KHWAJA MOINUDDIN CHISHTI LANGUAGE UNIVERSITY
UTTAR PRADESH, LUCKNOW

MCA Course Structure (Study and Evaluation Scheme)

Regulations 2022

As Per

National Education Policy 2020 /AICTE

(Effective from the Session: 2022-23)

Introduction

The Program's thrust is to provide the students a thorough and sound background in theoretical and skill-oriented courses relevant for productive careers in software industry, corporate sector, Govt. organizations and academia. The program emphasizesproviding skill-based environment for teaching and research in the core and emerging areas of software technology to solve mathematical, computing, communications/networking and commercial problems.

This Master's Degree Program has been designed with a semester approach in mind. The first-year courses are aimed at skills development in computers using various technologies while the second year is more focused on core courses providing conceptual frame work and the third year provides the specialization and the project work.

A two-year degree (six-semesters) in Computer Applications will get skills and information not only about Computer and Information Technology but also in communication, organization and management. One also gets to learn programming languages such as C, C++, Java, SQL, Php, Python, front-end and back-end design etc. Information about various computer applications and latest developments in IT and communication systems is also provided. The Master of Computer Application Programme has been designed to supply trained manpower it ever growing IT and IT Enabled industry.

1. Applicability

These regulations shall apply to the Master of Computer Application (MCA) programme from the session 2022-23.

2. Minimum Eligibility for Admission

Passed BCA/ Bachelor Degree in Computer Science Engineering or equivalent Degree.

OR

Passed B.Sc./ B.Com./ B.A. with Mathematics at 10+2 Level or at Graduation Level (with additional bridge Courses as per the norms of the concerned University).

Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

3. Programme Objectives

The MCA Programme is designed to enhance employability by preparing students for careers in computer science and leadership in both the private and public sectors. Students acquire a comprehensive foundation in the fundamentals of computer applications, the environment in which they will function, the analytical tools for intelligent decision-making and problem solving. Specifically:

- Produce knowledgeable and skilled human resources which are employable in IT and ITES.
- Impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or application.
- Produce entrepreneurs who can develop customized solutions for small to large Enterprises.

- To develop academically competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that compassionately foster the scientific temper with a sense of social responsibility.
- To develop students to become globally competent.
- To inculcate Entrepreneurial skills among students

4. Programme Outcomes (POs)

Upon completion of the MCA Programme, the students will be able to:

- PO1. To produce knowledgeable and skilled human resources which are employable in IT industry.
- PO2. To impart knowledge required for planning, designing and building complex Application Software Systems as well as provide support to automated systems or applications.
- PO3. To produce entrepreneurs who can develop customized solutions for small to large enterprises.
- PO4. To develop competent and professionally motivated personnel, equipped with objective, critical thinking, right moral and ethical values that foster the scientific temper with a sense of social responsibility.
- PO5. To train students to become globally competent and employable.

5. Programme Specific Outcomes (PSOs)

After completing the program students will be capable of:

- PSO1. Understanding to apply knowledge of computing and technological advances appropriate to the programme.
- PSO2. Analysing, identifying and defining problems for logical modelling and its solutions.
- PSO3. Understanding a sense of professional, ethical, legal, security and social issues and responsibilities.
- PSO4. Analysing the local and global impact of business solutions on individuals, organizations, and society.

6. Course Structure (Study and Evaluation Scheme)

The course structure of the Master of ComputerApplication (MCA) programme shall be as under:

Master of Computer Application (Two Year Course)
Study and Evaluation Scheme

ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
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Course	Course Code	Title of the Paper	Maximum Marks			Credits Allotted				Teaching Hours
Semester I										
			Internal	**ESE**	**Total**	**Lecture**	**Tutorial**	**Practical**	**Total Credits**	
Core Course	MCACC 101	Fundamental of Computers & Emerging Technologies	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 102	Problem Solving using C	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 103	Computer Organization & Architecture	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 104	Data Structures	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 105	Discrete Mathematics	30	70	100	**3**	**1**	**0**	**4**	**04**
Practical										
Core Course	MCACC 106	Lab: Problem Solving using C	30	70	100	**0**	**0**	**4**	**2**	**04**
Core Course	MCACC 107	Lab: Data Structures	30	70	100	**0**	**0**	**4**	**2**	**04**
Semester Total					**700**				**24**	

Course	Subject Code	Title of the Paper	Maximum Marks			Credits Allotted				Teaching Hours
	Semester II									
			Internal	**ESE**	**Total**	**Lecture**	**Tutorial**	**Practical**	**Total Credits**	
Core Course	MCACC 201	Object Oriented Programming using Java	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 202	Operating System	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 203	Database Management System	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 204	Automata Theory and Formal Languages	30	70	100	**3**	**1**	**0**	**4**	**04**
Core Course	MCACC 205	Computer Network	30	70	100	**3**	**1**	**0**	**4**	**04**
Generic Elective/ Minor Elective	MCAGE01	Fundamental of Computers & Emerging Technologies (For other department students) (MCA Students may opt the Minor Elective Course from the list of courses offered by other Departments / Subjects)	30	70	100	**3**	**1**	**0**	**4**	**04**
Practical										
Core Course	MCACC 207	Lab: OOP using Java	30	70	100	**0**	**0**	**4**	**2**	**04**
Core Course	MCACC 208	Lab: DBMS	30	70	100	**0**	**0**	**4**	**2**	**04**
Semester Total					**800**				**28**	

Course	Subject Code	Title of the Paper	Maximum Marks			Credits Allotted				Teaching Hours
	Semester III									
			Internal	**ESE**	**Total**	**Lecture**	**Tutorial**	**Practical**	**Total Credits**	
Core Course	MCACC 301	Python Programming	30	70	100	**3**	**1**	**0**	**4**	**04**
Core	MCACC 302	Software Engineering	30	70	100	**3**	**1**	**0**	**4**	**04**

Master of Computer Application (Two Year Course)
Study and Evaluation Scheme

Course										
Core Course	MCACC 303	Design and Analysis of Algorithms	30	70	100	**3**	**1**	**0**	**4**	**04**
Elective I/ MOOC	MCAE-I	Elective-I (Select any one from the list)	30	70	100	**3**	**1**	**0**	**4**	**04**
Elective II	MCAE-II	Elective-II (Select any one from the list)	30	70	100	**3**	**1**	**0**	**4**	**04**
(Non Credited Course)	MCANC01	Cyber Security	30	70		**2**		**0**	**0**	**02**
Practical										
Core Course	MCACC 304	Lab: Python Programming	30	70	100	**0**	**0**	**4**	**2**	**04**
Core Course	MCACC 305	Minor Project / Industrial Training (Software / Research)	30	70	100	**0**	**0**	**4**	**2**	**04**
		Semester Total			**700**				**24**	

Course	**Subject Code**	**Title of the Paper**	**Maximum Marks**			**Credits Allotted**				**Teaching Hours**
	Semester IV									
			Internal	**ESE**	**Total**	**Lecture**	**Tutorial**	**Practical**	**Total Credits**	
Core Course	MCACC 401	Artificial Intelligence	30	70	100	**3**	**1**	**0**	**4**	**04**
Elective-III/ MOOC	MCAE-III	Elective-III (Select any one from the list)	30	70	100	**3**	**1**	**0**	**4**	**04**
Elective-IV	MCAE-IV	Elective-IV (Select any one from the list)	30	70	100	**3**	**1**	**0**	**4**	**04**
	MCAP402	Project / Industrial Training (Software / Research)	150	350	500				**12**	
		Semester Total			**800**				**24**	
		GRAND TOTAL			**3000**				**100**	

MCACC – Core Course
MCANC – Non-Credited Course
MCAE – Elective Course
MOOC – Massive Open Online Course

- IA: Internal Assessment, ESE: End Semester Examination.
- Students are required to select one course from each set of electives (Elective-I to Elective-IV) offered by the department.
- ESE=70, IA=30, P=70 (30 Marks for Practical Problems, 30 Marks for Viva-Voce, 10 Marks for Lab Record)
- The weight age of Internal Assessment and External Assessment will be in the ratio of 30% and 70% of total marks in all theory, practical papers & projects.

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Elective Papers

MCA Semester-III

Elective-I

1. MCAE11- Applied Cryptography
2. MCAE12- Blockchain Fundamentals
3. MCAE13- Privacy & Security in Online Social Media
4. MCAE14- Mobile Computing
5. MOOC01 – MOOCs (any course of same credit)

Elective-II

1. MCAE21- Cloud Computing
2. MCAE22- Internet of Things (IoT)
3. MCAE23- Soft Computing
4. MCAE24- Software Testing and Quality Assurance

MCA Semester-IV

Elective-III

1. MCAE31- Machine Learning
2. MCAE32- Neural Network
3. MCAE33- Natural Language Processing
4. MCAE34- Pattern Recognition
5. MOOC02 – MOOCs (any course of same credit)

Elective-IV

1. MCAE41- Data Warehousing & Data Mining
2. MCAE42- Big Data Analytics
3. MCAE43- Advanced Database Management System
4. MCAE44- Compiler Design

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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.

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.

UNIT-IV **Lectures: 09**

Block chain: Introduction, overview, features, limitations and application areas fundamentals of Block Chain.
Crypto Currencies: Introduction, Applications and use cases

Cloud Computing: It nature and benefits, AWS, Google, Microsoft & IBM Services.

UNIT-V **Lectures: 09**

Emerging Technologies: 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
MCACC 102: 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 unctions, 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.	K2,K3
6	CO6. 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**

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

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 1/2D 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 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. BehroozParahami, "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
MCACC 104: 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 ofAlgorithms, 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, Generalized linked list.

UNIT-III **Lectures: 09**

Stacks: Abstract Data Type, Primitive Stack operations: Push & 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 andB 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,Polya'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/modifyexperiments, 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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MCACC 107: 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

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MCA Semester II
MCACC 201: Object Oriented Programming using Java

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

OBJECTIVES OF THE COURSE:

1. To understand Object Oriented Concepts using Java Language.
2. To develop, debug and document programs in Java using OOP paradigms.
3. Describe the meaning of the object-oriented paradigm and implement real-world entities like inheritance, hiding, polymorphism in programming using the object-oriented design process.
4. To understand and implement core Java concepts as interface, package, exception handling, etc.
5. To understand and develop GUI components using Applets.
6. To understand and develop applications using Servlets/JSPs with database handling.

UNIT-I **Lectures: 09**

Introduction: Object Oriented Programming: objects, classes, Abstraction, Encapsulation, Inheritance, Polymorphism, OOP in Java, Characteristics of Java, The Java Environment, Java Virtual Machine, Comparison to other languages as C++,Java Source File Structure, and Compilation. Fundamental Programming Structures in Java: Defining classes in Java, constructors, methods, access specifiers, static members, Comments, Data Types, Variables, Operators, Control Flow, Arrays.

UNIT-II **Lectures: 09**

Inheritance, Interfaces and Packages: Inheritance: Super classes, sub classes, Protected members, method overloading, constructor overloading, use of this and super keyword, Object class, abstract classes and methods. Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces. Packages: Defining Package, CLASSPATH Setting for Packages, Making JAR Files for Library Packages, importing and naming convention for Packages, Networking java.net package. Access control: private access, public access, protected access and package access.

UNIT-III **Lectures: 09**

Exception Handling, I/O, Multithreading: Exceptions: exception hierarchy, checked and unchecked exceptions, throwing and catching exceptions, finally clause, built-in exceptions, creating own exceptions, Stack Trace Elements, catching exceptions. Input / Output Basics: Byte streams and Character streams, Reading and Writing, Console Reading and Writing Files. Multi-threading overview.

UNIT- IV **Lectures: 09**

Applets and Graphics: Why applets, HTML Applet Tag, A simple applet, graphical shapes, colors, fonts, drawing complex shapes, reading text input inside applet. AWT: introduction, labels, buttons, check boxes, events etc; Layout manager: flow layout, border layout, grid layout, card layout; Menus: Dialog boxes, File dialog; Applet classes, Applet life cycle. Introduction of Java Swing.

UNIT- V **Lectures: 09**

Database Handling with JDBC, Servlets and JSP: An Overview of DBMS – JDBC Architecture – Working with JDBC, DriverManager and Connectivity, Statement and PreparedStatement, ResultSet. Servlets and JSP: Introduction to Servlet, The Servlet Lifecycle, Retrieving/ Sending Information using Servlets, HttpServlet: Request and responseJSP: overview, JSP elements/ directives/ implicit objects, standard action tags.
Multitier Applications using JDBC with Servlet-JSP.

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

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1 To understand Object Oriented Concepts using Java and understand/implement Java programming basics as data types, variable, constants, operators, control statements, arrays, etc.	K1, K2, K3
2	CO2. To understand and implement concepts of inheritance, hiding, polymorphism,interfaces and packages etc. in Java programming.	K2, K3
3	CO3. To handle exceptions in programs and gain practical experience on using I/O, multithreading, etc.	K2, K3
4	CO4. Explain and implementation approaches for GUI design using Applets.	K2, K3
5	CO5.Design and implement interactive applications using Servlets-JSP and database handling	K2, K3

Suggested Readings:

1. Herbert Schildt, "Java The Complete reference", McGraw Hill Education, 8th Edition, 2011.
2. Khalid Mughal, "A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA)", AddisonWesley.
3. Cay S. Horstmann, Gary Cornell, "Core Java Volume –I Fundamentals", Prentice Hall, 9th Edition,2013.
4. Steven Holzner, "Java Black Book", Dreamtech.
5. Balagurusamy E, "Programming in Java", McGraw Hill.
6. Naughton, Schildt, "The Complete reference java2", McGraw Hill.
7. Deitel and Deitel, Java, How to Program, Prentice-Hall.

8. Naughton, Schildt, "The Complete reference java2", McGraw Hill
9. Cay Horstmann, Java Concepts, John Wiley & Sons, Inc.
10. Cay Horstmann, Big Java John Wiley & Sons, Inc.
11. David Flanagan, Java in a Nutshell, O'Reilly.
12. Liang, "Introduction to Java Programming, Comprehensive Version", Pearson Education.
13. A.R.Venugopal, Rajkumar, T. Ravishanker "Mastering C++", TMH.
14. R.Lafore, "Object Oriented Programming using C++", Galgotia Publications.
15. E. Balagurusamy, "Object Oriented Programming with C++", TMH.

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MCA Semester II
MCACC 202: Operating System

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

OBJECTIVES OF THE COURSE:

1. To develop the understanding of the structure and functioning of Operating System.
2. To learn about Processes, Threads and Scheduling algorithms.
3. To understand the principles of concurrency and Deadlock.
4. To learn various memory management schemes.
5. To study I/O management and File systems.

UNIT-I **Lectures: 09**

INTRODUCTION Evolution of Operating System, Operating System Structure, types of Operating System: Batch Processing, Multiprogramming, Timesharing, Distributed System, Real Time System. Process: Concepts, Process control blocks, concurrency, mutual exclusion, semaphores, Interprocess Communication, Process Synchronization.

UNIT-II **Lectures: 09**

Processor management techniques; Threads, Process Scheduling, Scheduling Criteria types of scheduling, scheduling algorithms, Deadlocks, Deadlocks Prevention, Deadlocks Avoidance, Deadlocks Detection.

UNIT-III **Lectures: 09**

Memory Management: Real storage, Contiguous vs. Non-Contiguous storage allocation, Static and Dynamic Partitioned memory allocation; Virtual memory, management of virtual memory, Paging, Demand paging, Performance of demand paging, Page replacement algorithms, Thrashing, Cache memory organization, Locality of reference. Segmentation with Paging, Protection schemes, Paged segmentation.

UNIT-IV **Lectures: 09**

I/O Management: Disk Organization, disk space management, disk scheduling, Files types and operations, File access and security, File storage Management, File Organization. RAID: File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

UNIT-V **Lectures: 09**

Advanced Operating System : Basics of Network Operating System, Server Operating System and Real Time Operating. UNIX: Essential commands and utilities, Unix files, directory structure, file security, Bourne shell programming features, systems calls classification and basics, Linux: System components, Networking software layers, Case Study of UNIX/LINUXOS.

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

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Explain main components, services, types and structure of Operating Systems.	K2
2	CO2. Apply the various algorithms and techniques to handle the various concurrency control issues.	K3
3	CO3. Compare and apply various CPU scheduling algorithms for process execution.	K2,K4
4	CO4. Identify occurrence of deadlock and describe ways to handle it.	K3
5	CO5.Explain and apply various memory, I/O and disk management techniques.	K5

Suggested Readings:

1. Abraham Siberschatz and Peter Baer Galvin, "Operating System Concepts", Addision-Wesley
2. Milan Milankovic, "Operating Systems, Concepts and Design", Tata McGraw-Hill.
3. Harvey M Deital, "Operating Systems", Addison Wesley
4. Richard Peterson, "Linux: The Complete Reference", Osborne Tata McGraw-Hill.
5. SibsankarHalder and Alex A Aravind, "Operating Systems", Pearson Education
6. D M Dhamdhere, "Operating Systems : A Concept basedApproach", McGraw Hill.
7. Charles Crowley, "Operating Systems: A Design-Oriented Approach", Tata McGraw Hill Education".
8. Stuart E. Madnick& John J. Donovan.Operating Systems.McGraw Hill.
9. A. S. Tanenbaum, "Modern Operating Systems", PHI.
10. William Stallings, "Operating Systems – internals and design principles", PHI.

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MCA Semester II
MCACC 203: Database Management System

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

OBJECTIVES OF THE COURSE:

1. To learn the features of a database system and its application and compare various types of data models.
2. To construct an ER Model for a given problem and transform it into a relation database schema.
3. To formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.
4. To understand the need of normalization and normalize a given relation to the desired normal form.
5. To understand different approaches of transaction processing and concurrency control.

UNIT-I **Lectures: 09**

Introduction: Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.

UNIT-II **Lectures: 09**

Relational data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands.SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

UNIT-III **Lectures: 09**

Data Base Design & Normalization: Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design

UNIT-IV **Lectures: 09**

Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.

UNIT-V **Lectures: 09**

Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.

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

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Describe the features of a database system and its application and compare various types of data models.	K2
2	CO2. Construct an ER Model for a given problem and transform it into a relation database schema.	K5, K6
3	CO3. Formulate solution to a query problem using SQL Commands, relational algebra, tuple calculus and domain calculus.	K5, K6
4	CO4. Explain the need of normalization and normalize a given relation to the desired normal form.	K2, K3
5	CO5. Explain different approaches of transaction processing and concurrency control.	K2

Suggested Readings:

1. Date, C.J.,"An Introduction to Database Systems", Narosa Publishing House, New Delhi.
2. Korth, Silbertz, Sudarshan, "Database Concepts", Tata Mcgraw-hill Education (India).
3. Elmasri, Navathe, "Fundamentals Of Database Systems", Pearson Education New Delhi India.
4. G.K. Gupta, "Database Management System", Tata Mcgraw-hill Education (India) Pvt. Ltd.
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication.
6. Majumdar& Bhattacharya, "Database Management System", Tata Mcgraw-hill Education.
7. Ramakrishnan, Gehrke, "Database Management System", McGraw Hill (India) Pvt Ltd.
8. Chakravarti, "Advanced Database Mnagement System" Wiley Dreamtech Publications.
9. Ullman, J.D.,"Principles of Database Systems", Galgotia Publications, New Delhi.
10. James Mortin- Principles of Database Management Object Oriented Modeling & Design.

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MCA Semester II
MCACC 204: Automata Theory and Formal Languages

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

OBJECTIVES OF THE COURSE:

1. Introduce concepts in automata theory and theory of computation.
2. Identify different formal language classes and their relationships.
3. Design grammars and recognizers for different formal languages.
4. Prove or disprove theorems in automata theory using its properties.
5. Determine the decidability and intractability of computational problems.

UNIT-I **Lectures: 09**

Basic Concepts and Automata Theory: Introduction to Theory of Computation- Automata, Computability and Complexity, Alphabet, Symbol, String, Formal Languages, Deterministic Finite Automaton (DFA)- Definition, Representation, Acceptability of a String and Language, Non Deterministic Finite Automaton (NFA), Equivalence of DFA and NFA, NFA with ε-Transition, Equivalence of NFA's with and without ε-Transition, Finite Automata with output-Moore machine, Mealy Machine, Equivalence of Moore and Mealy Machine, Minimization of Finite Automata, Myhill-Nerode Theorem, Simulation of DFA and NFA.

UNIT-II **Lectures: 09**

Regular Expressions and Languages: Regular Expressions, Transition, Graph, Kleen's Theorem, Finite Automata and Regular Expression Arden's theorem, Algebraic Method Using Arden's Theorem, Regular and Non-Regular Languages- Closure properties of Regular Languages, Pigeonhole Principle, Pumping Lemma, Application of Pumping Lemma, Decidability- Decision properties, Finite Automata and Regular Languages, Regular Languages and Computers, Simulation of Transition Graph and Regular language.

UNIT-III **Lectures: 09**

Regular and Non-Regular Grammars: Context Free Grammar(CFG)-Definition, Derivations, Languages, Derivation Trees and Ambiguity, Regular Grammars-Right Linear and Left Linear grammars, Conversion of FA into CFG and Regular grammar into FA, Simplification of CFG, Normal Forms- Chomsky Normal Form(CNF), Greibach Normal Form (GNF),Chomsky Hierarchy, Programming problems based on the properties of CFGs.

UNIT-IV **Lectures: 09**

Push Down Automata and Properties of Context Free Languages: Nondeterministic Pushdown Automata (NPDA)- Definition, Moves, A Language Accepted by NPDA, Deterministic Pushdown Automata(DPDA) and Deterministic Context free Languages(DCFL),
Pushdown Automata for Context Free Languages, Context Free grammars for Pushdown Automata, Two stack Pushdown Automata, Pumping Lemma for CFL, Closure properties of CFL, Decision Problems of CFL, Programming problems based on the properties of CFLs.

UNIT-V **Lectures: 09**

Turing Machines and Recursive Function Theory : Basic Turing Machine Model, Representation of Turing Machines, Language Acceptability of Turing Machines, Techniques for Turing Machine Construction, Modifications of Turing Machine, Turing Machine as Computer of Integer Functions, Universal Turing machine, Linear Bounded Automata, Church's Thesis, Recursive and Recursively Enumerable language, Halting Problem, Post Correspondence Problem, Introduction to Recursive Function Theory.

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

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Define various types of automata for different classes of formal languages and explain their working.	K1,K2
2	CO2. State and prove key properties of formal languages and automata.	K1, K3
3	CO3. Construct appropriate formal notations (such as grammars, acceptors, transducers and regular expressions) for given formal languages.	K3, K4
4	CO4 .Convert among equivalent notations for formal languages.	K3
5	CO5. Explain the significance of the Universal Turing machine, Church Turing thesis and concept of Un-decidability.	K2

Suggested Readings:

1. J.E. Hopcraft, R. Motwani, and Ullman, "Introduction to Automata theory, Languages and Computation", Pearson EducationAsia,2nd Edition.
2. J. Martin, "Introduction to languages and the theory of computation", McGraw Hill, 3rd Edition.
3. C. Papadimitrou and C. L. Lewis, "Elements and Theory of Computation", PHI.
4. K.L.P. Mishra and N. Chandrasekaran ,"Theory of Computer Science Automata Languages and Computation" , PHI.
5. Y.N. Singh, "Mathematical Foundation of Computer Science", New Age International.

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MCA Semester II
MCACC 205: Computer Network

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

OBJECTIVES OF THE COURSE:

1. To understand the computer networks and concentrates on building a firm foundation
2. To provide the fundamental knowledge of the various aspects of computer networking
3. To understanding the OSI Reference Model and TCP/IP Model
4. To have a good knowledge of Reference Model Layers and associated protocols.
5. Analyze the requirements for a given organizational structure. Select the most appropriate networking architecture and technologies and appreciate recent developments in the area.

UNIT-I **Lectures: 09**

Introduction: Data Communication& Networking, Data communication Components, data representation and data flow, Network structure and architecture, Types of Connections, Topologies, Protocols and Standards, The OSI reference model and TCP/IP reference model, services, comparison of models, Physical Layer Transmission Media, Switching methods., Delaysand Performance of Network, Internetworking-Bridges, Switches, Routers and Gateways; Virtual. LANs.

UNIT-II **Lectures: 09**

Data Link Layer: Error Handling: Error Detection and Error Correction, Introduction–Block coding, Hamming Distance, CRC, Flow Control and Error control: Stop and Wait, Sliding Window protocols: Go-Back–N ARQ, Selective Repeat ARQ, Piggybacking, Medium Access sub layer, Channel Allocations, Multiple Access protocols, Random Access protocols: ALOHA CSMA, CSMA/CD,CDMA/CA protocols, Overview of IEEE standards.

UNIT-III **Lectures: 09**

Network Layer: Overview, Point-to-Pont Networks, IP addressing and subnetting, IPv4-IPv6 address, IP packet, Address mapping–ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols, Routing Algorithms: Distance Vector Routing; Link State Routing.

UNIT-IV **Lectures: 09**

Transport Layer: Process-to-Process Delivery, User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP, Congestion: Congestion Control techniques andpolicies, TCP Congestion Control, TCP- Window Management, Quality of Service(QoS) concept, Techniques for achieving QoS.

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UNIT-V **Lectures: 09**

Application Layer: Domain Name Space(DNS), TELNET-Virtual Terminals, Electronic-mail architecture and components, File transfer protocol (FTP), WWW-HTTP, SNMP, Electronic mail and other applications, Cryptography – Basic concepts.

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

S. No.	Course Outcome	Bloom's Taxonomy
1	CO1. Understand computer network basics, network architecture, TCP/IP and OSI reference models and other concepts.	K1,K2
2	CO2. Understand error handling concepts, data link protocols, flow-error control, multi-channel access protocols and Standards.	K1, K2
3	CO3. Describe network layer protocols, IP addressing, IPV4 addressing scheme, Routing algorithms, etc.	K1, K2
4	CO4.Describe functionality of Transport layer and related protocols; concept of QoS and techniques.	K1, K2
5	CO5. Define various application layer protocols such as DNS, Electronic Mail, FTP, HTTP, Telnet and understand network security	K2

Suggested Readings:

1. Forouzen, "Data Communication and Networking", TMH A.S.
2. Tanenbaum, Computer Networks, Pearson Education
3. W. Stallings, Data and Computer Communication, Macmillan Press
4. AnuranjanMisra, "Computer Networks", Acme Learning
5. G. Shanmugarathinam, "Essential of TCP/ IP", Firewall Media

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MCA Semester II
MCAGE01 - 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.

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.

UNIT-IV **Lectures: 09**

Block chain: Introduction, overview, features, limitations and application areas fundamentals of Block Chain.
Crypto Currencies: Introduction, Applications and use cases
Cloud Computing: It nature and benefits, AWS, Google, Microsoft & IBM Services.

UNIT-V **Lectures: 09**

Emerging Technologies: 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 II
MCACC 207: Lab-OOP using JAVA

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

OBJECTIVES OF THE COURSE:

1. To learn and implement OOP concepts using Java programming language.
2. To apply object oriented techniques to analyze, design and develop a complete solution for a given problem.

Use Java compiler and eclipse platform to write and execute java program:

- Creating simple java programs,
- Understand OOP concepts and basics of Java programming.
- Create Java programs using inheritance and polymorphism.
- Understand the use of java packages.
- Implement error-handling techniques as exception handling, IO/file-handling, concept of multithreading.
- Develop GUI applications like a simple calculator using JavaApplets, swing components.
- Develop a Client Server networking application.
- Develop simple dynamic web-application using Servlets/JSP with database connectivity and perform basic CRUD operations.

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 Use Java compiler and eclipse platform to write and execute java program.	K3
2	CO2. Create Java programs using inheritance and polymorphism.	K3
3	CO3 Implement error-handling techniques using exception handling, IO/ file-handling techniques, multithreading.	K3
4	CO4. Develop a Client Server Application and develop GUI applications using Swing components.	K3
5	CO5. Develop interactive web application using Servlets/JSP and JDBC for database connectivity.	K3

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MCA Semester II
MCACC 208: Lab-DBMS

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

OBJECTIVES OF THE COURSE:.

1. To write SQL commands to query a database.
2. To develop database and writing queries using MySQL, SQL Server.
3. To write, debug and implement SQL programs in MySQL, SQL Server.
4. To learn programming in SQL.

- Installing SQL Server/MYSQL.
- Creating Entity-Relationship Diagram using case tools.
- Writing basic SQL statements.
- Restricting and sorting data.
- Displaying data from multiple tables.
- Aggregating data using group function.
- Manipulating data.
- Creating and managing tables.
- Normalization.
- Creating procedure and functions etc.
- Design and implementation of Payroll processing system.
- Design and implementation of Library Information System.
- Design and implementation of Student Information System.
- Automatic Backup of Files and Recovery of Files.

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	CO1Creating Entity-Relationship Diagram using case tools.	K3
2	CO2. Write SQL commands to query a database and displaying data from multiple tables.	K3
3	CO3.Analyze front end tools to design forms, reports and menus.	K3
4	CO4.Aggregating data using group function. Manipulating data.	K3
5	CO5.Develop a Client Server Application.	K3