SEMESTER I

SYLLABUS

ANALOG ELECTRONICS			
Course Code:	**EA101**	**Course Credits:**	**4**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Lectures + Tutorials (Hrs./Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45+ 15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
1. To provide information on basic semiconductor device ideas and analog integrated circuit design.
2. To present a wide range of analog design equations and concepts.
3. To analyze and design Multistage transistor amplifier circuit.
4. To identify and discuss the operating principle of differential Amplifier.
5. To design and analyze Integrated circuit Biasing and frequency response of linear Amplifiers.

COURSE OUTCOMES
At the end of the course the students should be able to:
1. Analyze and design critical analog integrated circuit blocks at transistor level.
2. To design single and multistage amplifiers, bias networks and both elementary and advanced operational amplifier.
3. Determine the effect of feedback on circuit operation.
4. Design appropriate feedback network for amplifier and bias circuits.

UNIT- I

Review of semiconductor physics; p-n junction diode: Operation and V-I characteristics, breakdown mechanisms, depletion and diffusion capacitances; diode applications: rectifier, clipper and clamper circuits, Zener diode, Zener diodes as voltage regulator. LED, photodiode, Solar cell.

UNIT- II

Bipolar junction transistor: structure and operation, Input and output characteristics in Common-Base, Common Emitter, and Common Collector configurations, Early-effect. Bias stabilization: The need for stabilization, operating points, ac/dc load lines, Biasing Schemes: Fixed-bias, emitter-feedback bias, Voltage-divider bias; bias stability against variations in Ico, V_{BE}, and β, thermal stability.

UNIT-IV

Methods of coupling, RC coupled amplifier and its frequency response analysis; gain bandwidth calculation for multistage amplifiers; classification of amplifiers, the feedback concept, Effect of negative feedback on transfer gain, input resistances and output resistances of feedback amplifiers, the characteristics of negative feedback amplifiers, Conditions for sustained oscillators, Hartley, RC Phase shift and Wien Bridge Oscillator, Introduction to power amplifiers.

UNIT V

ANALOG ELECTRONICS LAB			
Course Code:	**EA 171**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Labs (Hrs/Week):	**1(2 hrs)**	**Mid Sem. Exam Hours:**	
Total No. of Labs :	**10**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To introduce students to the basic knowledge of KVL and KCL.			
2. To verify various biasing circuits like BJT and FET.			
3. To impart the concepts of frequency response of different types of amplifier circuits.			
4. To make students understand the concept of feedback.			
5. To implement clipper and clamper circuit on bread borad.			

COURSE OUTCOMES
At the end of the course the students should be able to:
1. Recognize and understand the various Electronics component and ICs
2. Able to design and develop basic Analog Electronic Circuits.
3. Able to define the concept of frequency response and feedback in single and multiple stage amplifiers.
4. Student must be able to define the application of Clipper and Clamper Circuit.
5. Develop confidence in plotting the various graphs associated with different biasing and amplifier circuits.

Classification, JFET features, operating point, various biasing approaches, enhancement- and depletion- type MOSFETs, JFET model, JFET amplifier analysis (CD, CS, and CG), CMOS, Introduction to FinFET, SCR, TRAIC, UJT.

LIST OF EXPERIMENTS, BUT NOT LIMITED TO:

1. To verify the configuration of various biasing techniques for BJTs.
2. To determine voltage gain output impedance and output power of a Darlington pair compound amplifier.
3. To determine the "h" parameters of a PNP transistor in common emitter mode.
4. To determine the frequency response of an IFT amplifier.
5. To determine voltage gain and plot the frequency response of a FET amplifier in common source mode.
6. To study the effect of negative feedback on voltage gain & bandwidth in a two stage amplifier
7. To study the V-I characteristics of Zener Diode, and graphical measurement of forward and reverse resistance.
8. To study and design the different type of clipper circuit.
9. To Study the operation of UJT as a Relaxation Oscillator.
10. To study and design of different type of Clamper circuit.
11. To determine voltage gain and plot the frequency response of a single stage, two stage RC coupled and direct coupled amplifiers.

DATA STRUCTURES			
Course Code:	**EA 103**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	U
Course Year (U / P):	**2U**	**Course Semester (U / P):**	3U
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1.To emphasize the importance of appropriate data structure in developing and implementing efficient algorithms			
2.Understand basic data structures such as arrays, stacks, queues, hash tables and linked list			
3.To analyze the asymptotic performance of various algorithms			
4.Solve problems using graphs, trees and heaps			

5.Apply important algorithmic design paradigms and methods of analysis
COURSE OUTCOMES
At the end of the course the students should be able to:
1.Define basic static and dynamic data structures and relevant standard algorithms for them.
2.Select basic data structures and algorithms for autonomous realization of simple programs or program parts.
3.Determine and demonstrate bugs in program, recognise needed basic operations with data structures
4.Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures
5.Evaluate algorithms and data structures in terms of time and memory complexity of basic operations.

UNIT I INTRODUCTION TO DATA STRUCTURES

Abstract data types, sequences as value definitions, data types in C, pointers in C, data structures and C, arrays in C, array as ADT, one dimensional array, Implementing one dimensional array, array as parameters, two dimensional array, structures in C, implementing structures, Unions in C, implementation of unions, structure parameters, allocation of storage and scope of variables, recursive definition and processes: factorial function, fibonacci sequence, recursion in C, efficiency of recursion,hashing: hash function, open hashing, closed hashing: linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

UNIT II STACK, QUEUE AND LINKED LIST

Stack definition and examples, primitive operations, example -representing stacks in C, push and pop operation implementation, queue as ADT, C Implementation of queues, insert operation, priority queue, array implementation of priority queue, inserting and removing nodes from a list-linked implementationof stack, queue and priority queue, other list structures, circular lists: stack and queue as circular list - primitive operations on circular lists, header nodes, doubly linked lists, addition of long positive integers on circular and doubly linked list.

UNIT III TREES

Binary trees: operations on binary trees, applications of binary trees, binary tree representation, node representation of binary trees, implicit array representation of binary tree, binary tree traversal in C, threaded binary tree, representing list as binary tree, finding the Kth element, deleting an element, trees and their applications: C representation of trees, tree traversals, evaluating an expression tree, constructing a tree.

UNIT IV SORTING AND SEARCHING

General background of sorting: efficiency considerations, notations, efficiency of sorting, exchange sorts:bubble sort; quick sort; selection sort; binary tree sort; heap sort, heap as a priority queue, sorting using a heap, heap sort procedure, insertion sorts: simple insertion, shell sort, address calculation sort, merge sort, radix sort,sequential search: indexed sequential search, binary search, interpolation search.

UNIT V GRAPHS

Application of graph, C representation of graphs, transitive closure, Warshall's algorithm, shortest pathalgorithm, linked representation of graphs, Dijkstra's algorithm, graph traversal,

traversal methods forgraphs, spanning forests, undirected graph and their traversals, depth first traversal, application of depthfirst traversal, efficiency of depth first traversal, breadth first traversal, minimum spanning tree, Kruskal's algorithm, round robin algorithm.

Text Books:

1. Aaron M. Tenenbaum, Yeedidyah Langsam, Moshe J. Augenstein, 'Data structures usingC', Pearson Education, 2004 / PHI.

2. E. Balagurusamy, 'Programming in Ansi C', Second Edition, TMH, 2003.

3. Robert L. Kruse, Bruce P. Leung Clovis L.Tondo, 'Data Structures and Program Designin C',Pearson Education, 2000 / PHI.

DATA STRUCTURES LAB			
Course Code:	**EA 173**	**Course Credits:**	**2**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Labs (Hrs/Week):	**2(3 hrs)**		
Total No. of Labs:	**10**	**End Sem. Exam Hours:**	**3**
LAB OBJECTIVES			
1.Introduce the concept of data structures through ADT including List, Stack, Queues .			
2.To design and implement various data structure algorithms.			
3.To introduce various techniques for representation of the data in the real world.			
4.To develop application using data structure algorithms			
5.Compute the complexity of various algorithms.			
LAB OUTCOMES			
At the end of the course the students should be able to:			
1. Select appropriate data structures as applied to specified problem definition			
2.Implement operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures.			
3.Students will be able to implement Linear and Non-Linear data structures.			
4. Implement appropriate sorting/searching technique for given problem.			
5. Design advance data structure using Non-Linear data structure			

List of Experiments:

1. Run time analysis of Fibonacci Series

2. Study and Application of various data Structure

3. Study and Implementation of Array Based Program
   a. Searching (Linear Search, Binary Search)
   b. Sorting (Bubble, Insertion, Selection, Quick, Merge etc)
   c. Merging
4. Implementation of Link List
   a. Creation of Singly link list, Doubly Linked list
   b. Concatenation of Link list
   c. Insertion and Deletion of node in link list

   d. Splitting the link list into two link list
5. Implementation of STACK and QUEUE with the help of
   a. Array
   b. Link List
6. Implementation of Binary Tree
7. Implementation of Binary Search Tree.
8. Write a program to simulate various traversing Technique

9. Representation and Implementation of Graph
   a. Depth First Search
   b. Breadth First Search
   c. Prims Algorithm
   d. Kruskal’s Algorithms

10. Implementation of Hash Table

FUNDAMENTAL OF COMPUTER PROGRAMMING			
Course Code:	**CS101**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To impart a basic understanding of computer architecture, particularly the number system. Overview of operating systems and discussion of computing history			
2. To provide adequate instruction on the use, meaning, and principles of programming and algorithms			
3. Create, implement, and document computerized solutions for a variety of issues utilizing the C language's characteristics			
4. To make it possible to use arrays, structures, functions, and pointers effectively; and to put the ideas of file organization into practice			
5. Learn difference between static and dynamic memory allocation method and also learn various a. dynamic memory allocation methods.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Describe the principles of computers and programming after completing this course			
2. Describe the basics of programming and computers			
3. Use your programming abilities for problem-solving			
4. Understand logic construction			
5. Create and execute C-language computer programs			

UNIT I INTRODUCTION TO COMPUTER AND PROGRAMMING CONCEPTS

Definition, characteristic, generation of computers, basic components of a computer system, memory, input, output and storage units, high level language and low level language, Soft- ware: system software, application software, hardware, firmware, Operating System, compiler, interpreter and assembler, linker, loader, debugger, IDE. Introduction to algorithm and flow chart; representation of algorithm using flow chart symbol, pseudo code, basic algorithm de- sign, characteristics of good algorithm, development of algorithm.

UNIT II INTRODUCTION TO C PROGRAMMING LANGUAGE

Introduction to C programming language, Declaring variables, preprocessor statements, arithmetic operators, programming style, keyboard input, relational operators, introduction, feature of C language, concepts, uses, basic program structure, simple data types, variables, constant, operators, comments, Control flow Statement if, while, for, do-while, switch.

UNIT III DATA TYPES AND STRUCTURES

Bitwise operators, Pre defined and User defined data types, arrays, declaration and opera- tions on arrays, searching and sorting on arrays, types of sorting, 2D arrays, Passing 2D arrays to functions, structure, member accessing, structure and union, array of structures, functions, declaration and use of functions, parameter passing, recurssion

UNIT IV FUNDAMENTAL OF POINTERS

Introduction to pointers, pointer notations in C, Declaration and usages of pointers, operations that can be performed on computers, use of pointers in programming exercises, parameter passing in pointers, call by value, call by references, array and characters using pointers, dynamic memory allocation

UNIT V FILE HANDLING IN C AND ENUM

Introduction to file handling, file operations in C, defining and opening in file, reading a file, closing a file, input output operations on file, counting: characters, tabs , spaces, file opening modes, error handling in input/output operations, Enumerated data types, use of Enum, declaration of Enum

Text Books:

1. C Programming by Herbert Shield
2. C Programming Language 2nd Edition by Brian, W Kernighan Pearson Education.
3. Programming in ANSI C by E. Balagurusamy, Tata Mgraw Hill
4. C Puzzle Book: Puzzles For The C. Programming Language by Alan R Feuer Prentice HallGale
5. Expert C Programming: Deep C Secrets (s) by Peter Van Der Linden Dorling Kindersley India.

COMPUTER PROGRAMMING LAB I			
Course Code:	**CS181**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Labs (Hrs/Week):	**1(2 hrs)**	**Mid Sem. Exam Hours:**	
Total No. of Labs :	**10**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

1. To introduce students to the basic knowledge of programming fundamentals of C language.
2. To impart writing skill of C programming to the students and solving problems.
3. To impart the concepts like looping, array, functions, pointers, file, structure.
4. Write programs to print output on the screen as well as in the files.
5. Apply all the concepts that have been covered in the theory course.

COURSE OUTCOMES

At the end of the course the students should be able to:

1. Recognize and understand the syntax and construction of C programming code
2. Able to design and develop Computer programs, analyzes, and interprets the concept of pointers, declarations, initialization, operations on pointers and their usage.
3. Able to define data types and use them in simple data processing applications also he/she must be able to use the concept of array of structures.
4. Student must be able to define union and enumeration user defined data types.
5. Develop confidence for self-education and ability for life-long learning needed for Computer language.

LIST OF EXPERIMENTS:

1. Write a program for the following:

   a) To find the reverse of a given number.

   b) Calculate factorial of a number using recursion.

2. Write a program to take marks of a student of 5 subjects as an input and print the grade. Also create the same program using switch.

   marks<40 = FAIL
   marks>=40 and <=59 =GOOD

3. Write a program to compute the length of a string using While Loop.

4. Write a program to print the following pattern: -

a) *

```
**
***
****
*****
```

b)

```
     *
   *  *
  *  *  *
 *  *  *   *
```

c)

```
      0
   1  2
  3   4  5
 6   7  8   9
```

5. Write a program to compute and display the product of two matrices.

6. Write a program to illustrate the difference between call by value and call by reference.

7. Write a program to check whether a given string is palindrome or not.

8. Create a structure called STUDENT having name, reg no., class as its field.

Compute the size of structure STUDENT.

9. Write a program to compute the length of a string using pointers.

10. Write a program to create a file, input data and display its content.

INTRODUCTION TO ARTIFICIAL INTELLIGENCE			
Course Code:	**EA 105**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1.Provide a strong foundation of fundamental concepts in Artificial Intelligence			
2.Enable the student to apply these techniques in applications which involve perception, reasoning and learning			
3.Provide a basic exposition to the goals and methods of Artificial Intelligence			
4.Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.			
5.Learn the different machine learning techniques to design AI machine and enveloping applications for real world problems.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1.Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.			
2. Apply these techniques in applications which involve perception, reasoning and learning			
3.Acquire the knowledge of real world Knowledge representation			
4.Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.			
5.To enable the student to apply these techniques in applications which involve perception, reasoning and learning			

UNIT-I INTRODUCTION

Introduction to AI, Components of AI, Goals of AI, Types of AI, History of AI, Turing Test in AI, Advantages and Disadvantages of AI, Intelligence, Intelligent System, Role of IS, Comparison of various IS, Weak AI and Strong AI, Mind Body Problem in AI, Chinese Room Experiment in AI, Parallel and Distributed AI

UNIT-II AGENTS IN AI

Intelligent Agents, Types of AI Agents, Simple Reflex Agent,Model-based reflex agent, Goal-based agents, Utility-based agent, Learning agent, Structure of an AI Agent, Agent Environment in AI, Examples of Agents, Knowledge Engineering, Knowledge Based System, Knowledge Engineering Techniques, Knowledge Engineering Principles, Knowledge Engineering Methodology

UNIT-III SEARCHING TECHNIQUES AND AI PROBLEMS

Searching in AI, Search Algorithm Terminologies, Properties of Search Algorithms, Breadth-first search, Depth-first search, Best First Search, Tic-Tac Toe Problem, Water Jug problem, Chess Problem,Tower of Hanoi problem, Travelling Salesman problem, Monkey and Banana Problem, Magic Square.

UNIT-IV KNOWLEDGE REPRESENTATION

Knowledge Representation Definition, Declarative Knowledge, Procedural knowledge, Meta Knowledge, Heuristic Knowledge, Structural Knowledge, Inheritable Knowledge, Inferential

Knowledge, Relational Knowledge, Explicit Knowledge, Tacit Knowledge, Uncertain Knowledge, Knowledge Storage, Relation between Knowledge and Intelligence, AI knowledge cycle

UNIT V AI TECHNIQUES AND APPLICATIONS

Introduction to Machine Learning, Introduction to Deep Learning, Introduction to Expert system, Introduction to Natural Language Processing, AI in future, AI in social Media, AI in Entertainment andeducation, AI in drones, AI in Automated Computer support, AI in personalized shopping experience, surveillance, Ai in education, AI in health care, AI in E commerce

1. Artificial Intelligence, Elaine Reich: Tata Mcgraw Hill publishing house, 2008.
2. Artificial Intelligence, Ela Kumar, IK Publishing.
3. Artificial Intelligence, Peterson, TataMcGraw Hill, 2008.
4. Artificial Intelligence, Russel and Norvig, Pearson Printice Hall Publication, 2006.
5. Artificial Intelligence, Winston, PHI publication, 2006
6. Artificial Intelligence- A modern approach (3rd Edition) By Stuart Russell & Peter Norvig
7. Artificial Intelligence: The Basics By Kevin Warwick

APPLIED MATHEMATICS			
Course Code:		**Course Credits:**	**4**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To familiarize students with the ideas of matrices, sequences and series.			
2. To equip students with knowledge and abilities in vector calculus and multivariable calculus necessary to design solutions for specific circumstances they could face in everyday engineering challenges.			
3. To teach students limits, continuity and differentiability.			
4. To familiarize students with maxima, minima, and Langrange's Theorem.			
5. To teach students gradient, Divergence, Curl, Gauss and Divergence Theorem.			
COURSE OUTCOMES			
1. The students should be able to: Build a sound foundation and have comprehensive knowledge of matrices, Infinite series, Fourier series, calculus of functions of more than one variable and vector calculus.			
2. Determine the convergence/divergence of an infinite series, approximation of functions and error estimation using Taylor's series expansion.			
3. Learn various concepts and applications of maxima and minima, multiple integrals, gradient, divergence, curl, Green's theorem, Gauss divergence theorem and Stoke's theorem			
4. Evaluate rank, inverse, Eigen values and Eigen vectors of a matrix			

UNIT-I

Matrix Algebra: Elementary operations and their use in getting the rank, Inverse of a matrix and solution of linear simultaneous equations, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian, normal & unitary matrices and their elementary properties, linear transformations, Eigen values and eigenvectors of a matrix, Cayley Hamilton theorem, diagonalization of a matrix

UNIT-II

Sequences and series: Introduction to sequences and Infinite series, tests for convergence/divergence, Limit comparison test, ratio test, root test, Raabe's test, log test, Gauss's test, Cauchy integral test, alternating series, absolute convergence and conditional convergence. Fourier series and its convergence, Fourier half range series.

UNIT-III

Differential Calculus: Functions of several variables: Limits, continuity and Differentiability, Successive differentiation, Leibnitz theorem, Partial differentiation, Euler's Theorem for homogenous equations. Composite functions, Change of variables, Taylor's and Maclaurin's Series, maxima and minima, Lagrange's method of undetermined multiplier.

UNIT-IV

Vector Calculus: Vector point functions, Gradient, Divergence and Curl and their physical interpretation, Line integrals, Multiple Integrals, Change of order of integration, Surface and Volume integrals, Green's, Gauss Divergence and Stoke's theorems (without proof).

TEXT BOOK

1. D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6^{th} Edition, The Jones and
2. Bartlett Learning Publishers, 2016 or latest.

Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 4^{th} Edition, Narosa

3. Publishing House Pvt. Ltd.2012 or latest.

Grewal, B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017 or

4. latest.
5. **Reference Books**
6. George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9^{th} Edition, Pearson Education India, 2010 or latest.
7. Greenberg M., "Advanced Engineering Mathematics", 2^{nd} Edition, Pearson Education, 1998 or latest.

SEMESTER II
SYLLABUS

DIGITAL ELECTRONICS			
Course Code:	**EA 102**	**Course Credits:**	**4**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To understand number representation and conversion between different representation in digital electronic circuits			
2. To analyze logic processes and implement logical operations using combinational logic circuits			
3. To understand characteristics of memory and their classification			
4. Create a relational database, add data to it, and convert the ER-model to relational tables.			
5. Normalize the database design to make it better.			
COURSE OUTCOMES			
1. The students should be able to: 2. Create a digital logic and apply it to solve real life problems.			
3. Analyze, design and implement combinational logic circuits.			
4. Understand different semiconductor memories			
5. To understand concept of Programmable Devices, PLA, PAL, TTL, ECL, CMOS logic families			
6. Analyze, design and implement sequential logic circuits			

Unit I: Minimization of Logic Function
Review of logic gate and Boolean algebra, Standard representation of logical functions, K-map representation and simplification of logical functions using Boolean algebra and K-map method, Quine - McClusky's method, Don't care conditions.

Unit II: Combinational Circuits
Combinational circuit design, adders, subtractor, code converters, magnitude comparators, decoders, encoders, multiplexers, de-multiplexer, parity checker.

Unit III: Sequential Circuits, Shift Registers and Counters
Sequential Circuits: R-S, J-K, D, T Flip-flops, race around condition, Master–Slave flip-flops, Edge triggered Flip Flop, Excitation table of a flip-flop, Analysis and design procedure to a synchronous sequential circuit, Conversion of flip flops from one to another.
Shift Registers: Buffer register, shift operations, SISO, SIPO, PISO, PIPO, and universal shift

registers and applications.

Counters: Ripple counter, Decade counter, Design of Synchronous counters, Programmable, down, Up, mod-m counters, difference between synchronous and asynchronous counters, ring, Johnson, cascade counters and application.

Unit IV: Logic Families

Diode and transistor as a switch, type and specification of digital logic family, RTL, DCTL, DTL,

ECL, TTL and its various types, MOS, CMOS, BiCMOS logic families, Characteristics and comparison of logic families.

Unit V: Semiconductor Memories and D/A and A/D Converters

Semiconductor Memories: Memory organization, Classification and characteristics of memories, sequential memories, RAM – static and dynamic, ROM, PROM, EPROM, EEPROM and Programmable logic arrays.

D/A and A/D Converters : Weighted register D/A converter, binary ladder D/A converter, steady state accuracy test, D/A accuracy and resolution, parallel A/D converter, Counter type A/D converter Successive approximation A/D converter, Single and dual slope A/D converter A/D accuracy and resolution.

Text Books:

1. Malvino, Digital Principle and Applications, TMH
2. R. P. Jain, Modern Digital Electronics, PHI

Reference Books:

1. Malvino, Digital electronics principle, THM
2. R J Tocci, Digital Electronics, PHI
3. Dr A K Gautam, Digital Electronics, Khanna Publication

DIGITAL ELECTRONICS LAB			
Course Code:	**EA 174**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Labs(Hrs/Week):	**2(2Hr)**	**Mid Sem. Exam Hours:**	
Total No. of Lectures (L + T):	**10**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To understand number representation and conversion between different representation in digital electronic circuits			
2. To analyze logic processes and implement logical operations using combinational logic circuits			
3. To understand characteristics of memory and their classification			
4. Create a relational database, add data to it, and convert the ER-model to relational tables.			
5. Normalize the database design to make it better.			
COURSE OUTCOMES			
1. The students should be able to: 2. Create a digital logic and apply it to solve real life problems.			
3. Analyze, design and implement combinational logic circuits			
4. Understand different semiconductor memories			
5. To understand concept of Programmable Devices, PLA, PAL, TTL, ECL, CMOS logic families			
6. Analyze, design and implement sequential logic circuits			

Suggested list of Experiments, but not limited to:

1. To verify the De-Morgan's theorems using NAND/NOR gates.
2. To design the full adder and half adder using AND, OR and X- OR gates.
3. To implement the logic circuits using decoder.
4. To implement the logic circuits using multiplexer.
5. To design parity generator and checker circuits.
6. To design and implement RS FLIP FLOP using basic latches.
7. Realization and testing of basic logic gates using discrete components.
8. Design 4 bit adder using IC 74283.
9. Design multiplexer using logic gates.
10. D-flip-flop using IC 7474, and verify D-flipflop work as toggle.
11. JK flip-flop using IC 7473.
12. Design T flipflop using JK flipflop.
13. Design 3 bit shift register using D-flip-flop.
14. Realization of 2 bit counter using IC 7473.
15. Realization of 3 bit counter using IC 7474.
16. Realization and testing of CMOS IC characteristics.
17. Realization and testing of TTL IC characteristics.
18. Realization and testing of RAM circuit using IC 7489.

SIGNALS AND SYSTEMS			
Course Code:	**EA 104**	**Course Credits:**	**4**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

1. The students will learn basic continuous time and discrete time signals and systems
2. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time
3. Students will also explore to power and energy signals and spectrum
4. Foundation of signals and systems for electrical, electronics and electronics and Communication engineering
5. Create strong foundation of communication and signal processing to be studied in the subsequent semester.

COURSE OUTCOMES

The students should be able to:

1. Understand about various types of signals, classify them, analyse them, and perform various operations on them
2. Understand about various types of systems, classify them, analyse them and understand their response behaviors.
3. Apply transforms in analysis of signals and system

4. Analyse the effects of applying various properties and operations on signals and systems by carrying out simulation

Unit I: Signals and Systems
Continuous-time and discrete-time signals, transformations of the independent variable, Exponential and Sinusoidal signals, Continuous-Time and discrete-Time LTI Systems and their properties, convolution sum and convolution integrals, LTI System described by differential and difference equation.

Unit II: Fourier Series and Fourier Transform
The response of LTI systems to complex exponentials, Fourier series representation of continuous-time, periodic signals and their properties, continuous time and discrete time Fourier transforms and their properties, system, characterized by linear constant coefficient differential equations and difference equation.

Unit III: Time and Frequency Characterization of Signals and Systems
Magnitude phase representation of the Fourier transform, magnitude phase representation of the frequency response of LTI systems, time domain properties of ideal frequency selective filter, time domain and frequency domain aspects of non-ideal filters, first order and second order continuous time and discrete time systems.

Unit IV: Laplace Transformation
Laplace transform, region of convergence, inverse Laplace transform, analysis and characterization of LTI system, block diagram representation, unilateral Laplace transform.

Unit V: Sampling and Z-Transform
Signal representation by samples, sampling theorem, impulse train sampling, sampling of discrete time signals, discrete time processing of continuous time signals., Z-Transform, Region of convergence, Inverse Z-transform, analysis and characterization of LTI system, block diagram representation, Unilateral Z-transform.

Text Books:
[1] Oppenheim, Willsky & Young, Signal and Systems, John Wiley & Sons.
[2] Michael J. Roberts, Fundamental of Signals and Systems, McGraw Hill.

Reference Books:
[3] Simon Haykin, Communication Signal and Systems, John Wiley & Sons.

PROGRAMMING WITH PYTHON			
Course Code:	**EA106**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Lectures + Tutorials (Hrs/Week):	**03 +0**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

1. Master the fundamentals of writing Python scripts.
2. Learn core Python scripting elements such as variables and flow control structures.
3. Discover how to work with lists and sequence data.
4. Write Python functions to facilitate code reuse.
5. Use Python to read and write files.

COURSE OUTCOMES

At the end of the course the students should be able to:

1. Problem solving and programming capability.
2. Explain basic principles of Python programming language
3. Implement database and GUI applications.
4. Implement object oriented concepts
5. Define and demonstrate the use of built-in data structures “lists” and “dictionary”

UNIT I PYTHON BASICS, CONDITIONAL &LOOPS

Installation of Python and python Notebook, Python Objects, Number & Booleans, Strings, Operators - Arithmetic, Bitwise, comparison and Assignment operators, Operators Precedence and associativity. Conditions (If else, if-elif-else), Loops (While, for), Break and Continue statements,Range Functions

UNIT II STRING OBJECTS AND LIST OBJECTS

String object basics, String methods, Splitting and Joining Strings, String format functions, listobject basics, list methods, List comprehensions.

UNIT III TUPLES, SET, DICTIONARIES & FUNCTIONS

Tuples, Sets, Dictionary Object basics, Dictionary Object methods, Dictionary View Objects.Functions basics, Parameter passing, Iterators

UNIT IV OOPS CONCEPTS & WORKING WITH FILES

OOPS basic concepts, creating classes and Objects, Inheritance, Multiple Inheritance, workingwith files, Reading and writing files, Buffered read and write, Other File methods

UNIT V MODULES, EXCEPTION HANDLING & DATABASE PROGRAMMING

Using Standard Module, Creating new modules, Exceptions Handling with Try-except, Creating, Inserting and retrieving Table, Updating and deleting the data.

Text Books:

1. Head First Python 2e: A Brain-Friendly Guide Paperback – Illustrated, 16 by PaulBarry,Oreilly
2. Python: The Complete Reference Paperback – 20 March 2018 by Martin C. Brown(Author), TMH Publication
3. Let Us Python by Yashavant Kanetkar , 1 January 2019, BPB publication
4. Python Programming, A modular approach , First Edition, By PearsonPublicationby Taneja Sheetal and Kumar Naveen , 26 September 2017

PYTHON PROGRAMMING LAB			
Course Code:	**EA172**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Labs (Hrs/Week):	**2(2 hrs)**	**Mid Sem. Exam Hours:**	
Total No. of Labs:	**10**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
1. To introduce students to use of Python programming to solve data analytics problems
2. To elaborate students to statistical analysis using Python programming
3. To describe various libraries required for data analytics
4. To elaborate statistical analysis using Python
5. To study special libraries in Python such as Numpy and Scipy

COURSE OUTCOMES
At the end of the course the students should be able to:
1. Improve problem solving and programming capability
2. Learn data analytics through python programming
3. Underline the use of package
4. Write simple Python programs for solving problems.
5. Decompose a Python program into functions, lists etc.

1. To print the largest/smallest of two numbers
2. To read two numbers x and n and print x^n (first write with the use of operator and then writewith the help of inbuilt function
3. To input the value of x and n and print the sum of the series:a. $1+x+x^2+x^3+x^4+\ldots\ldots.x^n$
4. Write a program to compute distance between two points taking input from the user (PythagoreanTheorem)
5. Write a program to count the numbers of characters in the string and store them in a dictionary datastructure
6. To print factorial of a number with and without using recursion
7. To tell the frequency of the most common word in a file or a given string
8. Write a function to find all duplicates in the list.
9. Write a program to perform addition and multiplication of two square matrices
10. To read from a text file and print each word separated by # symbol, example #vipin # rai

APPLIED COMPUTATIONL STATISTICS			
Course Code:	**EA 108**	**Course Credits:**	**4**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Lectures (Hrs/Week):	**03+01**	**Mid Sem. Exam Hours**	**1.5**
Total No. of Labs:	**45+15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. This course aims at providing the required skill to apply the statistical tools in engineering problems			
2. To introduce the basic concepts of probability and random variables.			
To introduce the basic concepts of two dimensional random variables			
4.To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Conduct simple calculations of probabilities and conditional probabilities, in particular by using methods for independent events.			
2. Give an account of basic properties for random variables and for the most common probability distributions, as well as calculations of expectations and variances for these distributions			
3. Use probabilistic methods in some areas of applications			
4. Explain the basics of statistical surveys and for methods of descriptive statistics.			

UNIT – I

PROBABILITY AND RANDOM VARIABLES

Concept of probability, additive and multiplicative law of probability, total and conditional probabilities, Baye's theorem. Measures of Central Tendency, dispersion, kurtosis, moments. Random Variables, density and distribution functions, mathematical expectation, variance, standard deviation and moment generating function.

TWO – DIMENSIONAL RANDOM VARIABLES

Jointly distributed random variables, Marginal and conditional distributions, Expected values, Covariance and Correlation. Central limit theorem (for independent and identically distributed random variables).

UNIT – II

PROBABILITY DISTRIBUTIONS AND REGRESSION

Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions. Linear Correlation, Correlation Coefficient, Rank Correlation Coefficient, Regression.

UNIT – III

PROBABILITY DISTRIBUTIONS AND REGRESSION

APPLIED STATISTICS

Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and standard deviations. Test of significance for small samples: t- Test for single mean and difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.

UNIT –IV

ROOTS OF NON-LINEAR EQUATIONS:

Bisection method, Regula-Falsi method, Iterative method, Newton-Raphson Method, Graeffe's Root Squaring Method; Rate of convergence and error analysis of the method; Newton-Raphson method for solution of a pair of non-linear equations.

UNIT –V

SOLUTION OF SYSTEM OF LINEAR EQUATIONS:

(i) Direct methods: Gauss Elimination Method without Pivoting and with Pivoting, LU-decomposition method; Ill conditioned linear system; (ii) Iterative Methods: Jacobi and Gauss-Seidel methods, Curve fitting using method of least squares.

Solution of simultaneous, first and second order ordinary differential equations: Picard's method, Taylor's series method, Euler, Modified Euler, Runge-Kutta methods and Milne's method.

Case Study / Implementation of above concepts using Excel.

Text Books

1. Montgomery, Douglas C., and George C. Runger. "Applied Statistics and Probability for Engineers", John Wiley & Sons, 7th Edition (2018) or latest.
2. Sheldon Ross M., Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 6th Edition (2020) or latest.
3. Rukmangadachari E., and Keshava, Reddy E. Probability and Statistics, Pearson Education India (2015) or latest.
4. Ravichandran J., Probability and Statistics for Engineers. Wiley India, 2010.

Reference Books

6. Devore, Jay L. "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage (2010) or latest.

7. Scheaffer, Richard, Madhuri Mulekar, and James McClave. Probability and Statistics For Engineers. Nelson Education, 2010.

8. Meyer, Paul L. Introductory Probability and Statistical Applications. 2nd Edition, Oxford and IBH publishing, 1965.

COMPUTER PROGRAMMING LAB II			
Course Code:	**EA 176**	**Course Credits:**	**2**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Labs (Hrs./Week):	**2(3 hrs)**		
Total No. of Lectures (L + T):	**10**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. Install and set up R and RStudio.			
2. Understand R data types			
3. Understand R data structures			
4. Understand R functions			
5. Understand R Markdown			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1.Access online resources for R and import new function packages into the R workspace			
2.Import, review, manipulate and summarize datasets in R			
3.learn the main R data structures – vector and data frame			
4.Explore datasets to create testable hypotheses and identify appropriate statistical tests			
5.Perform appropriate statistical tests using R			

List of Experiments

1. To know the history and features of R Program/MATLAB.
2. To know the local environment of R Program/MATLAB.
3. Find the transpose of matrix A= $\begin{matrix} 1 & 2 & -9 \\ 2 & -1 & 2 \\ 3 & -4 & 3 \end{matrix}$
4. Find the inverse of a matrix A= $\begin{matrix} 1 & 2 & 3 \\ 2 & 3 & 2 \\ 1 & 2 & 5 \end{matrix}$
5. Find the roots of Equations $6x^2 - 41x^4 + 97x^3 - 97x^2 + 41x - 6$.
6. Compute and plot the pdf of the binomial distribution with 10 trials and the probability of success 0.5.
7. Use the Runge-Kutta method with h=0.1 to find approximate value for the solution of the initial value problem
$$y' + 2y = x^3e^{-2x}, \quad y(0) = 1, \ at\ x = 0.1, 0.2.$$
8. Find Root of an equation $f(x) = x^3 - x - 1$ using Newton Raphson Method, Bisection Method and Regula-Falsi method .

9. Apply the Jacobi method to solve

$$5x_1 - 2x_2 + 3x_3 = -1$$

$$-3x_1 + 9x_2 + x_3 = 2$$

$$2x_1 - x_2 - 7x_3 = 3$$

Continue Iterations until two successive approximations are identical when rounded to three significant digits.

10. Use the Gauss-Seidel method to solve

$$5x_1 - 2x_2 + 3x_3 = -1$$

$$-3x_1 + 9x_2 + x_3 = 2$$

$$2x_1 - x_2 - 7x_3 = 3$$

Choose the initial guess $x_1 = 0, x_2 = 0, x_3 = 0$

Continue Iterations until two successive approximations are identical when rounded to three significant digits

11. A poker-dealing machine is supposed to deal cards at random, as if from an infinite deck. In a test, you counted 1600 cards, and observed the following:

Spades 404
Hearts 420
Diamonds 400
Clubs 376

Could it be that the suits are equally likely? Or are these discrepancies too much to be random? Use Chi-Square testing method.

HISTORY OF SCIENCE & TECHNOLOGY			
Course Code:	**EA 110**	**Course Credits:**	**2**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**2U**
No. of Lectures + Tutorials (Hrs/Week):	**01 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**16 + 00**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

6. This course is designed for undergraduate students, interested in learning about the ancient Indian Technology which is the hallmark of glorious Indian civilization, only living civilization of the world that exists till today.
7. The main emphasis is placed on nature centric aspects of ancient Indian technologies that can be adopted in modern time. As this is an introductory course, care has been taken to present the materials in a gradual manner to instill confidence in the minds of the students
8. Attempts have been made to keep the deliberation as simple as possible with intriguing questions so that students can take exploratory route to learn more about it in future.
9. Adequate emphasis is given in this course for exposing the students to ancient science and technologies which can be adopted for modern technological development.
10. The tenets of various technologies which are essential for human living are discussed in details to encourage the students to develop a feel for ancient Indian and technologies.

COURSE OUTCOMES

At the end of the course the students should be able to:

6. Students will gain an appreciation for the ancient Indian technology and its significance in shaping the Indian civilization, recognizing it as a living heritage that continues to influence modern society.
7. Students will develop an understanding of the nature-centric aspects of ancient Indian technologies and their relevance in addressing contemporary challenges, fostering an appreciation for sustainable and eco-friendly practices.
8. Students will cultivate a sense of curiosity and exploration towards ancient Indian technologies, motivated by intriguing questions and a gradual presentation of materials, leading to a deeper engagement with the subject matter.
9. Students will be equipped with knowledge of ancient scientific and technological advancements, enabling them to recognize their potential for modern technological development and innovation.
10. Students will develop a holistic understanding of various technological tenets essential for human living, fostering a sense of connection and appreciation for the ingenuity and wisdom inherent in ancient Indian technologies.

UNIT I Introduction

Why are ancient Indian science and technology relevant today? What is science? How is it different from technology?
Philosophy of ancient Indian technology, how is different from modern technology? Ancient Indian Scientific methods.
Glimpses of ancient Indian science and technology.

UNIT II Material Technology

Mining, Metals and Metallurgy, Iron Making a craftsmanship, Wootz Steel Technology, Extraction of Zinc in ancient India, Glass making, Bead making Techniques, Ceramic Technology.

UNIT III Agriculture & Water Harvesting System

Water Harvesting Technology, Irrigation Systems, and Town planning, Building construction, Sanitation, Agriculture and Textile Technology.

Text Books:

1. "Science and Technology in Ancient India" by Debiprasad Chattopadhyaya
2. "Indian Science and Technology in the Eighteenth Century" by Dharampal

Reference Books:

1. "A History of Science in World Cultures: Voices of Knowledge" edited by Scott L. Montgomery
2. "Technology of Ancient India" by D. P. Agrawal

SEMESTER III SYLLABUS

COMMUNICATION SYSTEM

B.Tech ECE
Specialization: AI ML **Effective from Batch**
2024-27

Course Code:	**EA201**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

1. To impart a basic understanding of the Communication System, particularly the Amplitude Modulation system. Detailed discussion on various types of amplitude modulation and angle modulation techniques.
2. To provide adequate information on the use of sampling theorem and quantization.
3. To implement communication transmitter and receiver design.
4. To learn baseband and passband communication techniques, line coding techniques, and noise analysis in various transmission environments.
5. After completing the course, students will be able to use analytical techniques to evaluate the performance of analog and digital communication systems.

COURSE OUTCOMES

1. At the end of the course, the students should be able to:
2. Identify the basic elements of a communication system.
3. Analyze baseband signals in time domain and frequency domain
4. Compare and Contrast various analog and digital modulation and demodulation techniques.
5. Evaluate the performance of modulation and demodulation techniques in various transmission environments.
6. Explain the importance of synchronization in the communication system.

UNIT I Introduction & Amplitude Modulation

Overview of communication system, communication channels, need for modulation, baseband and pass band signals.
Amplitude Modulation, Double side band with Carrier (DSB-C), Double side band without Carrier, Single Side Band Modulation, DSBSC, DSB-C, SSB Modulators and Demodulators, Vestigial Side Band (VSB), Quadrature Amplitude Modulator, Frequency division multiplexing, single side band transmission, comparison of various AM systems.

UNIT II Angle Modulation
Angle (Phase and frequency) Modulation, Mathematical Analysis, Deviation sensitivity, Waveforms, Phase deviation and modulation index, Frequency analysis of angle modulated system, Bandwidth requirement of angle modulated system, FM Modulators and Demodulators, Nonlinear effects in FM systems, FM Broadcasting, comparison of angle modulation and amplitude modulation.

UNIT III Sampling & Pulse Modulation
Sampling Theorem, Pulse Amplitude Modulation (PAM), Natural PAM Frequency Spectra for PAM, Flat-top PAM, Sample and hold circuits, Time division Multiplexing, PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM); Pulse Width Modulation(PWM), Pulse Position Modulation (PPM), PPM Demodulator, Quantization, Quantization Error, Pulse Code Modulation, Signal-to-Noise Ratio in PCM, Companding, Differential PCM, Delta Modulation, Adaptive Delta Modulation Slope Overload Error, Granular Noise

UNIT IV Digital Modulation Techniques
Analysis, Generation and Detection, Spectrum and Bandwidth of Amplitude Shift Keying, Binary Phase Shift Keying, Differential Phase Shift Keying, Quadrature Phase Shift Keying, M-ary PSK, Binary Frequency Shift Keying, M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation, Probability of error, bit error rate, Comparison of digital modulation techniques based on probability of error, Matched Filter

UNIT V Line Coding and Random Variables
Probability theory, random variables, statistical averages, the transformation of random variables, random processes, stationary, mean, correlations and covariance functions, ergodicity, power spectral density, and Gaussian process, Line Coding: Unipolar RZ and NRZ, Bipolar RZ and NRZ, AMI, Split Phase etc. Properties for the selection of Line Codes, HDB Signaling, B8ZS Signaling.

Text Books:

1. George Kennedy, Communication System, TMH
2. B. P. Lathi, Modern Digital and Analog Communication System, Oxford University Press.
3. B. Sklar: Digital Communication, Pearson Education
4. Haykin Simon: Digital Communication, Wiley Publication.

Reference Books:

1. Taub Schilling, Principles of Communication Systems, TMH
2. J. G. Proakis, M. Salehi, Communications Systems Engineering, PHI
3. D. Roddy and J. Coolen, Electronic Communications, PHI
4. Schaum’s Outline Series, Analog and Digital Communication

COMMUNICATION SYSTEM LAB			
Course Code:	**EA 271**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Labs (Hrs/Week):	**1(2 hrs)**	**Mid Sem. Exam Hours:**	
Total No. of Labs :	**10**	**End Sem. Exam Hours:**	**2**

COURSE OBJECTIVES

1. To introduce students to the basic knowledge of Matlab Tool.
2. To impart writing skills of Matlab programming and Simulink design to students
3. To integrate theory experiments so that the students appreciate the knowledge gained from the theory course.
4. To design and implement different modulation and demodulation techniques and their applications.
5. To develop Cognitive and behavioral skills for performance analysis of various modulation techniques.

COURSE OUTCOMES

At the end of the course, the students should be able to:

1. Know about the usage of equipment/Components/Software tools used to conduct the experiments in analog and digital modulation techniques.
2. Conduct the experiment based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally.
3. Analyze the performance of a given modulation scheme to find the important metric of the system theoretically.
4. Draw the relevant graphs between important metrics of the system from the observed measurements.
5. Compare the experimental results with that of theoretical ones and infer the conclusion.

LIST OF EXPERIMENTS

1. To study and analyze the waveforms of amplitude modulation using Digital Oscilloscope and Simulink.
2. To perform the Amplitude Modulation and Demodulation of DSB-SC using Simulink.
3. To Study and analyze the waveforms of frequency Modulation using DSO.
4. To study and analyze the phase modulation using DSO.
5. To study frequency and time division multiplexing using generating kits

6. To verify the Sampling Theorem using Matlab programming/Simulink.
7. To generate Modulated and demodulated Amplitude Shift Keying Signal.
8. To generate Modulated and Demodulated Frequency Shift Keying signals.
9. To generate Modulated and Demodulated Phase shift Keying Signal.
10. To generate Modulated and Demodulated QPSK Signal.
11. To Study the circuit of the PAM Modulator and Demodulator.
12. To study the Circuit of the PWM Modulator and Demodulator.
13. To study the circuit of the PPM Modulator and Demodulator.
14. To generate the modulated and demodulated DPSK Signal.

CIRCUIT THEORY			
Course Code:	**EA 203**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Lectures + Tutorials (Hrs/Week):	**3 + 1**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. To make the students capable of analyzing any given electrical network.			
2. To make the students capable of analyzing any given electrical network.			
3. To make the students learn how to synthesize an electrical network from a given impedance/admittance function.			
4. To analyze the behavior of the circuit's response in the time and frequency domain			
5. To understand the significance of network functions.			
6. To understand the concept of graphical solutions to the electrical network			
7. To learn techniques of solving circuits involving different active and passive elements			
8. To learn several powerful engineering circuit analysis techniques such as nodal analysis, mesh analysis, theorems, source transformation, and several methods of simplifying networks.			
9. To analyze various types of filters, attenuators, and two-port networks using network parameters, with different types of connections.			

COURSE OUTCOME
At the end of the course, the students should be able to:
1. Apply the fundamental concepts in solving and analyzing different electrical networks.
2. Analyze the electrical network in different conditions by selecting relevant techniques and apply mathematics in synthesizing the networks in time and frequency domain.
3. Evaluate the performance of a particular network from its analysis. Understand the various laws and theorems related to electric networks.

Unit I: Circuit Concepts and AC Network Theorem

Circuit Concepts: Independent and dependent sources, signals, and waveforms; periodic and singularity voltages, step, ramp, impulse, Doublet. Loop currents and loop equations, node voltage, and node equations.

AC Network Theorem: Super-position theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation Theorem, Tellegen's theorem.

Unit II: Graph Theory

Graph of a network, definitions, tree, co-tree, link, basic loop and basic cut set, incidence matrix, cut set matrix, Tie set matrix, duality, Loop and Node methods of analysis.

Unit III: Two-Port Network

Characterization of LTI two-port networks, Z, Y, ABCD and h-parameters, reciprocity and symmetry. Interrelationships between the parameters, inter-connections of two port networks, Ladder and Lattice networks. T and π representation.

Unit IV: Network Synthesis

Network functions, Impedance & Admittance function, Transfer functions, Relationship between transfer and impulse response, poles and zeros and restrictions, Network function for two terminal pair network, Sinusoidal network in terms of poles & zeros, Real liability condition for impedance synthesis of RL & RC circuits, Network synthesis techniques for 2-terminal network, Foster and Cauer forms.

Unit V: Filter Synthesis

Classification of filters, characteristics impedance and propagation constant of pure reactive network, Ladder network, T section, π −section, terminating half section, Pass bands and stop bands, Design of constant-K, m-derived filters, Composite filters.

Text Books:

[1] D R Choudhury, Network & Systems, New Age International.
[2] Van Valkenberg, Network Analysis & Synthesis, PHI International.

References:
[1] Sudhakar Sham Mohan , Network Analysis and Synthesis, TMH
[2] IVS Iyer, Network Synthesis, TMH
[3] Joseph A. Edminister, Electric Circuits, TMH
[4] A. Chakraborty, Circuit Theory: Analysis and Synthesis, Dhanpat Rai Publisher.

INTRODUCTION TO DATABASE MANAGEMENT SYSTEM			
Course Code:	**EA205**	**Course Credits:**	**3**
Course Category:	**CC**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. Identify and describe the core components of relational database management systems.			
2. Describe the fundamental ideas behind the entity-relationship paradigm and the relational data model.			
3. Create ER models to illustrate straightforward database application situations.			
4. Create a relational database, add data to it, and convert the ER-model to relational tables.			
5. By normalizing the database design, it can be improved.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Understand of database concepts and thorough knowledge of database software's.			
2.Model an application's data requirements using ER diagrams			
3. Write SQL commands to create tables and query data in a relational DBMS			
4. Execute various advanced SQL queries related to transactions, concurrency			
5. Explain the principle of transaction management design.			

UNIT-I DATA BASE SYSTEM
Data base system vs. file system, view of data, database architecture, data abstraction, instances and schemas, data models, ER model, relational model, database languages, DDL, DML, ER diagrams, ER design entities, attributes and entity sets, relationships and relationship sets, additional features of ER model, concept design with the ER model.
UNIT-II RELATIONAL MODEL

Introduction to the relational model, integrity constraint over relations, enforcing integrity constraints, querying relational data, and logical data base design, destroying /altering tables and views, relational algebra and calculus: relational algebra, tuple relational calculus.

UNIT-III BASIC SQL QUERY

Examples of basic SQL queries, nested queries, correlated nested queries set, NULL values, comparison using null values, outer joins, disallowing NULL values, complex integrity constraints in SQL triggers and active data bases.

UNIT-IV SCHEMA REFINEMENT

Problems caused by redundancy, decompositions, problem related to decomposition, reasoning about FDS, FIRST, SECOND, THIRD normal form, BCNF, forth normal form, lossless join decomposition, dependency preserving decomposition, multi valued dependencies

UNIT V OVERVIEW OF TRANSACTION MANAGEMENT

Transactions and schedules, concurrent execution of transaction, lock based concurrency control, performance locking, and transaction support in SQL, crash recovery, concurrency control, Serializability and recoverability, lock management, lock conversions, dealing with dead locks, specialized locking techniques, concurrency without locking, the write, check pointing

TEXT BOOK:

1. Elmasri Navrate, Data Base Management System, Pearson Education, 2008.
2. C. J. Date, Introduction to Database Systems, Pearson Education, 2009.

3. Silberschatz, Korth, Database System Concepts, McGraw hill, 5th edition, 2005.
4. Rob, Coronel & Thomson, Database Systems Design: Implementation and Management, 2009.

DATABASE MANAGEMENT SYSTEM LAB			
Course Code:	**EA 277**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**1U**	**Course Semester (U / P):**	**1U**
No. of Labs (Hrs/Week):	**2(2hr)**	**Mid Sem. Exam Hours:**	
Total No. of Labs	**10**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. Identify and describe the core components of relational database management systems.			
2. Describe the fundamental ideas behind the entity-relationship paradigm and the relational data model.			
3. Create ER models to illustrate straightforward database application situations.			
4. Create a relational database, add data to it, and convert the ER-model to relational tables.			
5. By normalizing the database design, it can be improved.			
COURSE OUTCOMES			
At the end of the course the students should be able to:			

1. Understand of database concepts and thorough knowledge of database software's.
2.Model an application's data requirements using ER diagrams
3. Write SQL commands to create tables and query data in a relational DBMS
4. Execute various advanced SQL queries related to transactions, concurrency
5. Explain the principle of transaction management design.

LIST OF EXPERIMENTS BUT NOT LIMITED TO:

1. Implementation of DDL commands of SQL with suitable examples.
2. Implementation of DML commands of SQL with suitable examples
   i) Insert table ii) Update table iii) Delete Table
3. To implement DCL statements.
4. Implementation of different types of operators in SQL.
5. Basic Study of VB Front-end Tools
6. Implementation of different types of Joins
7. Study & Implementation of
   i) Sub queries ii) Views
8. Study and implementation of different types of constraints
9. To Create a Database/ Table Space
10. To create an ER diagram of the management system

INTRODUCTION TO DATA SCIENCE			
Course Code:	**EA 207**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Lectures + Tutorials (Hrs./Week):	**03 + 01**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45+15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES

1. To make students understand and make inferences based on relations found in the sample, to relations in the population.
2. To Understand basic concepts in Excel
3. Design effective data visualizations to provide new insights into a research question or communicate information to the viewer.
4. Find and select appropriate data that can be used to create a visualization that answers aparticular research question.
5. For each statistical test students should be able to understand how it works, for whatdata and design it is appropriate and how results should be interpreted

COURSE OUTCOMES

At the end of the course the students should be able to:

1. Understand the fundamentals of Data Science and Excel
2. Key concepts in data science, including tools, approaches, and application scenarios
3. State-of-the-art tools to build data-science applications for different types of data, including text and CSV data
4. Work with frequency distribution, mean, covariance, serial correlation, multi-collinearity, conditional probability etc.
5. Analyze data using Sampling Distribution, t-distribution, F-distribution, Chi-Square distribution etc.

UNIT I Introduction

Introduction to Data Science , Evolution of Data Science, Data Science Roles, Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues. A description of the purpose and application of Excel.

UNIT II Data Collection and Data Pre-Processing

Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization, Techniques for sorting and filtering data, including controlling the order of precedence in a sort, advanced filters.

UNIT III Exploratory Data Analytics

Math's basic addition, subtraction, multiplication, division, multi brackets, Powers, Rounding, data set.Totals and counts – SUM (), COUNT() and COUNTA(). Other statistics. Conditional totals and counts. Advanced conditional sums, SUMPRODUCT and array formulas, Change the date system, format, or Automating processes with named ranges.

UNIT IV Model Development

Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

UNIT V Model Evaluation

Generalization Error, Out of Sample Evaluation Metrics, Cross Validation, Over fitting, Under Fittingand Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

REFERENCE BOOKS:

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC

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DATA SCIENCE LAB			
Course Code:	**EA275**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Labs (Hrs./Week):	**1(2 hrs)**		
Total No. of Lectures (L + T):	**10**	**End Sem. Exam Hours:**	**2**
COURSE OBJECTIVES			
1. Install python and explore features of various packages.			
2. Design and construct simple programs by using the concepts of various Libraries like Numpy, Scipy.			
3. To have a broad idea about using various data Set.			
4. To enhance programming skills while improving their practical knowledge using data set from different websites.			
5. To strengthen the practical ability to use suitable libraries and functions and for real time applications			
COURSE OUTCOMES			
At the end of the course the students should be able to:			
1. Students will be able to install Python on their systems and become familiar with its features and functionalities.			
2. Students will gain proficiency in designing and constructing programs using concepts from libraries such as NumPy and SciPy.			
3. Students will acquire a broad understanding of different types of data sets and their characteristics.			
4. Students will enhance their programming skills by working with real-world data sets sourced from different websites and domains.			
5. Students will strengthen their practical abilities by utilizing suitable libraries and functions for real-time applications.			

List of Experiments:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and

Pandas Packages.

2. Write a python code to implement the concepts of Numpy array.
3. Write a python code to implement the concepts of Pandas Dataframe .
4. Develop python program for Basic plots using Matplotlib.
5. Write a python program for frequency distribution.
6. Develop python program for Variability.
7. Develop python program for Averages.
8. Write a python program for Normal Curves.
9. Develop Python Program for Correlation and Scatter Plot.

9. Write a python program for Correlation Coefficient.

10. Develop python program for Linear Regression.

LINEAR INTEGRATED CIRCUITS			
Course Code:	**EA209**	**Course Credits:**	**3**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**3U**
No. of Lectures + Tutorials (Hrs/Week):	**03 + 00**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 00**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
11. To introduce the fundamentals of operational amplifiers (Op-Amps) and their applications in electronic circuits.			
12. To analyse the internal circuitry of Op-Amps, understand their ideal and practical models, and			

	characterize their behavior.
13.	To study the various configurations of Op-Amp circuits, including inverting and non-inverting amplifiers, current mirrors, active loads, level shifters, and output stages.
14.	To explore the characteristics of Op-Amps such as DC/AC characteristics, common-mode rejection ratio (CMRR), power supply rejection ratio (PSRR), and compensating techniques.
15.	To investigate frequency response and compensation techniques in Op-Amp circuits and interpret Op-Amp data sheets.
COURSE OUTCOMES	
At the end of the course the students should be able to:	
11.	Analyze and design basic Op-Amp circuits such as inverting and non-inverting amplifiers, current mirrors, and active loads, understanding their transfer characteristics and performance metrics.
12.	Implement various Op-Amp applications including summing/averaging amplifiers, difference amplifiers, instrumentation amplifiers, integrators, differentiators, voltage-to-current converters, current-to-voltage converters, comparators, Schmitt triggers, log/antilog circuits, precision rectifiers, clippers, and clampers
13.	Design and analyze waveform generator circuits using Op-Amps, including sine wave generators based on Barkhausen criterion, phase shift, Wein Bridge, and oscillator circuits such as Hartley, Colpitts, LC, RC, and crystal oscillators.
14.	Utilize Op-Amps in astable and monostable multivibrator configurations for square wave generation, ramp generation, triangular wave generation, and sawtooth wave generation.
15.	Understand and design active RC filters, including low-pass, high-pass, band-pass, and band-reject filters, employing idealistic and realistic responses and implementing higher-order filters

UNIT I Introduction to OP-AMP

Introduction to Op-Amp, Op-Amp models (Ideal & Practical), Analysis of internal circuit of OpAmp, Inverting & non-inverting amplifier, Transfer characteristics, ADM, ACM, CMRR, Current mirror, Active load, Level Shifter, Output Stages, IC 741 Op-Amp. Op-Amp Characteristics, DC/AC characteristics, Compensating techniques, Slew rate, CMRR, PSRR. Frequency Response and Compensation techniques, Op- Amp Data Sheet.

UNIT II General Applications

Op-Amp Applications: Summing/Averaging Amplifier, Difference Amplifier, Instrumentation amplifier, Integrator, Differentiator, Voltage-to-Current converters: Floating load and grounded load, Current-to-Voltage converters, Current amplifier, Comparator, Schmitt trigger, Log/antilog circuits using Op-Amp, Precision rectifiers. OP-AMP Clippers and Clampers.

UNIT III Waveform Generators

Sine wave generation (Barkhausen criterion, Phase shift, Wein bridge, Hartley, Colpitts, LC, RC & Crystal oscillators), OP-AMP as an Astable Multivibrator (Square wave generator), Monostable Multivibrator, Ramp generator, Triangular wave generator, Saw tooth wave generator. Voltage-controlled Oscillator, **555** Timer: Pin configuration, Block diagram, application as Monostable and

Astable Multivibrator.

UNIT IV Filters

Active RC filters, Idealistic and realistic response of filters (LP, BP, and HP), First order LP, Butterworth filter, Second order LP Butterworth filter, First order HP Butterworth filter, Second order HP Butterworth filter,
Higher order filters, Band pass filter, Band reject filters, All pass filter. Phase-Locked Loops: Operating principle, Monolithic PLL: 565 IC and PLL applications.

UNIT V Regulators and Converters

IC Regulators: Introduction, Analysis and design of regulators using 78XX and 723 monolithic ICs, Current limiting and Current foldback techniques using IC 723. Peak Detector, Sample and Hold Circuits, IC Data Converters: Introduction, Weighted Resistor DAC, Inverted R-2R Ladder DAC, Flash ADC, successive approximation ADC and dual slope ADC, DAC and ADC specifications, operational transconductance amplifier, introduction and its application as voltage amplifier, integrator, differentiator, filter, Schmitt trigger, and oscillator.

Text Books:

6. R. A. Gayakward, "Op-Amps and Linear Integrated Circuit" PHI (latest edition).
7. D. Roychaudhary, and S. B. Jain, "Linear Integrated Circuits" New Age International – 2018 (latest edition).
8. Albert Malvino, David J. Bates, "Electronic principles", 8th Edition, 2015 (latest edition).

Reference Books:

1. Sedra and Smith, "Microelectronic Circuits", 7th Edition, Oxford University Press, 2010 (latest edition).
2. David A. Bell, "*Operational Amplifiers and Linear ICs*," 3/e, Oxford Publications, 2011
3. Sergio Franco, "*Design with Operational Amplifiers and Analog Integrated Circuits*," 3/e, TMH, 2008.

SEMESTER IV
SYLLABUS

ELECTROMAGNETIC FIELD THEORY			
Course Code:	**EA202**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures + Tutorials (Hrs/Week):	**3L + 1T**	**Mid Sem. Exam Hours:**	**1**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
1. To understand the fundamental concepts of electric and magnetic fields.
2. To apply Maxwell's equations to different configurations and boundary conditions.
3. To analyze the behavior of electromagnetic waves in various media.
4. To evaluate the performance of antennas and transmission lines.
5. To develop the ability to model and solve complex electromagnetic problems.

COURSE OUTCOME
At the end of the course, the students should be able to:
1. Understand and Apply Fundamental concepts.
2. Analyze and Utilize Maxwell's Equations.
3. Analyze Electromagnetic Wave Behavior.
4. Evaluate Antennas and Transmission Lines Performance.
5. Solve complex Electromagnetic Problems.

Unit 1: Electrostatics

Topics: Coulomb's Law, Electric Field Intensity- Field due to continuous charge distributions – line, surface, and volume charge distributions, Electric Flux Density, Gauss's Law-: Application in spherical, cylindrical, and planar symmetries, Electric Potential, Capacitance- Capacitance calculations for parallel plate, spherical, and cylindrical capacitors; energy stored in an electric field.

Unit 2: Magnetostatics

Topics: Biot-Savart Law- Magnetic field due to current elements, straight and circular conductors., Ampere's Law- Magnetic field calculations for simple configurations, solenoids, and toroids., Magnetic Field Intensity- Force on a moving charge, force on a differential current element, Magnetic Flux Density: Relation with magnetic field intensity, magnetic circuits, Magnetic Materials: Classification, hysteresis, permeability and susceptibility, Inductance: Mutual and self-inductance, energy in magnetic fields.

Unit 3: Electromagnetic Induction and Maxwell's Equations

Topics: Faraday's Law, Lenz's Law, Electromagnetic induction, induced EMF, Displacement Current, Maxwell's Equations- Integral and differential forms, physical interpretation, boundary conditions, Applications of Maxwell's Equations: Wave equations, electromagnetic field relations

Unit 4: Electromagnetic Waves

Topics: Wave Equations, Wave Propagation in Free Space and Dielectrics, Wave Propagation: In dielectrics, conductors, polarization, Reflection and Refraction: Snell's law, critical angle, total internal reflection, Transmission line equations, impedance matching, Smith chart.

Unit 5: Antennas and Waveguides

Topics: Antenna Fundamentals, Radiation Patterns, Antenna Types- Dipole, Yagi-Uda, parabolic, horn antennas, Waveguides-Modes of propagation, cut-off frequencies, impedance considerations, Practical Applications: Satellite communication, radar systems, wireless networks.

Textbooks:

1. "Elements of Electromagnetics" by Matthew N.O. Sadiku
2. "Engineering Electromagnetics" by William H. Hayt and John A. Buck.

Reference books:

1. "Field and Wave Electromagnetics" by David K. Cheng
2. "Time-Harmonic Electromagnetic Fields" by Roger F. Harrington

DIGITAL LOGIC DESIGN USING VERILOG			
Course Code:	**EA204**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures + Tutorials (Hrs/Week):	**3L + 1T**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1. Understand the ASIC design flow and the architecture of Xilinx Virtex series FPGAs.			
2. Apply principles of Hardware Description Languages to model digital circuits.			
3. Analyze and design digital systems using gate-level and dataflow modeling in Verilog.			
4. Create and evaluate complex digital systems using behavioral modeling techniques.			
5. Implement tasks, functions, and user-defined primitives to optimize digital designs.			
6. Design, test, and debug complex digital systems such as adders, decoders, and finite state machines using Verilog.			
COURSE OUTCOME			
At the end of the course the students should be able to:			
1 Understand the role and principles of Hardware Description Languages.			
2 Apply gate primitives in Verilog to model simple digital circuits.			
3 Design complex digital systems using behavioral modeling constructs.			
4 Utilize task and function constructs to simplify and modularize digital designs.			
5 Evaluate and optimize digital designs for efficiency and performance.			
6 Synthesize complex digital systems that meet specified requirements using a combination of Verilog modeling techniques.			

Unit 1

ASIC Design Flow, Architecture and configuration of (Xilinx) Virtex series FPGA, Principles Hardware Description Languages, Y-Chart, Types of HDLs, Introduction to Verilog, Language Constructs, Modeling styles.

Unit 2

Gate Level Modeling: Modeling using Verilog gate primitives, description of various gates, fall, rise and turn off delays, min, max and typical delay. Dataflow modeling: Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

Unit 3

Behavioral Modeling: Structured procedures, initial and always, blocking and non-blocking statements delay control, Conditional Statements, Multi-way branching statement loops, Procedural statements, stratified event queue, sequential and parallel blocks, Delay based timing control, event-based timing control, Level sensitive timing control, sequential and parallel blocks

Unit 4

Introduction to Task and functions, difference between task and functions, Task declaration and invocation, Function declaration and Invocation, Assign-de assigned construct, force release constructs, and User defined primitives.

Unit 5

Design of Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter. Finite state machine, state table, Mealy FSM, Moore FSM

Text Books:

1. Verilog HDL by Samir Palnitkar, Pearson Pub.
2. M. Ercegovac, T. Lang and L.J. Moreno, ”Introduction to Digital Systems”, Wiley,2000

Reference Books:

1. Digital Design by Frank Vahid, Wiley, 20063.
2. Introduction to Digital Systems by M. Ercegovac, T. Lang and L.J. Moreno, Wiley, 2000.
3. Fundamentals of digital Logic with Verilog design by S. Brown & Z. Vransesic, TMH.
4. Design through Verilog HDL by T.R. Padmanabhan& B. Bala Tripura Sundari, Wiley Pub. 2007

B.Tech ECE
Specialization: AI ML **Effective from Batch 2024-27**

DIGITAL LOGIC DESIGN LAB			
Course Code:	**EA 274**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Labs (Hrs/Week):	**1(2 Hrs)**	**Mid Sem. Exam Hours:**	
Total No. of Labs :	**10**	**End Sem. Exam Hours:**	**2**
COURSE OBJECTIVES			
1. Design and simulate basic digital logic gates and circuits using Verilog HDL.			
2. Implement and verify the functionality of combinational and sequential logic circuits, including adders, subtractors, multiplexers, and flip-flops.			
3. Analyze and debug digital circuits using waveform verification techniques.			
4. Apply Verilog HDL to design complex digital systems like decoders, encoders, and parity checkers.			
5. Gain hands-on experience with FPGA technology for implementing and testing Verilog-based designs.			
COURSE OUTCOMES			
At the end of the course, the students should be able to:			
1. Apply Verilog HDL to design and simulate basic digital logic gates.			
2. Design and verify half adders and subtractors using Verilog HDL.			
3. Implement decoders and encoders in Verilog HDL and verify their operations through waveforms.			
4. Demonstrate understanding of data selection and routing in digital systems through simulation results.			
5. Design even and odd parity checkers to understand error detection mechanisms.			

List of Experiments

1. To design and verify the waveform for basic gates using Verilog HDL.
2. To design and verify the waveform for half adder and half subtractor.
3. Design full adder and full subtractor using Verilog HDL.
4. Design and verify the waveform for decoder and encoder using Verilog HDL.
5. Design multiplexer and demultiplexer using Verilog HDL.
6. To verify the waveform for S-R flipflop using Verilog HDL.
7. To verify the waveform for D and T flip-flop.
8. To verify the waveform for even and odd parity checker using verilog HDL.
9. Study and practical exposure of FPGA using Verilog HDL.
10. To verify functionality of basic gates using FPGA.

INTERNET OF THINGS			
Course Code:	**EA206**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures + Tutorials (Hrs/Week):	**3L + 1T**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**
COURSE OBJECTIVES			
1 To create understanding of various concepts of Internet of things IOT			
2 To learn the architectures of IOT			
3 To Understand and analyze various protocols in the domain area			
4 Conceptualize the application of IOT			
COURSE OUTCOME			
At the end of the course the students should be able to:			
1 Differentiate between traditional, adhoc and wireless sensor network and IOT.			
2 Use the concepts for conceptualizing modern day networks			
3 Explore various research domains in IOT and their protocols			
4 Develop the architectures of IOT based applications			

UNIT I Basics of IoT

Definition, building blocks of IoT, conceptual framework, M2M communication and IoT, IoT connectivity and communication APIs, role of sensor networks in IoT (sensing and actuation), vision of 5G and Next generation networks

UNIT II Reference Architecture & Protocols of IoT

Layered architecture of IoT, layer wise description of IoT protocols, IEEE standards, wired and wireless protocols for enabling IoT specific to each layer

UNIT III Data Analytics & Computing in IoT

Concept of Data analytics, Introduction to Big Data, Introduction of Machine Learning for IoT , Fog Computing, Edge Computing and Cloud Computing

UNIT IV Developing IoT Solutions and Security

Introduction to different IoT tools (hardware): arduino, Raspberry pi, node MCU, Implementation of IoT with IoT tools, Introduction to IoT operating systems (software): Contiki, Packet Tracer ; **Security in IoT:** An introduction to the basic aspects of security in IoT

UNIT V IoT Applications

Smart Home, Smart Healthcare, Smart Environmental monitoring, Structural Health Monitoring (SHM) in IoT, Smart Metering, Smart Transportation and logistics, Smart Industrial applications, IoT Challenges & Open Research Issues

Text Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things", First edition, Pearson Education (Cisco Press Indian Reprint)
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, First edition,2014

REFERENCE BOOKS:

3. Honbu Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC press, First edition, 2012
4. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things- Key applications and protocols", Wiley, 2012
5. Michael Miller, "The Internet of Things", QUE Publishing, 2015
6. Peter Waher, "Learning Internet of Things", Packt Publishing, 2015

INTERNET OF THINGS LAB			
Course Code:	**EA272**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures (Hrs/Week):	**1(02 Hrs)**		
Total No. of Labs:	**10**	**End Sem. Exam Hours:**	**2**

LIST OF EXPERIMENTS:

1. Basics of sensor networks, IoT, 6LoWPAN nodes (used in IoT applications), OS Contiki, Network Simulator COOJA, Download and Installation of Contiki (OS for IoT), Creation of Virtual Machine, Download and Installation of VM Player.

2. Initialization of Network Simulator COOJA, Understanding of all windows on simulator, study the Mote Configuration, Program the Motes so that all motes display "Hello World" on the output window, Change the values in files to display any desired output by all the motes.

3. Create a network topology having 5 motes of similar configuration. Program them to broadcast the data. Capture the broadcasted packets and analyze the values of various headers like IPv6, using analyzer. Repeat the program by changing the transmission range of all motes and observe the effect.

4. Create a complete wireless sensor network (WSN) topology having 6 motes. Configure 1 mote as Border Router and rest of the 5 motes as sender Motes. Go to the browser and check for the values of routing table of your WSN.

5. Create a Client-Server network topology having 8 motes. Configure 2 motes as server and 6 motes as client. Capture the packets and generate its pcap files. Analyze the captured packets using packet analyzer tool Wireshark.

6. Study of MoteWorks Network Landscape for deployment of wireless sensor network. Study of TinyOS and nesC.

7. Study of MoteConfig and MoteView. Program the motes using MoteConfig and create a live sensor network. Connect the live sensor network to a local PC and analyze the results using Moteview.

8. To study and verify the self-healing property of wireless sensor network.

9. Introduction to Cisco Packet Tracer and configuring various network devices, hosts & transmission media. Study of components of IoT and basic implementation of IoT network on packet tracer.

10. To deploy a home automation application and perform remote monitoring and control of home appliances.

Mini Project (Not Compulsory): Create an IoT application of Street Light System where the LEDs will glow automatically when luminosity is less than desired value and switch off when sufficient light is present.

MACHINE LEARNING			
Course Code:	**EA208**	**Course Credits:**	**4**
Course Category:	**CC-L**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures + Tutorials (Hrs/Week):	**03L + 01T**	**Mid Sem. Exam Hours:**	**1.5**
Total No. of Lectures (L + T):	**45 + 15**	**End Sem. Exam Hours:**	**3**

COURSE OBJECTIVES
16. To introduce fundamental concepts and applications of machine learning.
17. To make students familiarize with various machine learning paradigms.
18. To enable understanding and implementation of data preprocessing techniques.
19. To provide knowledge of classification algorithms and ensemble learning.
20. To introduce unsupervised learning and clustering techniques.
COURSE OUTCOMES
At the end of the course the students should be able to:
16. Demonstrate understanding of machine learning fundamentals.
17. Identify and formulate well-posed problems for machine learning.
18. Implement data preprocessing techniques effectively.
19. Apply classification algorithms and evaluate ensemble learning methods.
20. Analyze data using unsupervised learning and clustering algorithms.

UNIT I Machine Learning Fundamentals

Introduction to machine learning, Well-Posed Problems in ML, Machine Learning Process, designing a Learning System, Types of Machine Learning: Supervised, unsupervised, semi-supervised, and reinforcement learning paradigms, Machine learning Applications: healthcare, finance, engineering, and beyond, Feature Selection and Visualization, Testing ML Algorithms.

UNIT II Data Cleaning and Processing Techniques

Data Cleaning, Preprocessing Techniques: handling missing values, dealing with outliers, normalization, and standardization, Feature Selection and Extraction, Data Visualization for ML, Dealing with Categorical Data.

UNIT III Classification Algorithms

The Brain and The Neuron, Neural Networks, The Perceptron, Linear Separability, The Multilayer Perceptron, Forward and Back-error propagation, Case studies on Neural Networks, Learning with Decision Tree, ID3, CART, Ensemble Learning, Boosting, AdaBoost , Bagging, Random Forest. k-Nearest Neighbor Classification, Support Vector Machines, Naive Bayes classifiers, Case studies on various classifiers.

UNIT IV Unsupervised Learning and Clustering Techniques

Unsupervised Learning, Clustering, K-Means Clustering, Hierarchical Clustering, Partitioning methods, Distribution based clustering, Density based clustering, fuzzy clustering, Evaluation Parameters for Unsupervised Learning.

UNIT V Machine Learning Applications

Signal Processing: Signal denoising, filtering, feature extraction and classification, Speech Recognition and Natural Language Processing, Image and Video Processing, Predictive Maintenance in Electronics, Fault Detection and Diagnosis, Spectrum Sensing and Cognitive Radio, Security and Authentication in Communication Systems, Predictive Analytics in Network Management.

Text Books:

9. Alpaydin E. "Introduction to machine learning". MIT press; 2020 Mar 24.
10. Stephen Marsland, Machine Learning: An Algorithmic Perspective, Chapman and Hall/CRC; 2nd edition (8 October 2014)
11. Little MA. Machine learning for signal processing: data science, algorithms, and computational statistics. Oxford University Press; 2019 Aug 13.
12. Jurafsky D. Speech & language processing. Pearson Education India; 2000.

Reference Books:

1. Murphy KP. "Machine learning: a probabilistic perspective" MIT press; 2012 Sep 7.
2. Goodfellow I, Bengio Y, Courville A. Deep learning. MIT press; 2016 Nov 10.
3. Raschka S. Python machine learning. Packt publishing ltd; 2015 Sep 23.
4. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, Springer; 2nd ed. 2009, Corr. 9th printing 2017 edition (19 April 2017)
5. Yuheng Jia, Ying-Chang Liang, Yonghui Li "Machine Learning and its Applications in Wireless Communications".
6. Mark A. Richards "Radar Signal Processing and Machine Learning".

MACHINE LEARNING LAB			
Course Code:	**EA276**	**Course Credits:**	**1**
Course Category:	**CC-P**	**Course (U / P)**	**U**
Course Year (U / P):	**2U**	**Course Semester (U / P):**	**4U**
No. of Lectures (Hrs/Week):	**1(02 Hrs)**		
Total No. of Labs:	**10**	**End Sem. Exam Hours:**	**2**

LIST OF EXPERIMENTS

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML.
2. Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. To understand the principles of wavelet-transform and its application in denoising signals corrupted by noise.

5. To learn techniques for extracting informative features from signals and apply them for signal classification tasks.
6. To implement deep learning-based techniques for denoising images and evaluate their effectiveness.
7. To explore transfer learning techniques in image classification tasks and analyze the performance of pre-trained models.
8. To implement an HMM-based speech recognition system and evaluate its accuracy in recognizing spoken words or phrases.
9. To extract acoustic features from speech signals and train a machine learning model to recognize emotions conveyed in speech.
10. To classify different modulation schemes in wireless communication systems using machine learning techniques.
11. To implement algorithms for channel estimation and equalization and analyze their performance in mitigating channel distortions.
12. To detect abnormal network behavior using machine learning-based anomaly detection techniques.
13. To predict network performance metrics using regression models trained on historical network data.
14. To process radar signals and implement algorithms for detecting and localizing targets in radar scenarios.
15. To estimate target velocities and detect moving targets using Doppler processing techniques in radar communication.