JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

III Year – I Semester

S. No.	Course	Category	L	T	P	Credits
1	Linear Integrated Circuits and Applications	PC	3	0	0	3
2	Microprocessor and Microcontrollers	PC	3	0	0	3
3	Digital Communications	PC	3	0	0	3
4	Electronic Measurements & Instrumentation	PC	3	0	0	3
5	Professional Elective (PE 1)	PE	3	0	0	3
6	Linear Integrated Circuits and Applications - Lab	LC	0	0	3	1.5
7	Digital Communications Lab	LC	0	0	3	1.5
8	Microprocessor and Microcontrollers - Lab	LC	0	0	3	1.5
9	Mini Project with Hardware Development	PR	0	0	3	1.5
10	Essence of Indian Traditional Knowledge	MC	3	0	0	0
			Sub-Total			**21**

III Year – IISemester

S. No.	Course	Category	L	T	P	Credits
1	Wired and Wireless Transmission Devices	PC	3	0	0	3
2	VLSI Design	PC	3	0	0	3
3	Digital Signal Processing	PC	3	0	0	3
4	Professional Elective (PE2)	PE	3	0	0	3
5	Open Elective (OE1)	OE	3	0	0	3
6	Internet of Things	PC	3	0	0	3
7	VLSI Lab	LC	0	0	3	1.5
8	Digital Signal Processing Lab	LC	0	0	3	1.5
9	Intellectual Property Rights (IPR) & Patents	MC	3	0	0	0
			Sub-Total			**21**

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

LINEAR INTEGRATED CIRCUITS and APPLICATIONS

Course objectives::

- To understand the basic operation &performance parameters of differentialamplifiers.
- To understand & learn the measuring techniques of performance parameters ofOp-Amp
- To learn the linear and non-linear applications of operationalamplifiers.
- To understand the analysis & design of different types of active filters usingop-amps
- To learn the internal structure, operation and applications of different analogICs
- To Acquire skills required for designing and testing integratedcircuits

UNIT I

Introduction: InternalBlock Diagram of various stages of Op-Amp and Roll of each Stage. Differential Amplifier using BJTs and With R_E DC and AC Analysis, Basic Current Mirror Circuit, Improved Version of current mirror circuit, current repeated circuit, Wilson current source.

OP-Amp Block Diagram (Symbolic Representation), Characteristics of Op-Amp, Ideal and Practical Op-Amp specifications, DC and AC Characteristics, Definitions of Input and Output Off-set voltage and currents slow rate, CMRR, PSRR.etc, Measurements of Op-Amp Parameters. Three-Terminal Voltage Regulators 78xx& 79xx Series, current Booster,adjustable voltage, Dual Power Supply with 78xx &79xx.

UNIT II

LINEAR and NON-LINEAR APPLICATIONS OF OP-AMPS: Inverting and Non-inverting amplifier, Integrator and differentiator, Difference amplifier, Instrumentation amplifier, ACamplifier, V to I, I to V converters, Buffers. Non- Linear function generation, Comparators, Multivibrators, Triangular and Square wave generators, Log and Anti log Amplifiers, Precision rectifiers.

UNITIII

ACTIVE FILTERS, ANALOG MULTIPLIERS AND MODULATORS: Design & Analysis of Butterworth active filters – 1st order, 2nd order LPF, HPF filters. Band pass, Band reject and all pass filters.

Four Quadrant Multiplier, IC 1496, Sample & Hold circuits.

UNIT IV

TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation, AM, FM & FSK demodulators. Applications of VCO (566).

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UNIT V

DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS: Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, and IC 1408 DAC, Different types of ADCs – parallel Comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC.DAC and ADC Specifications, Specifications AD 574 (12 bit ADC).

TEXT BOOKS:

1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p)Ltd, 2nd Edition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad,PHI,1987.
3. Linear Integrated Circuits by Salivahan-3rd-Edition, McGrawHill,2018

REFERENCES:

1. Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SK Kataria& Sons; 2nd Edition,2010
2. Operational Amplifiers & Linear Integrated Circuits–R.F.Coughlin& FredrickDriscoll, PHI, 6th Edition,2000.
3. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition,2011.
4. LinearIntegratedCircuits,byGaneshBabuT.RandSuseelaB.Scitech, 5th-Editon, 2014.

Course Outcomes:

- Design circuits using operational amplifiers for variousapplications.
- Analyze and design amplifiers and active filters usingOp-amp.
- Diagnose and trouble-shoot linear electroniccircuits.
- Understand the gain-bandwidth concept and frequency response of the amplifier configurations.
- Understand thoroughly the operational amplifiers with linear integratedcircuits.

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		3	0	0	3

MICROPROCESSOR AND MICROCONTROLLERS

Course objectives::
The main objectives of this course are

- To acquire knowledge on microprocessors andmicrocontrollers.
- To select processors based onrequirements.
- To acquire the knowledge on interfacing various peripherals, configure and develop programs to interfaceperipherals/sensors.
- To develop programs efficiently on ARM Cortex processors anddebug.

UNIT–I
Introduction: Basic Microprocessor architecture, Harvard and Von Neumann architectures with examples, Microprocessor Unit versus Microcontroller Unit, CISC and RISC architectures.
8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum modeconfiguration.

UNIT–II
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

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

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

UNIT–V
ARM Architectures and Processors: ARM Architecture, ARM Processors Families, ARM Cortex-M Series Family, ARM Cortex-M3 Processor Functional Description, functions and interfaces.

Programmers Model – Modes of operation and execution, Instruction set summary, System address map, write buffer, bit-banding, processor core register summary, exceptions.
ARM Cortext-M3 programming – Software delay, Programming techniques, Loops, Stack and Stack pointer, subroutines and parameter passing, parallel I/O, Nested Vectored Interrupt Controller – functional description and NVIC programmers' model.

TEXTBOOKS:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
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. The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors by JosephYou.

REFERENCE BOOKS:

1. Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach in English, by Dr. Alexander G. Dean, Published by Arm Education Media,2017.
2. Cortex -M3 Technical ReferenceManual.

Course Outcomes:

At the end of this course the student will be able to:

- Understand the architecture of microprocessor/ microcontroller and theiroperation.
- Demonstrate programming skills in assembly language for processors andControllers.
- Analyze various interfacing techniques and apply them for the design of processor/Controller basedsystems.

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		3	0	0	3

DIGITAL COMMUNICATIONS

Course Objectives:
The student will be able to

- Understand pulse digital modulation systems such as PCM, DPCM andDM.
- Understand various digital modulation techniques and able to analyze various systems for their performance in terms of probability oferror.
- Study the concepts of information theory and need for sourcecoding.
- Study Block codes, cyclic codes and convolutioncodes.

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

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

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

UNIT IV
INFORMATION THEORY: Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties.Information rate, Mutual information and itsproperties.
SOURCE CODING: Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.

UNIT V
LINEAR BLOCK CODES: Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation, BCH Codes.
CONVOLUTION CODES: Introduction, encoding of convolution codes, time domain approach, transform domain approach. Graphical approach: state, tree and trellis diagram decoding using Viterbi algorithm.

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TEXT BOOKS:

1. Digital communications - Simon Haykin, John Wiley,2005
2. Digital and Analog Communication Systems - Sam Shanmugam, John Wiley,2005.

REFERENCES:

1. Principles of Communication Systems – H. Taub and D. Schilling, TMH,2003
2. Digital Communications – John Proakis, TMH, 1983. Communication Systems Analog& Digital – Singh & Sapre, TMH,2004.
3. Modern Digital and Analog Communication Systems –B.P.Lathi,Zhi Ding,Hari Mohan Gupta,Oxford University Press,4th Edition,2017

Course Outcomes:

After going through this course the student will be able to

- Analyze the performance of a Digital Communication System for probability of error and are able to design a digital communicationsystem.
- Analyze various source codingtechniques.
- Compute and analyze Block codes, cyclic codes and convolutioncodes.
- Design a coded communicationsystem.

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		3	0	0	3

ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Course Objectives:

- Learn and understand functioning of various measuring system and metrics for performance analysis.
- Acquire knowledge of principle of operation, working of differentelectronic
- Instruments viz. signal generators, signal analyzers, recorders and measuring equipment.
- To Compare various measuring bridges and their balancingconditions.
- Learn and understand the use of various measuring techniques for measurement of different physical parameters using different classes oftransducers.

UNIT I

Performance characteristics of instruments, Static characteristics; Accuracy, Resolution, Precision, Expected value, Error, Sensitivity.Dynamic Characteristics; speed of response, Fidelity, Lag and Dynamic error.Types of errors in measurements and their analysis. Design of multi-range AC , DC meters (voltmeter &ammeter) and ohmmeter(series &shunt type) using D'arsonval movement. True rms meter.

UNIT II

Specifications and designing aspects of Signal Generators - AFsine and square wave signal generators, Function Generators, Random noise generators, Arbitrary waveform generators. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers, Digital FourierAnalyzers.

UNIT III

Oscilloscopes- general purpose CROs; block diagram , functions and implementation of various blocks, specifications, various controls and their functions , types of probes used in CROs. Measurement of frequency and phase difference using Lissajous patterns.

Special purpose CROs; sampling oscilloscope, analog storage oscilloscope, digital storage oscilloscope.

UNIT IV

Bridge circuits- Wheat stone bridge, measurement of very low resistance, Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance-Schearing Bridge.Wien Bridge, Errors and precautions in using bridges.

Q-meter; principle of operation, measurement methods and sources of errors.

Counters : principle of operation -modes of operation- totalizing mode, frequency mode and time period mode- sources of errors.

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UNIT V

Transducers- active & passive transducers: Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers.

Measurement of physical parameters temperature, force, pressure, velocity, acceleration and displacement.

TEXTBOOKS :

1. Electronic instrumentation, second edition - H.S. Kalsi, Tata McGrawHill,2004.
2. Modern Electronic Instrumentation and Measurement Techniques – A.D. Helfrickand W.D. Cooper, PHI, 5th Edition, 2002.

REFERENCES :

1. Electronic Instrumentation & Measurements - David A. Bell, PHI, 3rd Edition,2013.
2. Electrical and Electronic Measurement and Instrumentation A.K. Sawhney. Dhanpat Rai & Co, 12thEdition,2002.

Course Outcomes:

The student will be able to

- Select the instrument to be used based on therequirements.
- Understand and analyze different signal generators andanalyzers.
- Understand the design of oscilloscopes for differentapplications.
- Design different transducers for measurement of differentparameters.

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		3	0	0	3

INFORMATION THEORY & CODING
(Professional Elective 1)

Course objectives:
The main objectives of this course are given below
- Understand the concept of Entropy and sourcecoding
- Understand the concept of channel and its capacity
- Encoding and Decoding of Digital DataStreams
- Be Aware of Compression and DecompressionTechniques
- Learn the Concepts of MultimediaCommunication

UNIT I
INFORMATION THEORY AND SOURCE CODING

Uncertainty, information, entropy and its properties, entropy of binary memory less source and its extension to discrete memory less source, source coding theorem, data compression, prefix coding, Huffman coding, Lempel-Ziv coding, Source with memory and itsentropy.

UNIT II
DISCRETE CHANNELS

Binary Symmetric Channel, mutual information & its properties, Channel capacity, channel coding theorem and its application to BSC, Shannon's theorem on channel capacity, capacity of a channel of infinite bandwidth, bandwidth - S/N trade off, practical communication systems in light of Shannon's theorem, Fading channel, channels withmemory.

UNIT III
GROUPS, FIELDS AND LINEAR BLOCK CODES

Galois field and its construction in GF(2^m) and its basic properties, vector spaces and matrices in GF(2), Linear block codes, systematic codes and its encoding circuit, syndrome and error detection, minimum distance, error detecting and correcting capabilities of block code, decoding circuit, probability of undetected error for linear block code in BSC, Hamming code and their applications.

UNIT IV
CYCLIC CODES AND BCH CODES

Basic properties of Cyclic codes, Generator and parity check matrix of cyclic codes, encoding and decoding circuits, syndrome computation and error detection, cyclic Hamming codes, encoding and decoding of BCH codes, error location andcorrection.

UNIT V
CONVOLUTIONALCODES

Introduction to convolution code, its construction and Viterbi algorithm for maximum likelihood decoding.Automatic repeat request strategies and their throughput efficiency considerations.

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Text Books:

1. Sklar, Digital Communication, Pearson Education Asia, 2nd Edition,2001.
2. Shu Lin and Costello, Error Control Coding: Fundamentals and Applications, 2nd Edition, Pearson,2004.

Reference Books:

1. Haykin Simon, Digital Communication, Wiley Publications,2013.
2. Information theory and coding, Muralidhar Kulkarni, KS AShiva prakash,2015.
3. JS Chithode, Information theory and coding, Technical publishers, 1st Edition,2014.

Course Outcomes:

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

- Design an Application with Error-Controlcoding
- Use Compression and DecompressionTechniques
- Perform source coding and channelcoding

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		3	0	0	3

DIGITAL SYSTEM DESIGN USING HDL

(Professional Elective 1)

Course objectives:
The student will be able to

- Learn and understand the architectures of Field-programmable GateArrays
- Translate a software application into hardware logic for FPGAarchitectures
- Design synthesizable systems based on industry-standard codingmethods
- Build test benches and create data models to verify bit-true accuratedesigns.

UNIT-I

INTRODUCTION: Hardware Description Languages, FPGA Boards and Software Tools.
Field-Programmable Gate Arrays: Transistor as a Switch, Logic Gates from Switches, FPGA Building Blocks, Layout of the Xilinx Artix-7 XC7A35T FPGA, Input/output Blocks, Configurable Logic Blocks, Interconnect Resources, Block RAM, DSP Slices, Clock Management, The XADC Block, High-Speed Serial I/O Transceivers, Peripheral Component Interconnect Express Interface, FPGA-Based Digital System Design Philosophy, How to Think While Using FPGAs, Advantages and Disadvantages of FPGAs, Usage Areas of FPGAs
Introduction to Verilog: Verilog Fundamentals, Module Representation, Timing and Delays in Modelling, Hierarchical Module Representation, Test bench Formation in Verilog, Structure of a Verilog Test bench File, Displaying TestResults.

UNIT-II

VERILOG DATA TYPES AND OPERATORS: Data Types in Verilog, Net and Variable Data Types, Data Values, Naming a Net or Variable, Defining Constants and Parameters, Defining Vectors, Operators in Verilog, Arithmetic Operators, Concatenation and Replication Operators, Application on Data Types and Operators, FPGA Building Blocks Used in Data Types and Operators, Implementation Details of Vector Operations, Implementation Details of Arithmetic Operations.

UNIT-III

COMBINATIONAL CIRCUITS: Combinational Circuit Analysis, Logic Function Formation between Input and Output, Boolean Algebra, Gate-Level Minimization, Combinational Circuit Implementation, Truth Table-Based Implementation, Combinational Circuit Design.
COMBINATIONAL CIRCUIT BLOCKS: Adders in Verilog, Comparators in Verilog, Decoders in Verilog, Encoders in Verilog, Multiplexers in Verilog, Parity Generators and Checkers in Verilog, Applications on Combinational Circuits, Implementing the Home Alarm System, Implementing the Digital Safe System, Implementing the Car Park Occupied Slot Counting System, FPGA Building Blocks Used in Combinational Circuits.
DATA STORAGE ELEMENTS: Latches in Verilog, Flip-Flops in Verilog, Register, Memory, Read-Only Memory, ROM in Verilog, ROM Formation Using IP Blocks, Random Access

Memory, Application on Data Storage Elements, FPGA Building Blocks Used in Data Storage Elements.

UNIT-IV

SEQUENTIAL CIRCUITS: Sequential Circuit Analysis, State Table, State Diagram, State Representation in Verilog, Timing in Sequential Circuits, Synchronous Operation, Asynchronous Operation, Shift Register as a Sequential Circuit, Shift Registers in Verilog, Multiplication and Division Using Shift Registers, Counter as a Sequential Circuit, Synchronous Counter, Asynchronous Counter, Counters in Verilog, Frequency Division Using Counters, Sequential Circuit Design, Applications on Sequential Circuits.

UNIT-V

DIGITAL INTERFACING: Universal Asynchronous Receiver/Transmitter(UART) in Verilog, UART Applications, Serial Peripheral Interface (SPI) in Verilog, , SPI Application, Inter-Integrated Circuit (I^2C) in Verilog, , I2C Application, Video Graphics Array (VGA) in Verilog, VGA Application, Universal Serial Bus (USB) Receiving Module in Verilog, USB Keyboard Application, Ethernet, FPGA Building Blocks Used in Digital Interfacing.

ADVANCED APPLICATIONS: Vending Machine, Digital Clock, Moving Wave via LEDs, Translator, Air Freshener Dispenser, Obstacle-Avoiding Tank, Intelligent Washing Machine, Non-Touch Paper Towel Dispenser, Car Parking Sensor System. Digital Table Tennis Game.

TEXT BOOKS:

1. CemUnsalan, BoraTar"DigitalSystemDesignwithFPGAImplementationUsing Verilog and VHDL" McGraw-Hill Education,2017
2. Design through Verilog HDL – T.R. Padmanabhan and B. Bala Tripura Sundari, WSE, IEEE Press,2004.

REFERENCES:

1. Advanced Digital Design with Verilog HDL – Michael D. Ciletti, PHI,2005.
2. Fundamentals of Logic Design with Verilog – Stephen. Brown andZvonkoVranesic, TMH,2005.
3. A Verilog Primer – J. Bhasker, BSP,2003.

Course Outcomes:

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

- Understand the architecture of FPGAs, tools used in modelling of digitaldesign
- Analyze and design basic digital circuits with combinatorial and sequential logic circuits using VerilogHDL.
- Model complex digital systems at several levels ofabstractions.
- Design real time applications such as vending machine and washing machinesetc.

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DATASTRUCTURES and ALGORITHMS
(Professional Elective 1)

Course objectives:

- Explain the systematic methods of efficiently organizing and accessing data in data structures andalgorithms.
- Identify the properties and structural patterns in datastructures.
- Apply abstract data types to the design of datastructures.
- Analyze algorithms using a mathematical notation and experimentalstudies.
- Perform comparative analysis of the typical data structures andalgorithms.
- Design and analyze recursive algorithms in datastructures

UNIT – I:

Data Structures Basics: Structure and Problem Solving, Data structures, Datastructure Operations, Algorithm: complexity, Time- spacetrade-off.

Linked List: Introduction, Linked lists, Representation of linked lists in Memory, traversing a linked list, Searching a linked list, Memory allocation and Garbage collection, insertion into linked list, Deletion from a linked list, Types of linkedlist.

UNIT – II:

Stack and Queue: Introduction, Array Representation of Stack, Linked List Representation of stack, Application of stack, Queue, Array Representation of Queue, Linked List Representation of Queue.

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Sequential and Other Representations of Trees, Tree Traversal.

UNIT – III:

Graphs: Matrix Representation of Graphs, List Structures, Other Representations of Graphs, Breadth First Search, Depth First Search, Spanning Trees. Directed Graphs Types of Directed **Graphs;** Binary Relation as a Digraph; Euler's Digraphs; Matrix Representation of Digraphs.

Applications of Graphs: Topological Sorting, Shortest-Path Algorithms – Weighted Shortest Paths – Dijkstra's Algorithm, Minimum spanning tree- Prim's Algorithm, Introduction to NP-Completeness.

UNIT – IV:

Searching and Sorting Techniques: Sorting Techniques – Bubblesort, Merge sort, Selection sort, Heap sort, Insertion Sort, Searching Techniques – SequentialSearching, Binary Searching, Search Trees.

Elementary Algorithms: Notation for Expressing Algorithms; Role and Notation for Comments; Example of an Algorithm; Problems and Instances; Characteristics of anAlgorithm;

Building Blocks of Algorithms; Procedure and Recursion – Procedure, Recursion; Outline of Algorithms; Specification Methods for Algorithms.

UNIT – V:

Mathematical Functions and Notations: Functions and Notations; Modular Arithmetic / Mod Function; Mathematical Expectation in Average Case Analysis; Efficiency of an Algorithm; Well Known Asymptotic Functions and Notations; Analysis of Algorithms – Simple Examples; Well Known Sorting Algorithms – Insertion sort, Bubble sort, Selection sort, Shell sort, Heap sort.

Divide and Conquer: Divide and Conquer Strategy; Binary Search; Max. And Min.; Merge sort; Quick sort. Greedy Method: Greedy Method Strategy; Optimistic Storage on Tapes; Knapsack Problem; Job Sequencing with Deadlines; Optimal Merge Pattern; Single Source ShortlistPaths.

Dynamic Programming: Dynamic Programming Strategy; Multistage Graphs; All Pair Shortest Paths; Travelling Salesman Problems. Backtracking Strategy, 8-Queens Problem, Sum of Subsets, Knapsack Problem.

TEXTBOOKS:

1. Data structures and Algorithm Analysis in C++, M. A. Weiss, 3rdEdition, Addison-Wesley,2005.
2. Data structures in C++, Malik D.S, 2nd Edition, Cengage Learning,2009.
3. Data structures, Richard F.Gilberg andBehrouz A. Forouzan, 2nd Edition, Cengage Learning,2007.

REFERENCE BOOKS:

1. Data Structures and Algorithms: Concepts – Techniques and Applications, G. A. V. Pai, 1st Edition, McGraw HillEducation,2017.
2. Classic Data Structures, Debasis Samanta, 2nd Edition, PHI,2009.
3. Data structures, Seymour Lipschutz, 1st Edition, McGraw Hill Education,2014.

Course Outcomes:

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

- Demonstrate analytical comprehension of concepts such as abstract datatypes
- Analyze various generic programmingtechniques,
- Compare various sorting algorithms and perform their efficiencyanalysis.
- Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate theirsolutions.
- Demonstrate the ability of using generic principles for data representation & manipulation with a view for efficiency, maintainability, andcode-reuse.

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		3	0	0	3

SOFT COMPUTING TECHNIQUES AND PYTHON PROGRAMMING
(Professional Elective 1)

Course Objectives:
The objectives of this course include

- Teach an example of scripting and interpretative language and compare it with classical compiled programminglanguages
- Introduce the student to Python programmingfundamentals
- Expose students to application development and prototyping usingPython
- Learn to apply fundamental problem solvingtechnique
- Introduce the student to soft computing and genetic algorithms with relevantapplications

UNIT-I:
Introduction: History of Python, Need of Python Programming, how a program works, Variables, Operators in python, type conversions, expressions, if, if-elif-else, for, while, break, continue, pass.

UNIT – II:
Types, Data structures and functions: Types - Integers, Strings, Booleans; Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions. Defining Functions, Calling Functions, Passing Arguments, types of arguments, Anonymous Functions, Scope of the Variables in a Function - Global and Local Variables, introduction to modules, creating modules, name spacing.

UNIT –III: Design with classes and GUI - Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, polymorphism, working with instances. GUI Programming, using the tkinter module, display text with label widgets, widgets with frames, button widgets and info dialog boxes, getting input with entry widget, check buttons, radio buttons, Turtle Graphics.

UNIT – IV: Introduction to soft computing and fuzzy systems: Evolutionary computing, soft computing vs hard computing, soft computing methods, recent trends in soft computing, characteristics of soft computing, applications of soft computing, fuzzy sets, fuzzy relations, fuzzy logic, fuzzy rule-based systems

UNIT – V: Genetic Algorithms: Basic concepts, basic operators for genetic algorithms, crossover and mutation properties, genetic algorithm cycle, fitness function. Rough sets, rule induction and discernibility matrix, integration of soft computing techniques.

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TEXT BOOKS :

1. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011, Cengage learning.
2. Think Python First Edition, by Allen B. Downey, O'rielly publishing,2001.
3. Python Programming, vamsi kurama, Pearson,2017.
4. Soft Computing – Advances and applications – Jan 2015 by B.K. Tripathy and J.Anuradha CengageLearning

REFERENCE BOOKS:

1. Introduction to Computation and programming using python. John v. guttag, the MIT press, 2nd Edition,2016.
2. James Payne, beginning python using python 2.6 and python 3, Wrox publishing,2010.

Course Outcomes:

- Understand and comprehend the basics of pythonprogramming.
- Demonstrate the principles of structured programming and be able to describe,design, implement, and test structured programs using currently acceptedmethodology.
- Explain the use of the built-in data structures list, sets, tuples anddictionary.
- Make use of functions and itsapplications.
- Identify real-world applications using oops, files and exceptionhandling provided by python.
- Formulate and implement a program to solve a real-world problem using GUI and Turtle graphics.
- Understand soft computing applications

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

SIMULATION & MATHEMATICAL MODELING
(Professional Elective 1)

OBJECTIVE:
To introduce various system modelling and simulation techniques and highlight their applications in different areas. It includes modelling, design, simulation, planning, verification andvalidation.

UNIT – I:
Introduction to Simulation
When simulation is the appropriate tool and when it is not appropriate; Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study. The basics of Spreadsheet simulation, Simulation example: Simulation of queuing systems in a spreadsheet. General Principles, Simulation software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling; List processing.

UNIT –II:
Mathematical Models
Statistical Models in simulation – Concepts, Discrete Distribution, Continuous Distribution, Poisson Process, Empirical Distributions, Queuing Models – Characteristics, Notation, Queuing Systems, Markovian Models, Generation of Pseudo Random numbers, Properties of random numbers, Techniques for generating random numbers, Testing random number generators, Generating Random-Variates, Inverse Transform technique, Acceptance- Rejection technique, Composition & Convolution Method

UNIT – III:
Analysis of Simulation Data
Input modelling: Data Collection; Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models.
Estimation of Absolute Performance: Types of simulations with respect to output analysis; Stochastic nature of output data; Absolute measures of performance and their estimation; Output analysis for terminating simulations; Output analysis for steady-state simulations.

UNIT – IV:
Verification, Calibration, and Validation
Optimization: Model building, verification and validation; Verification of simulation models; Calibration and validation of models, Optimization via Simulation
Simulation of computer systems and case studies

Simulation tools, Model input, high level computer system simulation, comparison of systems via simulation, simulation programming techniques, development of simulationmodels.

UNIT – V:
Case Studies
City traffic simulation, Indoor air quality simulation of a building, machine health simulation (DC motorhealth)

TEXTBOOKS:

1. Discrete Event System Simulation, Jerry Banks and John S. Carson II, 5thEdition, Pearson,2010.
2. Simulation Modelling and Analysis, Averill M. Law, 4thEdition, McGraw Hill,2007.
3. Introduction to probability models, Sheldon M. Ross, 7th Edition, Academic Press,2000.

REFERENCE BOOKS:

1. Simulation, Sheldon M. Ross, 5th Edition, Elsevier,2012.
2. System Modelling and Simulation – An Introduction, Frank L. Severance, Wiley,2001.
3. System Simulation, Geoffrey and Gordon, 2nd Edition, PHI,2002.
4. Handbook of simulation: Principles, Methodology, Advances, Applications and Practice, Jerry Banks, 1st Edition, Wiley,1998.

Course Outcomes:

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

- Solve real world problems which cannot be solved strictly by mathematicalapproaches.
- Understand the principles within mathematic modelling of materialsscience.
- Demonstrate the ability describe the mathematical components in mechanical and thermal analyses.
- beable to describe the conditions in numerical code for solving stress loadingproblems.

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		0	0	3	1.5

LINEAR INTEGRATED CIRCUITS and APPLICATIONS LAB

List of Experiments: (Minimum Twelve Experiments to be conducted)

1. Study of OP AMPs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning,parameters andSpecifications.
2. OP AMP Applications – Adder, Subtractor, ComparatorCircuits.
3. A. Integrator and DifferentiatorCircuits.
4. B. Waveform Generator using single OP-AMP with variable dutycycle
5. Active Filter Applications – LPF, HPF (firstorder)
6. Active Filter Applications – BPF, Band Reject (Wideband) and NotchFilters.
7. Oscillator Circuits – Phase Shift and Wien Bridge Oscillators using singleOP-AMP
8. Function Generator using OPAMPs.
9. IC 555 Timer – Monostable Operation Circuit, Astable OperationCircuit
10. Design Schmitt Trigger Circuits – using Single OP-AMP with Referencevoltage.
11. PLL Operation and Estimation of Capture and Lockrange.
12. IC 566 – VCOApplications.
13. Design of Dual Power Supply using 78XX and 79XX (use full wave BridgeRectifier
14. with shunt capacitancefilters.

Equipment required for Laboratories:

1. DualTRPS
2. CRO
3. Function Generators1MHz
4. Multi Meters (Digital, FET inputVoltmeters)
5. Analog IC TrainerKits

7. Bread Boards
8. Components: - IC741, IC555, IC565, IC1496, IC723, 7805, 7809, 7912,8038 and other

Essential components:

1. Analog IC Tester.

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Add on Experiments:

1. Design a 4-bit R-2R Ladder network with OP-AMP Buffer and Measure theoutput waveform for various inputcombinations.
2. Construct Waveform Generator using 8038 for a fixed frequency and trace theoutput waveform.
3. Design and Construct ± 12V DC Power Supply using Three terminal VoltageRegulators 7812and7912.

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		0	0	3	1.5

DIGITAL COMMUNICATIONS LAB

List of Experiments: Minimum Twelve Experiments to be conducted:

1. Time divisionmultiplexing.
2. Pulse codemodulation.
3. Differential pulse codemodulation.
4. Deltamodulation.
5. Frequency shiftkeying.
6. Phase shiftkeying.
7. Differential phase shiftkeying.
8. Companding
9. Source Encoder andDecoder
10. Linear Block Code-Encoder andDecoder
11. Binary Cyclic Code - Encoder andDecoder
12. Convolution Code - Encoder andDecoder
13. BCH Codes

Equipment required for Laboratories:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 MHz.
3. Function Generators - 0 – 1 MHz
4. RF Generators - 0 – 1000 M Hz./0 – 100 MHz.
5. Rated Voltmeters andAmmeters
6. Lab Experimental kits for DigitalCommunication
7. Components
8. Breadboards and Multimeters
9. Spectrum Analyzer

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MICROPROCESSOR and MICROCONTROLLERS LAB

List of Experiments:

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

1. Programs for 16 -bit arithmetic operations (using Various AddressingModes).
   a. Addition of n-BCDnumbers.
   b. Multiplication and Divisionoperations.
2. Program for sorting anarray.
3. Program for Factorial of givenn-numbers.
4. Interfacing ADC to8086
5. Interfacing DAC to8086.
6. Interfacing stepper motor to8086.

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 ofn-numbers.
3. Program and verify Timer/ Counter in8051.
4. Interfacing Traffic Light Controller to8051.
5. UART operation in8051
6. Interfacing LCD to8051.

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 binarynumbers.
2. Write an assembly program to find the sum of first 10 integersnumbers.
3. Write a program to toggle LED every second using timerinterrupt.

Equipment Required:

1. Regulated Powersupplies
2. Analog/Digital StorageOscilloscopes
3. 8086 Microprocessorkits
4. 8051 microcontrollerkits
5. ADCmodule
6. DACmodule
7. Stepper motormodule

8. Keyboardmodule
9. LED, 7-SegemtUnits
10. DigitalMultimeters
11. ROM/RAM Interfacemodule
12. Bread Boardetc.
13. ARM CORTEX M3
14. KEIL MDKARM

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		0	0	3	1.5

MINI PROJECT WITH HARDWARE DEVELOPMENT

Mini Project is introduced during V semester. The student may execute the mini project during summer vacation for a period of 6 weeks i.e. between IV and V Semesters. The student shall submit a diary and a technical report for evaluation. This shall be evaluated in the V semester for 50 marks by a committee consisting of external examiner, Head of the Department along with supervisor and two senior faculty members of the Department. Mini Project work may involve carrying out a detailed feasibility study, literature survey along with the implementation results and preparing a work plan for major project. A student shall acquire 1.5 credits assigned, when he/she secures 40% or more marks for the total of 50 marks. In case, if a student fails, he/she shall reappear as and when the VII semester supplementary examinations are conducted.

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

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Course Objectives:
To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledgesystem
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge andprotection
- To know the student traditional knowledge in differentsector

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

- Understand the concept of Traditional knowledge and itsimportance
- Know the need and importance of protecting traditionalknowledge
- Know the various enactments related to the protection of traditionalknowledge
- Understand the concepts of Intellectual property to protect the traditionalknowledge

UNIT I
Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge
Learning Outcomes:
At the end of the unit, the student will able to:

- Understand the traditionalknowledge.
- Contrast and compare characteristics importance kinds of traditionalknowledge.
- Analyze physical and social contexts of traditionalknowledge.
- Evaluate social change on traditionalknowledge.

UNIT II
Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.
Learning Outcomes:
At the end of the unit, the student will able to:

- Know the need of protecting traditionalknowledge.
- Apply significance of tkprotection.

- Analyze the value of tk in globaleconomy.
- Evaluate role ofgovernment

UNIT III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);B:The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand legal framework ofTK.
- Contrast and compare the ST and other traditional forestdwellers
- Analyze plant variantprotections
- Evaluate farmers rightact

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes:

At the end of the unit, the student will ableto:

- Understand TK andIPR
- Apply systems of TKprotection.
- Analyze legal concepts for the protection ofTK.
- Evaluate strategies to increase the protection ofTK.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Learning Outcomes:

At the end of the unit, the student will able to:

- Know TK in differentsectors.
- Apply TK inengineering.
- Analyze TK in varioussectors.
- Evaluate food security and protection of TK in thecountry.

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Reference Books:

1) Traditional Knowledge System in India, by Amit Jha,2009.
2) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan2012.
3) Traditional Knowledge System in India by Amit Jha Atlantic publishers,2002
4) "Knowledge Traditions and Practices of India" Kapil Kapoor, MichelDanino

e-Resources:

1) https://www.youtube.com/watch?v=LZP1StpYEPM
2) http://nptel.ac.in/courses/121106003/