ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, Uttar Pradesh (India)
U.P. State Government University
(Recognised Under Section 2(F) & 12(B) of the UGC Act 1956 & B.Tech Approved by AICTE)

MCA Semester I
MCACC 101 - Fundamental of Computers & Emerging Technologies

Credit: 04, IA Marks: 30, ESE Marks: 70
Lectures: 45 Hours, Tutorial: 15 Hours

OBJECTIVES OF THE COURSE:

1. To demonstrate the knowledge of the basic structure, components, features and generations of computers.
2. To describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.
3. To Compare and contrast features, functioning & types of operating system and computer networks.
4. To demonstrate architecture, functioning & services of the Internet and basics of multimedia.
5. To illustrate the emerging trends and technologies in the field of Information Technology.

UNIT-I **Lectures: 09**

Introduction to Computer: Definition, Computer Hardware & Computer Software.
Components: Hardware–Introduction, Input devices, Output devices, Central Processing Unit, **Memory**-Primary and Secondary. **Software**-Introduction, Types, System and Application.
Computer Languages: Introduction, Concept of Compiler, Interpreter & Assembler
Problem Solving Concept: Algorithms–Introduction, Definition, Characteristics, Limitations, Conditions in pseudo-code, Loops in pseudo code.

UNIT-II **Lectures: 09**

Operating System: Definition, Functions, Types, Classification, Elements of command based and GUI based operating system.
Computer Network: Overview, Types (LAN, WAN and MAN), Data communication, Topologies, OSI Model.

UNIT-III **Lectures: 09**

Internet: Overview, Architecture, Functioning, Basic services like WWW, FTP, Telnet, Gopher etc., Search engines, E-mail, Web Browsers.
Internet of Things (IoT): Definition, Sensors, their types and features, Smart Cities, Industrial Internet of Things.
Parallel and Distributed Computing: Scope, issues, applications and challenges of Parallel and Distributed Computing.

UNIT-IV **Lectures: 09**

Block chain: Introduction, overview, features, limitations and application areas fundamentals of Block Chain.
Crypto Currencies: A Brief History of Cryptocurrency, Traditional Currencies vs. Cryptocurrencies, Definition of Cryptocurrency, Types of Cryptocurrencies, Applications, Advantages and disadvantages of Cryptocurrency.

Cloud Computing: A Brief History of Cloud Computing, Definition of Cloud Computing, Cloud Delivery Models, Cloud Deployment Models, Applications, Characteristics of Cloud Computing, Top leading Cloud Computing companies, Advantages and Disadvantages of Cloud Computing, A Brief introduction of Virtualization,

Digital Image Processing: Scope, issues, applications and challenges of Digital Image Processing

UNIT-V **Lectures: 09**

Introduction, Overview, Features, Limitations and Application Areas of **Augmented Reality, Virtual Reality, Grid Computing, Green Computing, Big Data Analytics, Quantum Computing** and **Brain Computer Interface**.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Demonstrate the knowledge of the basic structure, components, features and generations of computers.	K1, K2
2	CO2. Describe the concept of computer languages, language translators and construct algorithms to solve problems using programming concepts.	K2, K3
3	CO3. Compare and contrast features, functioning & types of operating system and computer networks.	K4
4	CO4. Demonstrate architecture, functioning & services of the Internet and basics of multimedia.	K2
5	CO5. Illustrate the emerging trends and technologies in the field of Information Technology.	K1, K2

Suggested Readings:

1. Rajaraman V., "Fundamentals of Computers", Prentice-Hall of India.
2. Norton P., "Introduction to Computers", McGraw Hill Education.
3. Goel A., "Computer Fundamentals", Pearson.
4. Balagurusamy E., "Fundamentals of Computers", McGraw Hill
5. Thareja R., "Fundamentals of Computers", Oxford University Press.
6. Bindra J., "The Tech Whisperer- on Digital Transformation and the Technologies that Enable it", Penguin.

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MCA Semester I
MCACC102: Problem Solving using C

Credit: 04, IA Marks: 30, ESE Marks: 70
Lectures: 45 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To describe & understand the problem-solving techniques.
2. To understand the concept of basic terminology used in C programming.
3. To develop programs in C language by writing, compiling and debugging.
4. To develop programs involving simple statements, conditional statements, iterative statements, array, strings, functions, recursion, structure and union.
5. To differentiate between call by value and call by reference, acquire skills of using dynamic memory allocations, use of pointers and basic operations on a file.

UNIT-I **Lectures: 09**

Basics of programming: Approaches to problem solving, Use of high-level programming language for systematic development of programs, Concept of algorithm and flowchart, Concept and role of structured programming.
Basics of C: History of C, Salient features of C, Structure of C Program, Compiling C Program, Link and Run C Program, Character set, Tokens, Keywords, Identifiers, Constants, Variables, Instructions, Data types, Standard Input/Output, Operators and expressions.

UNIT-II **Lectures: 10**

Conditional Program Execution: if, if-else, and nested if-else statements, Switch statements, Restrictions on switch values, Use of break and default with switch, Comparison of switch and if-else.
Loops and Iteration: for, while and do-while loops, Multiple loop variables, Nested loops, break and continue statement.
Functions: Introduction, Types, Declaration of a Function, Function calls, Defining functions, Function Prototypes, Passing arguments to a function Return values and their types, Writing multifunction program, Calling function by value, Recursive functions.

UNIT-III **Lectures: 09**

Arrays: Array notation and representation, declaring one-dimensional array, Initializing arrays, Accessing array elements, Manipulating array elements, Arrays of unknown or varying size, Two-dimensional arrays,
Multidimensional arrays.
Pointers: Introduction, Characteristics, '*' and '&' operators, Pointer type declaration and assignment, Pointer arithmetic, Call by reference, Passing pointers to functions, array of pointers, Pointers to functions, Pointer to pointer, Array of pointers.
Strings: Introduction, initializing strings, Accessing string elements, Array of strings, Passing strings to functions, String functions.

UNIT-IV **Lectures: 09**

Structure: Introduction, Initializing, defining and declaring structure, Accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure, Pointers to structure. **Union:** Introduction, Declaring union, Usage of unions, Operations on union. Enumerated data types. **Storage classes**: Introduction, Types- automatic, register, static and external.

UNIT-V **Lectures: 08**

Dynamic Memory Allocation: Introduction, Library functions – malloc, calloc, realloc and free. **File Handling:** Basics, File types, File operations, File pointer, File opening modes, File handling functions, File handling through command line argument, Record I/O in files.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Describe the functional components and fundamental concepts of a digital computer system including number systems.	K1, K2
2	CO2. Construct flowchart and write algorithms for solving basic problems.	K2, K3
3	CO3. Write 'C' programs that incorporate use of variables, operators and expressions along with data types.	K2, K3
4	CO4. Write simple programs using the basic elements like control statements, functions, arrays and strings.	K2, K3
5	CO5. Write advanced programs using the concepts of pointers, structures, unions and enumerated data types. Apply pre-processor directives and basic file handling	K2, K3

Suggested Readings:

1. Kanetkar Y., "Let Us C", BPB Publications.
2. E. Balagurusamy, Computer Concepts and Programming in C, *McGraw Hill*.
3. Yashwant Kanetkar, "Working with C", BPB Publications.
4. E. Balagurusamy, "Programming in ANSI C", TMH.
5. Reema Thareja, Computer Fundamentals and Programming in C, Oxford Publication.
6. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, Pearson Education.
7. Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Computer Science- A Structured Programming Approach Using C, Cengage Learning.
8. Schildt H., "C- The Complete Reference", McGraw-Hill.
9. Goyal K. K. and Pandey H.M., Trouble Free C", University Science Press
10. Gottfried B., "Schaum's Outlines- Programming in C", McGraw-Hill Publications.
11. Kochan S.G., "Programming in C", Addison-Wesley.
12. Dey P. and Ghosh M., "Computer Fundamentals and Programming in C", Oxford University Press.
13. Goyal K. K., Sharma M. K. and Thapliyal M. P. "Concept of Computer and C Programming", University Science Press.

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MCA Semester I
MCACC 103: Computer Organization & Architecture

Credit: 04, IA Marks: 30, ESE Marks: 70
Lectures: 45 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To study functional units of digital system and how arithmetic and logical operations are performed by computers
2. To understand the operations of control unit and sequence of instructions for carrying out simple operation using various addressing modes.
3. To design various types of memory and its organization.
4. To study the various modes in which IO devices communicate with CPU and memory.
5. To analyze various types of flip flops used for designing registers and counters.
6. To understand the criteria for classification of parallel computer.
7. To learn various architectural schemes.

UNIT-I **Lectures: 09**

Introduction: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer.
Processor Organization: general registers organization, stack organization and addressing modes.

UNIT-II **Lectures: 09**

IEEE Standard for Floating Point Numbers, **Arithmetic and Logic Unit:** Look ahead carries adders. **Multiplication**: Signed operand multiplication, Booth's algorithm and array multiplier. Division and logic operations, Floating point arithmetic operation, Arithmetic & logic unit design.

UNIT-III **Lectures: 09**

Control Unit: Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro-operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. **Hardwire and micro programmed control**: micro-program sequencing, concept of horizontal and vertical microprogramming.

UNIT-IV **Lectures: 09**

Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2.5D memory organization, ROM memories, **Cache Memories**: Concept and design issues & performance, address mapping and replacement. **Auxiliary Memories**: magnetic disk, magnetic tape and optical disks, **Virtual Memory**: Concept and implementation.

UNIT-V **Lectures: 09**

Input / Output: Peripheral devices, I/O interface, I/O ports, **Interrupts**: interrupt hardware, types of interrupts and exceptions. **Modes of Data Transfer**: Programmed I/O, interrupt initiated

I/O and Direct Memory Access., I/O channels and processors. **Serial Communication**: Synchronous & asynchronous communication, standard communication interfaces.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Describe functional units of digital system and explain how arithmetic and logical operations are performed by computers	K2, K3
2	CO2. Describe the operations of control unit and write sequence of instructions for carrying out simple operation using various addressing modes.	K2, K4
3	CO3. Design various types of memory and its organization.	K3
4	CO4. Describe the various modes in which IO devices communicate with CPU and memory.	K2, K3
5	CO5. List the criteria for classification of parallel computer and describe various architectural schemes.	K1, K2

Suggested Readings:

1. John P. Hayes, "Computer Architecture and Organization", McGraw Hill.
2. William Stallings, "Computer Organization and Architecture-Designing for Performance", Pearson Education.
3. M. Morris Mano, "Computer System Architecture", PHI.
4. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", McGraw-Hill.
5. Behrooz Parahami, "Computer Architecture", Oxford University Press.
6. David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier Pub.
7. Tannenbaum, "Structured Computer Organization", PHI.

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MCA Semester I
MCACC104: Data Structures

Credit: 03, IA Marks: 30, ESE Marks: 70
Lectures: 45 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To develop the understanding of data structures, their types and applications.
2. To familiarize with concepts of algorithm and complexity.
3. To implement, analyze various data-structures as array, linked-list, stack, queue, tree, graph, etc. in detail and utilization of data structure techniques in problem solving.
4. To develop the understanding of various sorting and searching techniques.
5. To implement them using C programming language.

UNIT-I **Lectures: 08**

Introduction to data structure: Basic Terminology, Elementary Data Organization, Definition of Data structures, Types of Data Structures: Linear and Non-Linear Data Structure, Abstract data type, Data Structure operations, Time-Space trade-off.
Introduction to Algorithms: Definition of Algorithms, Algorithm Design Techniques, Performance Analysis of Algorithms, Complexity of various code structures, Order of Growth, Asymptotic Notations.

UNIT-II **Lectures: 09**

Arrays: Definition, Single and Multidimensional Arrays, **Representation of Arrays**: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D Array Application of arrays, Sparse Matrices and their representations.
Linked lists: Representation and Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, **Operations on a Linked List:** Insertion, Deletion, Traversal, Polynomial Representation.

UNIT-III **Lectures: 09**

Stacks: Abstract Data Type, **Stack Operations**: Push and Pop, Array and Linked Implementation of Stack in C, **Application of stack**: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion, Problem solving using iteration and recursion with examples.
Queues: Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.

UNIT-IV **Lectures: 10**

Trees: Basic terminology used with Tree, Binary Trees, Binary Tree Representation, Representation and Implementation (Pointer), **Types of Binary Tree:** Complete Binary Tree, Extended Binary Trees, Threaded Binary Trees, Tree Traversal Algorithms: In-order, Pre-order and Post-order, Binary Search Tree, Operation of Insertion, Deletion, Searching & Modification of data in Binary Search Tree, Constructing Binary Tree from given Tree Traversal, AVL Tree and B-Tree.

Graphs: Terminology used with Graph, **Data Structure for Graph Representations**: Adjacency Matrices, Adjacency List. **Graph Traversal**: Depth First Search and Breadth First Search, Spanning Trees, Minimum Spanning Trees, Single Source and All Pair Shortest Path Algorithms.

UNIT-V **Lectures: 09**

Searching: Concept of Searching, Sequential Search, Index Sequential Search, Binary Search, Concept of Hashing & Collision resolution Techniques used in Hashing.
Sorting: Insertion Sort, Selection Sort, Bubble Sort, Heap Sort, Comparison of Sorting Algorithms, **Sorting in Linear Time**: Counting Sort and Bucket Sort.
Divide and Conquer with Examples: Merge Sort, Quick Sort, Matrix Multiplication: Strassen's Algorithm

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Explain the concept of data structure, abstract data types, algorithms and analysis of algorithms.	K1, K2
2	CO2. Describe basic data organization schemes such as arrays and linked lists, implementation of linked lists, operations on linked-list,	K2, K3
3	CO3. Describe stacks and queues, their applications and implement various operations on them using arrays and linked lists.	K2, K3
4	CO4. Describe the properties of trees and graphs and implement various operations such as searching and traversal on them.	K2, K3
5	CO5. Apply, compare and analyze various searching and sorting algorithms, incremental and divide-and-conquer approaches of designing algorithms for problems.	K3, K4

Suggested Readings:

1. Y. Langsam, M. Augenstin and A. Tannenbaum, Data Structures using C and C++, Pearson Education Asia.
2. Ellis Horowitz, S. Sahni, D. Mehta Fundamentals of Data Structures in C++, Galgotia Book Source, New Delhi.
3. S. Lipschutz, Data Structures Mc-Graw Hill International.
4. Data Structures: A Pseudocode Approach with C, Second Edition, Richard F. Gilberg, Behrouz A. Forouzan
5. Jean-Paul Tremblay, Paul. G. Soresan, An introduction to Data Structures with Applications, Tata Mc-Graw Hill International Edition.
6. A. Michael Berman, Data structures via C++, Oxford University Press.
7. Thomas H. Cormen, Introduction to Algorithms, 3rd Edition (The MIT Press).
8. M. Weiss, Data Structures and Algorithm Analysis in C++, Pearson Education.

9. Tremblay & Sorenson, An Introduction to Data Structures with Applications, Mcgraw Hill.
10. R.S. Salaria, Data Structures and Applications using C, Khanna Book Publishing.
11. Samanta D., “Classic Data Structures”, Prentice Hall India.
12. Aho, Ullman and Hopcroft, “Design and Analysis of algorithms”, Pearson Education.
13. R. Neapolitan and K. Naimipour, “Foundations of Algorithms”, Jones an Bartlett, Student edition.
14. Reema Thareja, Data Structures using C, Oxford Univ. Press

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MCA Semester I
MCACC 105: Discrete Mathematics

Credit: 03, IA Marks: 30, ESE Marks: 70
Lectures: 45 Hours, Tutorials: 15 Hours

OBJECTIVES OF THE COURSE:

1. To perform operations on **discrete structures** such as sets, functions, relations.
2. To apply mathematical arguments using logical connectives and quantifiers.
3. To identify and prove properties of Algebraic Structures.
4. To formulate and solve recurrences and recursive functions.
5. To apply the concept of combinatorics to solve basic problems in discrete mathematics.

UNIT-I **Lectures: 09**

Set Theory: Introduction, Size of sets and Cardinals, Venn diagrams, Combination of sets, Multisets, Ordered pairs and Set Identities. **Relation:** Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation. **Functions:** Definition, Classification of functions, Operations on functions,
Recursively defined functions.

UNIT-II **Lectures: 09**

Posets, Hasse Diagram and Lattices: Introduction, Partial ordered sets, Combination of Partial ordered sets, Hasse diagram, Introduction of lattices, Properties of lattices, Bounded, Complemented, Modular and Complete lattice. **Boolean Algebra:** Introduction, Axioms and Theorems of Boolean algebra, Boolean functions. Simplification of Boolean functions, Karnaugh maps, Logic gates.

UNIT-III **Lectures: 09**

Propositional: Propositions, Truth tables, Tautology, Contradiction, Algebra of Propositions, Theory of Inference and Natural Detection. **Predicate Logic:** Theory of Predicates, First order predicate, Predicate formulas, Quantifiers, Inference theory of predicate logic.

UNIT-IV **Lectures: 09**

Algebraic Structures: Introduction to algebraic Structures and properties. Types of algebraic structures: Semi group, Monoid, Group, Abelian group and Properties of group. Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism and Isomorphism of groups.
Rings and Fields: Definition and elementary properties of Rings and Fields.

UNIT-V **Lectures: 09**

Natural Numbers: Introduction, Piano's axioms, Mathematical Induction, Strong
Induction and Induction with Nonzero Base cases.
Recurrence Relation & Generating functions: Introduction and properties of Generating Functions. Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences.

Combinatorics: Introduction, Counting techniques and Pigeonhole principle, Olya's Counting theorem.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Use mathematical and logical notation to define and formally reason about basic discrete structures such as Sets, Relations and Functions	K1, K2
2	CO2. Apply mathematical arguments using logical connectives and quantifiers to check the validity of an argument through truth tables and propositional and predicate logic	K2, K3
3	CO3. Identify and prove properties of Algebraic Structures like Groups, Rings and Fields	K3, K4
4	CO4. Formulate and solve recurrences and recursive functions	K3, K4
5	CO5. Apply the concept of combinatorics to solve basic problems in discrete mathematics	K1, K3

Suggested Readings:

1. Kenneth H. Rosen, "Discrete Mathematics and Its Applications", McGraw Hill.
2. B. Kolman, R.C Busby and S.C Ross, "Discrete Mathematics Structures", Prentice Hall.
3. R.P Girimaldi, "Discrete and Combinatorial Mathematics", Addison Wesley.
4. Y.N. Singh, "Discrete Mathematical Structures", Wiley- India.
5. Swapankumar Sarkar, "A Textbook of Discrete Mathematics", S. Chand & Company PVT. LTD.V.
6. Krishnamurthy, "Combinatorics Theory & Application", East-West Press Pvt. Ltd., New Delhi.
7. Liptschutz, Seymour, "Discrete Mathematics", McGraw Hill.
8. J.P. Trembely & R.Manohar, "Discrete Mathematical Structure with application to Computer Science",McGraw Hill.

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MCACC 106: Lab: Problem Solving using C

Credit: 02, IA Marks: 30, ESE Marks: 70

OBJECTIVES OF THE COURSE:

1. To write, compile, debug and execute programs in a C programming environment.
2. To learn programs that incorporate use of variables, operators and expressions along with data types.
3. To learn programs for solving problems involving use of decision control structures and loops.
4. To learn programs that involve the use of arrays, structures and user defined functions.
5. To Write programs using file handling operations.

- Program to implement conditional statements in C language.
- Program to implement switch-case statement in C language
- Program to implement looping constructs inC language.
- Program to perform basic input-output operations in C language.
- Program to implement user defined functions in C language.
- Program to implement recursive functions in C language.
- Program to implement one-dimensional arrays in C language.
- Program to implement two-dimensional arrays in C language.
- Program to perform various operations on two-dimensional arrays in C language.
- Program to implement multi-dimensional arrays in C language.
- Program to implement string manipulation functions in C language.
- Program to implement structure in C language.
- Program to implement union in C language.
- Program to perform file handling operations in C language.

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Write, compile, debug and execute programs in a C programming environment.	K3
2	CO2. Write programs that incorporate use of variables, operators and expressions along with data types.	K3
3	CO3. Write programs for solving problems involving use of decision control structures and loops.	K3
4	CO4. Write programs that involve the use of arrays, structures and user defined functions.	K3
5	CO5. Write programs using file handling operations.	K3

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MCACC107: Lab: Data Structures

Credit: 02, IA Marks: 30, ESE Marks: 70

OBJECTIVES OF THE COURSE:

1. To learn implementation of various Data Structures.
2. To applying data structures in solving real life problems using C.
3. To learn implementation of various Data Structures.

Program in C for following:

- To implement addition and multiplication of two 2D arrays.
- To transpose a 2D array.
- To implement stack using array
- To implement queue using array.
- To implement circular queue using array.
- To implement stack using linked list.
- To implement queue using linked list.
- To implement BFS using linked list.
- To implement DFS using linked list.
- To implement Linear Search.
- To implement Binary Search.
- To implement Bubble Sorting.
- To implement Selection Sorting.
- To implement Insertion Sorting.
- To implement Merge Sorting.
- To implement Heap Sorting.
- To implement Matrix Multiplication by Strassen's algorithm
- Find Minimum Spanning Tree using Kruskal's Algorithm

Note: The instructor may add/delete/modify experiments, wherever he/she feels in a justified manner.

Course Outcome: After successful completion of this course students will be able to:

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Write and execute programs to implement different searching algorithms.	K3
2	CO2. Write and execute programs to implement various sorting algorithms	K3
3	CO3. Write and execute programs to implement various operations on two-dimensional arrays.	K3
4	CO4. Implement various operations of Stacks and Queues using both arrays and linked lists data structures.	K3
5	CO5. Implement graph algorithm to solve the problem of spanning tree	K3