IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
Scheme Based on AICTE Flexible Curriculum

Department of Computer Science & Engineering

Bachelor of Technology (B.Tech.)

Computer Science & Engineering (IOT)

III Semester

S. No.	Course Type	Course Code	Course Title	Scheme			Credits
				L	T	P	
1	BSC	MA04	Discrete Structure	2	1	–	3
2	PCC	IO01	Analog and Digital Electronics	2	1	–	3
3	PCC	IO02	Data Structure & Algorithms	3	1	–	4
4	PCC	IO03	Computer System Organization	2	1	–	3
5	PCC	IO04	Object Oriented Concept	3	–	–	3
6	HSMC	HS03	Innovation and Creativity	–	–	2	1
7	LC	IO01(P)	Analog and Digital Electronics Lab	–	–	2	1
8	LC	IO02(P)	Data Structure & Algorithms Lab	–	–	2	1
9	LC	IO03(P)	Computer System Organization Lab	–	–	2	1
10	LC	IO04(P)	Object oriented concept Lab (C++)	–	–	2	1
11	LLC	LLC02	Liberal Learning Course –II (NCC/NSO/NCA)	–	–	2	–
12	MLC	MLC01	Professional Laws, Ethics, Gender, Human value and Harmony	1	–	–	*Audit
Total Academic Engagement and Credits				**13**	**4**	**12**	**21**
				29			

Note:

- **Liberal Learning Course-II, LLC02(Any One Course from NCC/NSO/NCA)**

A. NCC

B. NSO

- Anyone Sports at State Level

C. NCA

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

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III Semester

MA04	Discrete Structure	2L:1T:0P(3hrs.)	3 Credits

Prerequisite: Nil

Course Objective: This course introduces the applications of discrete mathematics in the field of computer science. It covers sets, logic, proving techniques, combinatory, functions, relations, Graph theory and algebraic structures.

Course Contents:

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

Set Theory, Relation, Function, Theorem Proving Techniques : Set Theory: Definition of sets, countable and uncountable sets, Venn Diagrams, proofs of some general identities on sets Relation: Definition, types of relation, composition of relations, Pictorial representation of relation, Equivalence relation, Partial ordering relation, Job- Scheduling problem Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle. Theorem proving Techniques: Mathematical induction, Proof by contradiction.

Module 2: **(8hrs.)**

Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, example and standard results, Rings and Fields: definition and standard results.

Module 3: **(8hrs.)**

Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers.

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

Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs.

Module 5: **(10hrs.)**

Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices.

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Combinatorics: Introduction, Permutation and combination, Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions, Generating functions, Solution by method of generating functions.

Course Outcome:

1. Describe sets, relations, functions and mathematical induction.
2. Formulate and solve Groups and Rings problems
3. Apply Propositional logic and finite state automata to solve problems
4. Apply the Concepts of Graph theory to Solve real world problems.
5. Formulate and solve Poset and recurrence relations.

List of Text/Reference Books:

1. L. Liu, “Elements of Discrete Mathematics” Tata McGraw-Hill Edition.
2. J Trembley, R Manohar; “Discrete Mathematical Structure with Application CS”, 2001 McGraw Hill.
3. Kenneth H. Rosen, “Discrete Mathematics and its applications”, 7th Ed., McGraw Hill.
4. R K Bisht, H S Dhami, “Discrete Mathematics”,2015, Oxford University Press
5. P C Biswal, “Discrete Mathematics & Graph Theory”, 4th Ed. , PHI

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III Semester

IO02	Data Structure & Algorithms	3L:1T:0P(4hrs.)	4 Credits

Prerequisite: C language

Course Objective: The objective of this course is to understand different types of data structures and algorithms used in programs.

Course Contents:

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

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: **(10hrs.)**

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 D queue and Priority Queue, Queue simulation, Application of queues.

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

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, Btree, B+ tree, B*tree and red-black tree.

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

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.

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

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 systems, DBMS etc.

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” Computer Science Press.
2. Mark Allen Weiss “Algorithms, Data Structures, and Problem Solving with C++”, Pearson Education (US) 1996
3. R.G. Dromey“HowtoSolveitbyComputer”,2ndImpressionby,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, Gilberg Behrouz, Forouzan ,“Data structure – A Pseudocode Approach with C”, 2nd Ed., Thomson press.

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III Semester

IO03	Computer System Organization	2L: 1T: 0P (3 hrs.)	3 Credits

Prerequisite: Basic electronics and computer

Course Objective: Students to be familiarize the basic principles of computer architecture, Design and Multiprocessing, Types of data transfer, Concept of semiconductor memories which is useful for research work in field Computer System.

Course Contents:

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

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 Microinstruction.

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

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'scomplement.

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

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: **(08hrs.)**

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: **(08hrs.)**

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III Semester

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 Multi core Processor–Intel, AMD.

Course Outcome:

1. Explain the basic structure & components of the computer system, Micro programmed 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:"ComputerOrganizationandDesign",3rd Ed.PHI

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III Semester

IO04	Object Oriented Concept	3L:0T:0P(3hrs.)	3 Credits

Prerequisite: C language

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

Course Contents:

Module 1: **(10hrs.)**
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 associatively & Control statements.

Module 2: **(08hrs.)**
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: **(08hrs.)**
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: **(08hrs.)**
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: **(08hrs.)**
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, IO stream class hierarchy, Class ios, Other stream classes, Basics of file handling.

Course Outcome:

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III Semester

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, Pearson Education.
2. Josée Lajoie and Stanley B. Lippman "C++ Primer", 3rd Edition, Addison Wesley
3. Balagurusamy "Object Oriented Programming with C++ ", 7e, TMH
4. Rajesh K. Shukla "Object Oriented Programming in C++", Wiley India

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III Semester

IO02(P)	Data Structure & Algorithm Lab	0L:0T:2P(2hrs.)	1Credit

Prerequisite: C language

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

Course Contents:

Module 1: **(4hrs.)**
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: **(4hrs.)**
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: **(4hrs.)**
Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of D equeue and Priority Queue, Queue simulation, Application of queues.

Module 4: **(4hrs.)**
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: **(6hrs.)**
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 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" Computer Science Press.
2. Mark Allen Weiss "Algorithms, Data Structures, and Problem Solving with C++", Pearson Education (US) 1996
3. R.G. Dromey"HowtoSolveitbyComputer",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, Gilberg Behrouz, Forouzan ,"Data structure – A Pseudo code Approach with C", 2nd Ed., Thomson press.

List of Experiments:

Write a Program:

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

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III Semester

IO03(P)	**Computer System Organization Lab**	**0L: 0T: 2P (2 hrs.)**	**1 Credit**

Prerequisite: Basic Electronics and computer

Course Objective:

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

Course Contents:

Module 1: **(4hrs.)**

Introduction to Desktop Computers, Introduction to 8085 microprocessor,8085 Instruction set, Flags, Logic Gates, Combinational circuits, Multiplexer, De-multiplexer.

Module 2: **(4hrs.)**

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

Module 3: **(4hrs.)**

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

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

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

Module 5: **(6hrs.)**

Characteristics of Multiprocessor, RISC and CISC, Study of Multi core Processor–Intel, AMD.

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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, WilleyIndia
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

IO04(P)	Object Oriented Concept Lab	0L:0T:2P(2 hrs.)	1Credit

Prerequisite: C language

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

Course Contents:

Module 1: **(4hrs.)**
Introduction of C++, Programming paradigms, Language translator, Structure of C++ program.

Module 2: **(4hrs.)**
Array: Declaration & Initialization, 2-D Array & Multidimensional Array. Function: Declaration, Definition and call, Inline function, Main function argument, Reference variable, Function overloading.

Module 3: **(4hrs.)**
Class: Class, Members, Constructor and destructor, Copy constructor, parameterized constructor, Static member.

Module 4: **(4hrs.)**
Introduction, Polymorphism, Overloading, Parametric and inclusion polymorphism Inheritance: inheritance, types of inheritance and its programming

Module 5: **(6hrs.)**
Class template, Member function inclusion, Function template, Specialization, Inheritance, Namespace. Concept of exception handling.

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III Semester

Course Outcome:

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

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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 class objects. Read and display the contents of the array.
2. To declare Struct. Initialize and display contents of member variables.
3. To declare a class. Declare pointer to class. Initialize and display the contents of the class member.
4. Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5. To read the data of N employee and compute Net salary of each employee (DA=52% of Basic and income Tax (IT) =30% of the gross salary).
6. To illustrate the concepts of console I/O operations.
7. To use scope resolution operator. Display the various values of the same to allocate memory using new operator.
8. To create multilevel inheritance. (Hint: Classes A1, A2, A3)
9. To create an array of pointers. Invoke functions using array objects.
10. To use pointer for both base and derived classes and call the member function. Use Virtual keyword.
11. To implement a file handling program for demonstration of database connectivity.
12. To make a small project using C++.