Zener Diode Characteristics

3. Part A: V-I Characteristics

Part B: Zener Diode as Voltage Regulator

4. Rectifiers (without)

Part A: Half-wave Rectifier

Part B: Full-wave Rectifier

5. BJT Characteristics (CE Configuration)

6. FET Characteristics (CS Configuration)

7. Transistor Biasing

8. CRO Operation and its Measurements

9. BJT-CE Amplifier

10. Emitter Follower-CC Amplifier

11. FET-CS Amplifier

CO-PO Mapping

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	3	2	2	1	–	–	–	–	–	3	2
CO2	3	3	3	2	2	–	–	–	–	–	–	3	2
CO3	3	3	3	2	2	–	–	–	–	–	–	3	2

DIGITAL ELECTRONICS LAB

Subject Code : UGEC0M1023	**L**	**T**	**P**	**C**
	0	**0**	**3**	**1.5**

COURSE OUTCOMES (COS)

CO 1. Understand and verify the behavior of basic logic gates, combinational circuits, and their minimization techniques using hardware kits.

CO 2. Analyze and implement sequential logic components like flip-flops, counters, and shift registers for various digital applications.

CO 3. Design, simulate, and test practical digital circuits such as adders, multiplexers, decoders, and display systems using standard digital ICs.

<u>**List of Experiments**</u>**: (**Minimum of Ten Experiments has to be performed)

1) Verification of truth tables of Logic gates
2) Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive OR (vi) Exclusive NOR
3) Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit
4) Verification of functional table of 3 to 8 line Decoder/De-multiplexer
5) Four variable logic function verification using 8 to1 multiplexer.
6) Design full adder circuit and verify its functional table.
7) Verification of functional tables of

(i) JK Edge triggered Flip–Flop (ii) JK Master Slav Flip–Flop (iii) DFlip-Flop

8) Design a four bit ring counter using D Flip–Flops/JK Flip Flop and verify output
9) Design a four bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
10) Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
11) Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T- Flip- Flops and Test it with a low frequency clock and Sketch the output wave forms.
12) Design MOD–8 synchronous counter using T Flip- Flop and verify the result and Sketch the output wave forms.

    (a) Draw the circuit diagram of a single bit comparator and test the output

    (b) Construct 7 Segment Display Circuit Using Decoder and 7 Segment LED and test it.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	1	2	–	–	–	–	–	–	3	–
CO2	3	2	3	2	2	–	–	–	–	–	–	3	–
CO3	3	3	3	2	2	–	–	–	–	–	–	3	2

INTERNET OF THINGS LAB

Subject Code : UGEC0M1123

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES (COS)

CO 1. Demonstrate proficiency in setting up embedded development environments and interfacing sensors and actuators with platforms like Raspberry Pi, NodeMCU, Arduino, and PSoC BLE.

CO 2. Develop programs for real-time data acquisition, control, and communication using GPIOs, serial communication, and Bluetooth Low Energy (BLE).

CO 3. Design and implement basic IoT applications integrating sensor data, actuators, and wireless communication for automation and monitoring tasks.

List of Experiments: (Minimum of Twelve Experiments has to be performed)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
2. Python-based IDE(integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
3. Display a word on LCD, Interfacing with Raspberry Pi.
4. Using Raspberry Pi, Display Seven Segment.
5. Servo Motor Controlling with Interfacing using Raspberry Pi.
6. Soil Moisture detecting with soil moisture sensor using Raspberry Pi.
7. Calculate the distance using distance sensor Using Node MCU.
8. Basic LED functionality Using Node MCU
9. Familiarization with ARM keil MDK for programming and debugging an application on the PSoC 4 BLE chip and perform necessary software installation.
10. To interface Push button/Digital sensor (IR/LDR) with ARM keil MDKonPSoC4BLEchipandwriteaprogramtoturnONLED when push button is pressed or at sensor detection.
11. Setup a Bluetooth Low Energy (namely Bluetooth Smart)connection between the PSoC BLE kit and a smart phone and use an app to send and receive data to and from the BLE Pioneer kit.
12. To interface capacitor sensor (touch sensor) with smart phone and write a program to turn RGBLEDON/OFFwhen„1“/“0“ is received from smart phone using Bluetooth.
13. Automatic street light control to control the street light (Turn on and off based on the light)using Arduino/Node MCU/Raspberry Pi
14. SmokeDetectionusingMQ-2GasSensor
15. Detecting obstacle with IR Sensor and Arduino/NodeMCU/Raspberry Pi

Equipment required for Laboratories:

- Arduino/NodeMCU/Raspberry Pi+PSoC4 BLE Bluetooth Low Energy Pioneer Kit + Hardware, MQ-2 Gas Sensor, Ultrasonic sound sensor.

CO-PO Mapping

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	3	1	1	1	2	2	2	3	2
CO2	3	2	3	2	3	1	1	1	2	2	2	3	3
CO3	3	3	3	3	3	2	2	1	3	2	2	3	3

DIGITAL SIGNAL PROCESSINGLAB

Subject Code : UGEC0M1223

L	T	P	C
0	0	3	1.5

COURSE OUTCOMES (COS)

CO 1. Generate and analyze basic discrete-time (DT) signals using simulation tools and DSP kits.
CO 2. Implement and differentiate linear and circular convolutions of DT signals using MATLAB and Code Composer Studio (CCS).
CO 3. Compute Discrete Fourier Transform (DFT) and perform spectral analysis of signals using FFT algorithms.
CO 4. Design and implement FIR and IIR filters using DSP hardware tools and software environments.

List of the Experiments

(Note: Students have to perform at least FIVE experiments from each part.)

PART-A

1. Generation of DT signals.
2. Verify the Linear Convolution of two DT signals
a) Using MATLAB
b) Using Code Composer Studio(CCS)
3. Verify the Circular Convolution of two DT signals
a) Using MATLAB
b) Using Code Composer Studio (CCS)
4. Find the sum of DT sinusoidal signals.
5. Computation of Discrete Fourier Transform (DFT) and Inverse Discrete Fourier Transform (IDFT)
a) Using MATLAB
b) Using Code Composer Studio (CCS)
6. Compute N-point DFT of a given DT sequence using Decimation in Time. (Without Using Library Function)
7. Compute N-point DFT of a given DT sequence using Decimation in Frequency. (Without Using Library Function)

PART-B

Following Experiments are to be done using a TI DSP Starter Kit.
7. Generation of a sinusoidal signal.
8. Linear and circular convolution of DT sequences.
9. Compute N-point DFT of a given DT sequence
10. Design and implementation of FIR filters.
11. Design and implementation of IIR filters.

CO-PO Mapping

COs\ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	3	–	–	–	1	–	–	2	2
CO2	3	3	3	2	3	–	–	–	2	–	–	3	2
CO3	3	3	3	3	3	–	–	–	2	–	–	3	3
CO4	3	3	3	3	3	–	–	–	2	–	–	3	3