Syllabi of
Departmental Courses (DC) Courses
B.Tech II Semester
For batch admitted 2023-24
(Computer Science and Engineering)
Under Flexible Curriculum

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.)
(A Govt. Aided UGC Autonomous Institute Affiliated to RGPV, Bhopal)
NAAC Accredited with A+ + Grade

Department of Computer Science and Engineering

DATA STRUCTURES
(3150221) (DC)

COURSE OBJECTIVES

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit-I

Introduction to Data Structures: Algorithms & their characteristics, asymptotic notations. arrays and its representations, index to address translation. **Link list:** Introduction, implementation of linked list, operations, circular link list, doubly linked list, polynomial manipulation using linked list

Unit-II

Stacks: Concepts and implementation of stacks, operations on stack, conversion of infix to postfix notation, evaluation of postfix expression, recursion.

Queues: Concepts and implementation, operations on queues, dequeue, priority queues, circular queues and application.

Unit-III

Trees: Types, terminology, binary tree -representations, traversal, conversion of general tree to binary tree, binary search tree, threaded binary tree and height balanced tree.

Unit-IV

Searching & Sorting: Linear search, binary search, bubble sort, selection sort, insertion sort, quick sort, merge sort, radix sort and heap sort, comparison between sorting techniques, hashing and collision resolution techniques.

Unit-V

Graphs: Background, graph theory terminologies, representation of graphs- sequential & linked representation, path matrix, graph traversals- BFS, DFS, spanning trees, applications of graph.

RECOMMENDED BOOKS

- Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2nd Edition.
- An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
- Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

COURSE OUTCOMES

After completion of this course, the students would be able to:

1. **Describe** the basics of Algorithms and their performance criteria's.
2. **Explain** the working of linear/Non Linear data structures.
3. **Identify** the appropriate data structure to solve specific problems.
4. **Analyze** the performance of various Data Structures & their applications.
5. **Evaluate** the time/space complexities of various data structures & their applications.

DATA STRUCTURES
(3150221) (DC)
List of Experiments

Write C/C++ Programs to illustrate the concept of the following:

1. Implementation of Array and linked list.
2. Implementation of Sorting Algorithms-Non-Recursive and Recursive.
3. Implementation of Searching Algorithms-Linear and Binary Search.
4. Implementation of Stack using Array.
5. Implementation of Queue using Array.
6. Implementation of Circular Queue using Array.
7. Implementation of Stack using Linked List.
8. Implementation of Queue using Linked List.
9. Implementation of Circular Queue using Linked List.
10. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
11. Graph Implementation, BFS, DFS, Minimum cost spanning tree, shortest path algorithm.

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DATA STRUCTURES
(3150221) (DC)
Skill-Based Mini Project List

1. Develop an application to calculate the address of given index position of 2D,3D,4D and nD array elements.
2. Develop an utility to store polynomial equations and to add two polynomial equations.
3. Design the solution of Tower of Hanoi mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:

a) Only one disk can be moved at a time.
b) Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.
c) No disk may be placed on top of a smaller disk. Develop an application to generate preoder, postorder and inorder traversing sequences of given binary tree.

4. Design a Palindrome-Checker algorithm and implement the utility for Palindrome checking. A palindrome is a string that reads the same forward and backward, for example, radar, toot, and madam.
5. Design a solution of the Word Ladder Problem and develop a software. Example - Transform the word "FOOL" into the word "SAGE". In a word ladder puzzle, you must make the change occur gradually by changing one letter at a time. At each step you must transform one word into another word, you are not allowed to transform a word into a non-word.
6. Develop an application to solve Single-Source Shortest Path (SSSP) problem All-Pairs Shortest Path (APSP).
7. Find out Longest Increasing Subsequence in the given elements. The Longest Increasing Subsequence (LIS) problem is to find the length of the longest subsequence of a given sequence such that all elements of the subsequence are sorted in increasing order. For example, the length of LIS for {10, 22, 9, 33, 21, 50, 41, 60, 80} is 6 and LIS is {10, 22, 33, 50, 60, 80}.

Please Note: *Each project has to be submitted by a group of 3 to 4 students, and each group will be assigned only one project.*

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Department of Computer Science and Engineering

Object Oriented Programming & Methodology
3150222 (DC)

COURSE OBJECTIVES

- To study about the concept of object oriented programming.
- To create C++ programs that leverage the object oriented features of the C++ Language.
- To apply object oriented or non-object oriented techniques t o solve bigger computing problems.

Unit-I

Introduction to C++ and Object Oriented Concepts: Basics of C++, Tokens, I/O Statements, Structure of Program, Operators and Expressions, Flow of Control, Arrays, Structures, Functions and its type, Function Prototyping, Pointers, Pointer Variables, Pointers and Arrays, Array of Pointers, Pointers and Structures, Dynamic Memory Allocation.

Programming Techniques: Unstructured & Structured Programming, Object Oriented Paradigm, Features of Oops, Comparison with Procedural Oriented Programming & Object Oriented Programming, Abstract Data Types, Reference Variable, Scope Resolution Operator.

Unit-II

Classes & Objects: Specification of Class, Visibility Modes: Private, Public, Protected, Defining Member Functions, Creating of Objects, Characteristics of Object, Static Data Member, Static Member Function, Array of Objects, Object as Arguments, Inline Function, Default Arguments, Friend Function, Recursion.

Constructors and Destructors: Introduction, Types of Constructors- Default Constructor, User Defined Constructor, Parameterized Constructor, Copy Constructor, Constructor with Default Arguments, Rules of Constructor Definition and Usage, Destructs

Unit-III

Polymorphism: Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading: Binary Operators, Arithmetic Assignment Operators, Unary Operators, Rules for Operator Overloading, Pitfalls of Operator Overloading, Data Conversion, Type Casting.

Unit-IV

Inheritance: Introduction to Code Reuse, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes, Overriding Member Function. Containership: Classes with in Classes, Function Overriding.

Unit-V

Pointer & File Concept: Pointers Overview, Pointers to Objects, This Pointer, Pointers to Derived Classes, Virtual Functions & Pure Virtual Function, Association, Type of Association, Aggregation, File Concepts, Study of Various Files and Streams, Opening and Closing of Files- Functions Get(), Getline(), Put(), Opening The Files Using Function Open(), File Manipulator Function.

RECOMMENDED BOOKS

- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
- Programming with C++, D Ravichandran, T.M.H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt, TMH.
- Object-Oriented Programming in C++, E Balagurusam.
- Fundamentals of Programming C++, Richard L. Halterman

COURSE OUTCOMES

After completion of this course, the students would be able to:

1. **Describe** various fundamental of object oriented design for programming practices..
2. **Apply** fundamental Object-Oriented Programming principles such as encapsulation, inheritance, and polymorphism in real problem.
3. **Develop** robust and scalable software systems and applications.
4. **Create** modular, maintainable, and extensible code that adheres to industry best practices.
5. **Evaluate** Object-Oriented solutions and make informed design decisions.

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Object Oriented Programming &Methodology
3150222 (DC)

List of Experiments

1. Write a program to swap two integers without using third variable. The swapping must be done in a function of a particular class.
2. Write a program that uses a class where the member functions are defined outside a class.
3. Design a class to represent a bank account. Which includes account number, name of the depositor, type of the account, balance amount in the account. Define Methods, to assign initial values, to Deposit an amount, to Withdraw amount after checking balance, to display name and balance.
4. Write a program to find the greater of two given numbers in two different classes using friend function.
5. Create an inheritance hierarchy of Rodent, Mouse, Gerbil, Hamster etc. In the base class provide methods that are common to all Rodents and override these in the derived classes to perform different behaviors, depending on the specific type of Rodent. Create an array of Rodent, fill it with different specific types of Rodents and call your base class methods.
6. Create two classes: Polar and Cartesian, to represent Polar and Cartesian coordinates of a point. Demonstrate how to convert Polar coordinates to Cartesian coordinates by writing the conversion code in source class.
7. Write a program to demonstrate anomaly caused in Multi-path Inheritance. Also, write a program to overcome the anomaly.
8. Create an abstract class Shape which has a field P1=3.14 as final and it has an abstract method Volume. Make two sub-classes 'Cone' and 'Sphere' from this class and they should print their volume.
9. Create a class called LIST with two pure virtual function store() and retrieve().To store a value call store and to retrieve call retrieve function. Derive two classes stack and queue from it and override store and retrieve.
10. Write a program to demonstrate working of various file handling operations in C++.

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Object Oriented Programming & Methodology
3150222 (DC)

Skill-Based Mini Project List

1. 'Movie World' Shop has a huge collection of movies (in the form of DVDs). You are required to make software using OOPS paradigm that manages the rental operations of movies.
2. Question Bank computerizes the MCQ based exams. It takes input from a file having questions and their answers and presents randomly before the exam takers. Use OOPS concepts to implement the question bank system.
3. Design an OOPS to implement the basic operations of Leave Management System.
4. An Inventory System computerizes the Stock, Sale and Purchase of goods. Design an OOPS to implement it.
5. An electricity board charges the following rates to domestic users to discourage large consumption of energy: For the first 100 units - 60P per unit For next 200 units - 80P per unit Beyond 300 units - 90P per unit All users are charged a minimum of Rs.50.00. if the total amount is more than Rs.300.00 than an additional surcharge of 15% is added. Design an OOPS system to register users to the system, maintain his/her record and display monthly bills.
6. Library Systems is aimed to computerize the library management operations, e.g. Registering a Student, Issuing a book, Handling Books Return, etc. Design an OOPS system
to implement the same.
7. Design an OOPS to implement a Personal Diary Management System.

Please Note: Each project has to be submitted by a group of 3 to 4 students, and each group will be assigned only one project.

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Department of Computer Science and Engineering

COMPUTER SYSTEM ORGANIZATION (DC)(3150223)(new)

COURSE OBJECTIVES

- To provide the fundamental knowledge of a computer system and its processing units.
- To provide the details of input & output operations, memory management and performance measurement of the computer system.
- To understand how computer represents and manipulate data.

Unit -I

Introduction: Von-Neumann Model, Various Subsystems: Input Unit, Output Unit, Memory Unit, CPU, System Bus, Program Counter, Accumulator, Memory Register, Register Transfer and Micro Operations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Register Transfer Micro Operations, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro- Operations.

Unit- II

Computer Arithmetic: Addition and Subtraction with Signed-Magnitude, Multiplication Algorithm, Division Algorithm, Division Algorithms, Floating-Point Arithmetic Operations.

Central Processing Unit (CPU): General Purpose Register Organization, Stack Organization, Instruction Formats, Data Transfer and Manipulation, Program Control, Hardwired and Micro programmed Control Unit, Reduced Instruction Set Computer (RISC).

Unit -III

Microprocessors: Introduction of 8085 Microprocessor: Architecture, pin diagram, Instruction Set, Addressing Modes, Flag Register, Interrupts and Basic Assembly Language Programming: Data Transfer instructions, Arithmetic instructions, Logical and Branch instructions.

Unit -IV

Input-Output Organization: Peripheral Devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA (DMA Controller, DMA Transfer),

Input-Output Processor (IOP), Data Transfer- Serial/Parallel, Simplex/ Half Duplex/ Full Duplex.

Unit-V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory- Organization and Mappings, Memory Management Hardware, Introduction to Pipelining & Hazards, Multiprocessors.

RECOMMENDED BOOKS

- Computer System Architecture, Morris Mano, PHI.
- Microprocessor Architecture, Programming and Applications with the 8085, Gaonkar,
- Computer Organization, Carl Hamacher, THM.
- Computer Architecture and Organization, J P Hayes, Mc-Graw Hills, New Delhi.

COURSE OUTCOMES

After completion of the course students would be able to:

1. **Recall** the basic building blocks of computer Architecture.
2. **Describe** different memories and the functional units of a processor.
3. **Demonstrate** the concept of working of microprocessor, multiprocessor and pipelining.
4. **Analyze** various modes of Input-Output data transfer.
5. **Explain** different cache mapping techniques.
6. **Develop** the skill of writing low level programming.

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Department of Computer Science and Engineering

COMPUTER SYSTEM ORGANIZATION
(DC) 2150223(old)

COURSE OBJECTIVES

- To provide the fundamental knowledge of a computer system and its processing units.
- To provide the details of input & output operations, memory management and performance measurement of the computer system.
- To understand how computer represents and manipulate data.

Unit -I

Introduction: Von-Neumann Model, Various Subsystems, CPU, Memory, I/O, System Bus, CPU and Memory Registers, Program Counter, Accumulator, Register Transfer and Micro Operations: Register Transfer Language, Register Transfer, Tree-State Bus Buffers, Bus and Memory Transfers, Arithmetic Micro-Operation, Logic Micro-Operation, Shift Micro-Operation Register Transfer Micro Operations, Arithmetic Micro-Operations, Logic Micro-Operations and Shift Micro-Operations.

Unit- II

Computer Arithmetic: Addition and Subtraction with Signed-Magnitude, Multiplication Algorithm, Division Algorithm, Division Algorithms, Floating-Point Arithmetic Operations.

Central Processing Unit (CPU): General Purpose Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC).Hardwired and Micro programmed Control.

Unit -III

Microprocessors: Introduction of 8085 Microprocessor: Architecture, Instruction Set, Addressing Modes, Interrupts and Basic Assembly Language Programming, Introduction to Pipelining & Multiprocessors.

Unit -IV

Input-Output Organization: Peripheral Devices, I/O Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, DMA (DMA Controller, DMA Transfer),

Input-Output Processor (IOP), Data Transfer- Serial/Parallel, Simplex/ Half Duplex/ Full Duplex.

Unit-V

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory- Organization and Mappings, Memory Management Hardware.

RECOMMENDED BOOKS

- Computer System Architecture, Morris Mano, PHI.
- Microprocessor Architecture, Programming and Applications with the 8085, Gaonkar,
- Computer Organization, Carl Hamacher, THM.
- Computer Architecture and Organization, J P Hayes, Mc-Graw Hills, New Delhi.

COURSE OUTCOMES

After completion of the course students would be able to:

CO1. Recall the basic building blocks of computer Architecture.
CO2. Explain different memories and the functional units of a processor.
CO3. Explain the concept of working of microprocessor, multiprocessor and pipelining.
CO4. Analyze various modes of Input-Output data transfer.
CO5. Evaluate the arithmetic related to the number system.
CO6. Develop the skill of writing low level programming.

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Department of Computer Science & Engineering

COMPUTER GRAPHICS
3150224(DC)

COURSE OBJECTIVES

- To provide an introduction to the theory and practice of computer graphics.
- To give a good exposure related to Computer Graphics algorithms and to design various graphics primitives.
- To enhance the proficiency in programming skills related to animation and graphics object Design

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Unit-I

Introduction to Computer Graphics: Interactive Computer Graphics, Application of Computer Graphics, Random and Raster Scan Displays, Storage Tube Graphics Display, Calligraphic Refresh Graphics Display, Flat Panel Display, Refreshing, Flickering, Interlacing, Resolution, Bit Depth, Aspect Ratio etc.

Unit-II

Scan Conversion Technique: Image representation, Line drawing: DDA, Bresenham's Algorithm. Circle Drawing: General Method, Mid-Point, DDA, Bresenham's Circle Generation Algorithm, And Ellipse Generation Algorithm, Curves: Parametric Function, Bezier Method, B-Spline Method.

Unit-III

2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, Shearing, Inverse Transformation, Composite Transformation, World Coordinate System, Viewing Transformation, Representation of 3D object on Screen, Parallel and Perspective Projections.

Unit-IV

Clipping: Point clipping, Line Clipping, Simple Visibility Line Clipping Algorithm, Cohen Sutherland Line Clipping Algorithm etc., Polygon Clipping, Convex and Concave Polygon, Sutherland Hodgeman Polygon Clipping Algorithm etc., Area Filling, Hidden Surface Elimination: Z- Buffer algorithm and Painter's Algorithm.

Unit-V

Basic Illumination Models: Diffuse Reflection, Specular Reflection, Phong Shading, Gouraud Shading, and Color Models like RGB, YIQ, CMY, HSV etc., and Introduction to Digital Image Processing (DIP), Fundamental Steps and Components of DIP.

RECOMMENDED BOOKS

- Computer Graphics, Donald Hearn and M.P. Becker, PHI Publication.
- Computer Graphics principle and Practice, FoleyVandam, Feiner, Hughes.
- Principles of Computers Graphics, Rogers, TMH.
- Computer Graphics, Sinha and Udai, TMH.
- Digital Image Processing, Gonzalez.

COURSE OUTCOMES

After completion of the course students will be able to:

1. **Apply** graphics principles to new and evolving application domains.
2. **Identify** and troubleshoot common issues related to computer graphics rendering.
3. **Implement** graphics algorithms for tasks such as clipping, rasterization, and shading.
4. **Apply** mathematical transformations to manipulate and transform graphical objects.
5. **Grasp** the key concepts of 2D and 3D graphics representation.
6. **Demonstrate** ethical considerations in the use and creation of computer graphics.

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Department of Computer Science & Engineering

COMPUTER GRAPHICS
3150224(DC)

List of Experiments

1. Installation and Introduction to OpenGL basics, graphic functions, commands for compiling and executing an OpenGL Program.
2. Write an OpenGL Program to create an output window, to plot a point with given coordinates and other basic demonstrations.
3. Write an OpenGL Program to implement DDA Line Drawing Algorithm.
4. Write an OpenGL Program to implement Bresenham Line Algorithm.
5. Write an OpenGL Program to implement Mid-Point Circle Algorithm.
6. Write an OpenGL Program to implement following 2D transformations:
    i. Translation of a point, line and polygon.
    ii. Scaling of a line and polygon.
    iii. Rotation of a line and polygon around origin.
7. Write an OpenGL Program to implement:
    i. Flood Filling Algorithm using polygon.
    ii. Boundary Filling Algorithm using polygon.

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COMPUTER GRAPHICS
3150224(DC)

Skill Based Mini Projects

1. Develop a project to implement a stretch band effect. In which a user will click on the screen and drag the mouse / arrow keys over the screen coordinates. The line should be updated like rubber-band and on the right-click gets fixed.
2. Develop a project to implement the DDA algorithm for drawing line. In this project a programmer is expected to shift the origin to the center of the screen and divide the screen into required quadrants.
3. Develop a project with menu option to input the line coordinates from the user to generate a line using Bresenham's method and DDA algorithm.
4. Develop a project to demonstrate 2D animation such as clock simulation.
5. Develop a project to demonstrate 2D animation such as rising sun.
6. Develop a project to implement the bouncing ball inside a defined rectangular window.
7. Develop a project to to draw Bezier and B-Spline Curves with interactive user inputs for control polygon defining the shape of the curve.
8. Develop a project to demonstrate shear transformation in different directions on a unit square situated at the origin.
9. Develop a project in which a set of lines and a rectangular area of interest is given by user, the task is to remove lines which are outside the area of interest and clip the lines which are partially inside the area.

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Department of Computer Science and Engineering

Hardware and Troubleshooting Lab
3150225(DLC)

COURSE OBJECTIVES:

- To understand various number systems, boolean algebra, logic Gates.
- To acquire the knowledge of a computer system, motherboard and Its processing unit.
- To be aware of different memories, I/O devices, installation and SMPS.

Unit – I:

Number System, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Boolean Relations, Digital Logic Gates, De Morgan's Theorem, Karnaugh Maps and simplifications.

Unit – II:

Combinational Circuits. Half Adder, Full Adder, Binary Adder-Subtractor, Binary Multiplier, Comparator, Decoders, Encoders, Multiplexers.

Unit – III:

Sequential Circuits, Latches, Flip-Flops: Edge-triggered D Flip-flop, Edge-triggered JK Flip-flop, JK Master-slave Flip-flop, Registers. Integrated circuits.

Unit – IV:

Introduction of Motherboard, components of Motherboard, Types of Motherboard, Bios, Form-factor, CPU Sockets, types of memory sockets, IDE Ports, chipset, Integrated Peripherals, Peripheral card slots, Bootstrapping process.

Unit – V:

Introduction to Memory, Types of Memory, Installation and Partition of Hard Disk, Working of HDD and SDD. Basics of I/O Devices, Buffering and spooling, Introduction to Ports, Identify the Different Ports, Ports Troubleshooting. Linux and Windows Installation. SMPS (Switch Mode Power Supply).

RECOMMENDED BOOKS:

- **Digital Design, Morris Mano M. and Michael D. Ciletti, IV Edition, Pearson Education.**
- **Digital Electronics: Principles, Devices and Applications, Anil K. Maini, Wiley.**
- **The Indispensable PC Hardware Book, Hans-Peter Messmer, Third Edition.**

COURSE OUTCOMES:

After completion of this course, the students would be able to:

1. **Displays** the features & functions of Motherboard, BIOS, Harddisk and other devices.
2. **Assemble** and Disassemble the Computer System.
3. **Perform** installation of system & application software as well as troubleshooting

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Hardware and Troubleshooting Lab
3150225(DLC)

List of Experiments

1. Study the different parts of computer system
2. Study different parts of motherboard
3. Study various types of connectors
4. Draw the pin details of various connectors
5. Study CMOS setup
6. Partition and format the hard disc
7. Installation of OS: Linux and windows
8. Connect systems in network using switch
9. Connect the systems in peer to peer network
10. Configure e-mail server
11. Configure e-mail client
12. Configure browser for Internet access using proxy server
13. Configure Virtual Private Network (VPN)
14. Study of PC Troubleshooting.

Skill Based Project

- **To create a multiple Star topology.**
- **To connect a multiple hard disk drive in a computer and then create a multiple volume.**
- **To create multiple Wi-Fi access network.**
- **How to do complete pc assembling.**
- **To create a domain server with a client .**
- **To create a DHCP server and assign dynamic IP address in a local pc**
- **Explain in detail to install multiple windows in a pc**
- **To create pair to pair network**
- **To create combine LAN & WAN network.**
- **To describe IP address and a connect pc different network IP address.**