Semester-III

S.No.	Course Type	Course Code	Course Title	Hrs./ Week			Credits
				L	T	P	
1	BSC	MA03	Probability and Statistics	2	1	-	3
2	PCC	CS01	Data Communication	3	-	-	3
3	PCC	CS02	Data Structure and Algorithm	2	1	-	3
4	PCC	CS03	Computer Organization and Architecture	2	1	-	3
5	HSMC	HS04	Entrepreneurship and Principles of Management	1	-	-	1
6	LC	CS01(P)	Data Communication Lab	-	-	2	1
7	LC	CS02(P)	Data Structure and Algorithm Lab	-	-	4	2
8	LC	CS03(P)	Computer Organization and Architecture Lab	-	-	2	1
9	SBC	CS01(P)	Programming Practices (C++)	-	-	4	2
10	PROJ	CS01	Seminar	-	-	2	1
11	LLC	LLC02	Liberal Learning Course-II	Credit to be added in fourth Semester			
12	MLC	MLC01	Professional Laws, Ethics, Gender, Human Values and Harmony	1	-	-	Audit
						Total Credits	20

- **Liberal Learning Course-II, LLC01 (Any One Course from NCC/NSO/NCA)**

NCC

NSO

- Any one Sports at State Level

NCA

- Music
- Dance
- Photography
- Cinematography
- Podcasting
- Theatre
- Painting etc.

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III Semester

PCC- CS01	Data Communication	3L: 0T: 0P (3 hrs.)	3 Credits

Prerequisite: Mathematics, Basics of Electronics

Course Objective: The course is designed to cover the fundamentals, principles, concepts, and techniques of analog and digital communication systems like various modulation techniques, data transmission, and communication technologies. And to understand the basic technologies used in data communication like mode of communication, interfacing of devices, medium of communication and detection and correction of errors occurs during data transmission.

Course Content:

Module 1: **(08 Hrs.)**

Signals and Systems: Introduction of a communication system, signal-definition, types of signals. System definition, classification of systems. Modulation, need of modulation, types of modulation techniques, AM modulators, advantages and disadvantages of AM. Demodulation of AM. Introduction and types of angle modulation, frequency modulation, frequency deviation, modulation index, deviation ratio. Phase modulation, difference between FM and PM.

Module 2: **(08 Hrs.)**

Sampling of signal: sampling theorem. Types of sampling, Aperture effect, PAM, Digital signal, Quantization, Pulse code modulation (PCM), Data rate and Baud rate, Bit rate, Delta Modulation (DM) and Adaptive Delta Modulation (ADM), comparison of various systems. Digital modulations Techniques: Amplitude shift keying (ASK), Binary Phase Shift keying (BPSK), Differential phase shift keying (DPSK), offset and non-offset Quadrature phase shift keying (QPSK), , Binary frequency Shift Keying (BFSK).

Module 3: **(08 Hrs.)**

Introduction to data communication: Components, data representation, OSI model and function of each layer, data representation, Serial & Parallel transmission, Modes of data transmission, Study of various types of topology and their comparative study. Line Encoding: Unipolar, Polar, Bipolar & block codes.

Module 4: **(08 Hrs.)**

Physical Layer: Introduction, Interface, Standards, EIA-232-D, RJ-45, RJ-11, BNC connector & EIA-449 digital Interface: Connection, specifications & configuration, X.21. Modem: Types, features. Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM. Switched Communication Networks: Circuit, Message, Packet & Hybrid Switching.

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Module 5: **(8 Hrs.)**

Transmission Errors: Content Error, flow integrity error, methods of error control, Error detection, Error correction, Bit error rate, Error detection methods: Parity checking, Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum .

Course Outcomes:

Students earned credits will develop ability to

1. Understand the concept of Analog modulation techniques.
2. Understand the concept of Digital modulation techniques.
3. Illustrate the different modes of data transmission, encoding techniques.
4. Illustrate the interfacing and connecting devices, different types of multiplexing technique and switching techniques.
5. Analyze the problem of errors in communication and technique of error detection and corrections in transmission.

List of Text/Reference Book:

1. Singh & Sapre, “Communication Systems”, TMH.
2 . Taub Schilling, “Principles of Communication Systems”, TMH.
3. B. P. Lathi, “Modern Analog and Digital Communication Systems” Oxford University press.
4. Behrouz A Forouzan, “Data communication and networking”, 4th edition, McGrawHil Education, 2017.
5. Tanenbaum A. S., “Computer Networks”, Pearson Education, 5th edition, 2011.
6. William Stallings, “Data & Computer Communication”, Pearson Education, 8th edition, 2006.

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III Semester

PCC- CS02	**Data Structure & Algorithm**	**2L: 1T: 0P (3 hrs.)**	**3 Credits**

Prerequisite: Programming for Problem Solving.

Course Objective:

The objective of this course is to understand different types of data structures and algorithms used in program.

Course contents:

Module 1: **(10 hrs.)**

Review of C programming language. Introduction to Data Structure: Concepts of Data and Information, Classification of Data structures, Abstract Data Types, Implementation aspects: Memory representation. Analysis of algorithm: Time Complexity and Space Complexity, Data structures operations and its cost estimation, Basic of Asymptotic notation. Introduction to linear data structures- Arrays, String, representation & Operations, Linked List: Representation of linked list in memory, different implementation of linked list. Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation using linked list, etc.

Module 2: **(10 hrs.)**

Stacks: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue, Queue simulation, Application of queues.

Module 3: **(10 hrs.)**

Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search, AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B* tree and red-black tree.

Module 4: **(08 hrs.)**

Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST)- Kruskal, Prim's algorithms. Dijkstra's shortest path algorithm; Comparison between different graph algorithms. Application of graphs.

Module 5: **(08 hrs.)**

Sorting: Introduction, Classification of sorting method, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Case Study: Application of various data structures in operating system, DBMS etc.

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III Semester

Course Outcome:

1. Understand basic data structures such as arrays, linked lists, stacks and queues
2. Introduce the concept of data structures through ADT including List, Stack, Queues.
3. Understand the basic operations of trees and its types.
4. Understand the basic concept of graph and its operations.
5. Demonstrate and implement searching sorting algorithms.

List of Text / Reference Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures" ComputerScience Press.
2. Mark Allen Weiss "Algorithms, Data Structures, and Problem Solving withC++" , Pearson Education (US) 1996.
3. R. G. Dromey "How to Solve it by Computer", 2nd Impression by, PHI.
4. AM Tanenbaum, Y Langsam& MJ Augustein, "Data structure using C and C++",2nd Ed., 2006 , Prentice Hall India.
5. Robert Kruse, Bruse Leung, "Data structures & Program Design in C", 2nd Ed.,1997, Pearson Education.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Pearson Education.
7. Richard, GilbergBehrouz, Forouzan ,"Data structure – A Pseudocode Approachwith C", 2nd Ed., Thomson press.

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III Semester

PCC- CS03	**Computer Organization and Architecture**	**2L : 1T : 0P (3 hrs.)**	**3 credits**

Prerequisite: Basic Electronics Engineering.

Course Objective:

Students to be familiarize the basic principles of computer architecture, Design and Multi Processing, Types of data transfer, Concept of semi conductor memories which is useful for research work in field Computer System.

Course Contents:

Module 1: **(10 hrs.)**

Basic Structure of Computer: Structure of Desktop Computers, CPU: General Register Organization-Memory Register, Instruction Register, Control Word, Stack Organization, Instruction Format, ALU, I/O System, bus, CPU and Memory Program Counter, Bus Structure, Register Transfer Language-Bus and Memory Transfer, addressing modes. Control Unit Organization: Basic Concept of Instruction, Instruction Types, Micro Instruction Formats, Fetch and Execution cycle, Hardwired control unit, Micro- programmed Control unit micro program sequencer Control Memory, Sequencing and Execution of Micro Instruction.

Module 2: **(08 hrs.)**

Computer Arithmetic: Addition and Subtraction, Tools Compliment Representation, Signed Addition and Subtraction, Multiplication and division, Booths Algorithm, Division Operation, Floating Point Arithmetic Operation, Number concept 1's and 2's complement representation, addition and subtraction using 2's complement.

Module 3: **(08 hrs.)**

I/O Organization: I/O Interface–PCI Bus, SCSI Bus, USB, Data Transfer: Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, Direct Memory Access (DMA), I/O Processor.

Module 4: **(08 hrs.)**

Memory Organization: Main memory-RAM, ROM, Secondary Memory –Magnetic Tape, Disk, Optical Storage, Cache Memory: Cache Structure and Design, Mapping Scheme, Replacement Algorithm, Improving Cache Performance, Virtual Memory, memory management hardware.

Module 5: **(08 hrs.)**

Multiprocessors: Characteristics of Multiprocessor, Inter-Processor Communication and Synchronization. Memory in Multiprocessor System, Concept of Pipelining, Vector Processing, Array Processing, RISC And CISC, Study of Multicore Processor –Intel, AMD.

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III Semester

Course Outcome:

1. Explain the basic structure & components of the computer system, Microprogrammed Control Unit.
2. Demonstrate the concepts of computer arithmetic.
3. Explain the input output organization of the computer system.
4. Illustrate memory organization and memory management techniques.
5. State the core concepts of multiprocessor and pipelining.

List of Text / Reference Books:

1. Morris Mano , "Computer System Architecture " 3rd Ed., 2007, PHI
2. Alan Clements: "Computer Organization and Architecture", 2012, Cengage Learning
3. Subrata Ghosal: "Computer Architecture and Organization", 2011, Pearson Education
4. William stalling ,"Computer Organization and Architecture" 10th Ed., 2016, Pearson Education
5. M. Usha, T.S. Shrikant: "Computer System Architecture & Organization", 2019,Willey India
6. Chaudhuri, P.Pal: "Computer Organization and Design", 3rd Ed. PHI

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III Semester

LC CS01(P)	**Data Communication Lab**	**0L : 0T : 2P (2 hrs.)**	**1 credits**

Prerequisite: Mathematics, Basics of Electronics

Course Objective: The course is designed to cover the fundamentals, principles, concepts, and techniques of analog and digital communication systems like various modulation techniques, data transmission, and communication technologies. And to understand the basic technologies used in data communication like mode of communication, interfacing of devices, medium of communication and detection and correction of errors occurs during data transmission.

Course Content:

Module 1: **(08 Hrs.)**

Modulation, types of modulation techniques, AM modulators, Demodulation of AM. Introduction and types of angle modulation, frequency modulation.

Module 2: **(08 Hrs.)**

Digital signal, Quantization, Pulse code modulation (PCM), Digital modulations Techniques: Amplitude shift keying (ASK), Binary Phase Shift keying (BPSK), Differential phase shift keying (DPSK), offset and non-offset Quadrature phase shift keying (QPSK), , Binary frequency Shift Keying (BFSK).

Module 3: **(08 Hrs.)**

Introduction to data communication: Components, data representation, data representation, Serial & Parallel transmission, Modes of data transmission, Study of various types of topology and their comparative study. Line Encoding: Unipolar, Polar, Bipolar & block codes.

Module 4: **(08 Hrs.)**

Multiplexing: FDM, TDM, WDM, Synchronous & Statistical TDM.

Module 5: **(8 Hrs.)**

Transmission Errors: Content Error, flow integrity error, methods of error control, Error detection, Error correction, Bit error rate, Error detection methods: Parity checking, Checksum Error Detection, Cyclic Redundancy Check, Hamming code, Interleaved codes, Block Parity, Convolution code, Hardware Implementation, Checksum .

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III Semester

Course Outcomes:

Students earned credits will develop ability to

1. Understand the concept of Analog modulation techniques.
2. Understand the concept of Digital modulation techniques.
3. Illustrate the different modes of data transmission.
4. Illustrate the different encoding techniques.
5. Illustrate the multiplexing technique.

List of Experiment:

1. To perform & analyze AM Modulation and Demodulation (Envelope Detector).
2. o perform & analyze Frequency modulation using varactor modulator.
3. To perform & analyze Pulse Code Modulation and Demodulation.
4. To perform & analyze Amplitude Shift Keying.
5. To perform & analyze Frequency Shift Keying.
6. To perform & analyze Quadrature phase shift keying.
7. To perform & analyze Line Coding Technique.
8. To perform & analyze Time Division Multiplexing.
9. To perform & analyze serial communication using RS- 232, RJ, and Fiber optics.
10. To perform & analyze Parallel Communication.

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III Semester

LC –CS02(P)	**Data Structure and Algorithm Lab.**	**0L: 0T: 4P (4 hrs.)**	**2 credits**

Prerequisite: Programming for Problem Solving.

Course Objective:

The objective of this course is to understand different types of data structures and algorithms used in program.

Course Contents:

Module 1:
Arrays, String, &their representation & Operations. Linked List: Representation of linked list in memory, different implementation of linked list. Circular linked list, doubly linked list, etc.

Module 2:
Stacks: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion, Example of recursion.

Module 3:
Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dequeue and Priority Queue, Queue simulation, Application of queues.

Module 4:
Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search, Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS)

Module 5:
Sorting: Introduction, Classification of sorting method, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods.

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III Semester

Course Outcomes:

1. Understand basic data structures such as arrays, linked lists.
2. Introduce the concept of data structures through ADT including stack.
3. Understand the basic operations of Queues.
4. Understand the basic concept of Tree and Graph and their operations.
5. Demonstrate and implement searching sorting algorithms.

List of Text / Reference Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures" ComputerScience Press.
2. Mark Allen Weiss "Algorithms, Data Structures, and Problem Solving with C++" , Pearson Education (US) 1996
3. R. G. Dromey "How to Solve it by Computer", 2nd Impression by, PHI
4. AM Tanenbaum, Y Langsam& MJ Augustein, "Data structure using C and C++", 2nd Ed., 2006 , Prentice Hall India.
5. Robert Kruse, Bruse Leung, "Data structures & Program Design in C", 2nd Ed.,1997, Pearson Education.
6. Aho, Hopcroft, Ullman, "Data Structures and Algorithms", Pearson Education.
7. Richard, GilbergBehrouz, Forouzan ,"Data structure – A Pseudocode Approach with C", 2nd Ed., Thomson press.

List of Experiments:

Write a Program:

1. To perform insertion and deletion operations on array.(CO1)
2. To perform multiplication operation on matrix.(CO1)
3. To implement single linked list.(CO1)
4. To implement doubly linked list.(CO1)
5. To calculate factorial of number using recursion.(CO2)
6. To demonstrate static implementation of stack.(CO2)
7. To demonstrate dynamic implementation of stack.(CO2)
8. To demonstrate static implementation of Linear queue.(CO3)
9. To demonstrate dynamic implementation of Linear queue. (CO3)
10. To implement circular queue. (CO3)
11. To implement binary search tree. (CO4)
12. To perform BFS and DFS operations on graph. (CO4)
13. To perform binary search operation. (CO4)
14. To perform sorting operation using bubble sort. (CO5)
15. To perform sorting operation using insertion sort. (CO5)

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III Semester

LC- CS03(P)	**Computer Organization and Architecture Lab**	**0L: 0T: 2P (2 hrs.)**	**1 credits**

Prerequisite: Basic Electronics Engineering.

Course Objective:

Students to be familiarize the basic principles of computer architecture, Design and Multi Processing, Types of data transfer, Concept of semi conductor memories which is useful for research work in field Computer System.

Course Contents:

Module 1:
Introduction to Desktop Computers, Introduction to 8085 microprocessor,8085 Instruction set, Flags, Logic Gates, Combinational circuits, Multiplexer , Demultiplexer.

Module 2:
Introduction to Binary number systems, 1's & 2's Complement, Arithmetic Operations, Half adder, Half subtractor, Full Adder and Full Subtractor .

Module 3:
Introduction to Assembly Language, Programming Arithmetic and Logic Operations, Shift Operations, Program Loops.

Module 4:
Memory Hierarchy, Main Memory, Types of Memory, Memory Allocation Methods, Virtual Memory, Page Replacement Algorithms.

Module 5:
Characteristics of Multiprocessor, RISC And CISC, Study of Multicore Processor –Intel, AMD.

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III Semester

Course Outcome:

1. Explain the basic structure & components of the computer system, 8085 Micro Processor.
2. Demonstrate the concepts of computer arithmetic.
3. Demonstrate the concepts of Assembly Language.
4. Illustrate memory organization and memory management techniques.
5. State the core concepts of multiprocessor.

List of Text / Reference Books:

1. Morris Mano , "Computer System Architecture " 3rd Ed., 2007, PHI
2. Alan Clements: "Computer Organization and Architecture", 2012, Cengage Learning
3. Subrata Ghosal: "Computer Architecture and Organization", 2011, Pearson Education
4. William stalling ,"Computer Organization and Architecture" 10th Ed., 2016, Pearson Education
5. M. Usha, T.S. Shrikant: "Computer System Architecture & Organization", 2019,Willey India
6. Chaudhuri, P.Pal: "Computer Organization and Design", 3rd Ed. PHI

List of Experiments:

1. Case study of Desktop Computers.(CO1)
2. Study of Multiplexer and Demultiplexer. (CO1)
3. Write a Program to demonstrate Flags in microprocessor 8085. (CO1)
4. Study of Half Adder and Half Subtractor. (CO2)
5. Study of Full Adder and Full Subtractor. (CO2)
6. Write a program to add the contents of memory locations 4000H and 4001H and place the result in memory location 4002H. (CO3)
7. Write a program to multiply two 8-bit numbers stored in memory locations 2200H and 2201H by repetitive addition and store the result in memory locations 2300H and 2301H. (CO3)
8. Program for simulate memory allocation strategies (First fit, Best fit, Worst fit). (CO4)
9. Programs for page replacement algorithms. (CO4)
10. Case study of RISC and CISC. (CO5)

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III Semester

SBC-CS01(P)	**Programming Practices (C++)**	**0L: 0T: 4P (4 hrs.)**	**2 credits**

Prerequisite: C-language Course Objective:

Interpret good knowledge in C++ programming language and enable them to build Programs.

Course Contents:

Module 1:
Introduction of C++, Programming paradigms, Language translator, Structure of C++ program. Declaration, Expression and statements: Data types, Variables, Constants, Operator and expression, Operator precedence and associativity & Control statements.

Module 2:
Array: Declaration & Initialization, 2-D Array & Multidimensional Array. Function: Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading, Default argument, Parameter passing, Recursion, Scope of variable, Return-by-value and Return-by-reference.

Module 3:
Class: Class, Members, Constructor and destructor, Copy constructor, parameterized constructor, Static member, Scope of class names. Dynamic memory management: Operators new and delete.

Module 4:
Introduction, Polymorphism, Overloading, Parametric and inclusion polymorphism Inheritance: inheritance and Types of inheritance, Virtual base class, Virtual function, Abstract class, Overriding and hiding, Dynamic binding of functions.

Module 5:
Class template, Member function inclusion, Function template, Specialization, Inheritance, Namespace. Concept of exception handling, Catch block, Nested try-catch block, Condition expression in throw expression, Constructor & destructor, Runtime standard exception. Standard library function, Input and output, Iostream class hierarchy, Class ios, Other stream classes, Basics of file handling.

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III Semester

Course Outcomes:

1. Understand expression and statements and apply them in solving Problems.
2. Explain and be able to use array and function in writing programs.
3. Explain and be able to use class in writing programs.
4. Explain and be able to use Polymorphism and Inheritance in writing programs.
5. Explain and be able to use template and exception handling in writing programs

List of Text / Reference Books:

1. B. Stroutstrup "The C++ Programming Language", 3rd Edition, 2002, PearsonEducation.
2. Josée Lajoie and Stanley B. Lippman "C++ Primer", 3rd Edition, Addison Wesley
3. E.Balagurusamy "Object Oriented Programming with C++ ", 7e, TMH
4. Rajesh K.Shukla "Object Oriented Programming in C++", Wiley India

List of Experiments:

Write a C++ Program:

1. To display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of classobjects. Read and display the contents of the array.(CO1)
2. To declare Structure. Initialize and display contents of member variables. (CO2)
3. To declare a class. Declare pointer to class. Initialize and display the contents of the classmember. (CO3)
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members. (CO3)
5. To read the data of N employee and compute Net salary of each employee (DA=52% ofBasic andIncome Tax (IT) =30% of the gross salary). (CO3)
6. To illustrate the concepts of console I/O operations. (CO3)
7. To use scope resolution operator. Display the various values of the same. (CO1)
8. To allocate memory using new operator. (CO3)
9. To create multilevel inheritance. (Hint: Classes A1, A2, A3). (CO4)
10. To create an array of pointers. Invoke functions using array objects. (CO2)
11. To use pointer for both base and derived classes and call the member function. Use Virtual keyword. (CO4)
12. To implement a file handling program for demonstration of database connectivity. (CO5)
13. To make a small project using C++.(CO5)