NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

Master of Computer Applications

MCA

First Year

(Effective from the Session: 2025-26)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Master of Computer Applications
MCA
Evaluation Scheme
SEMESTER-I

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods		Evaluation Schemes					End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	CMCA0104	Discrete Mathematics	Mandatory	3	1	0	30	20	50		100		150	4
2	CMCA0103	Operating Systems	Mandatory	3	1	0	30	20	50		100		150	4
3	CMCA0105	Workplace Communication Competence 1	Mandatory	3	0	0	30	20	50		100		150	3
4	CMCA0101	Computer System & Organization	Mandatory	3	1	0	30	20	50		100		150	4
5	CMCA0102	Programming in C	Mandatory	3	0	0	30	20	50		100		150	3
6	CMCA0153	Operating Systems Lab	Mandatory	0	0	4				50		50	100	2
7	CMCA0151	Computer System & Organization Lab	Mandatory	0	0	2				50		50	100	1
8	CMCA0155	Workplace Communication Competence 1- Lab	Mandatory	0	0	4				50		50	100	2
9	CMCA0152	Programming in C	Mandatory	0	0	4				50		50	100	2
		*Massive Open Online Courses	MOOCs											
		TOTAL							**250**	**200**	**500**	**200**	**1150**	**25**

*** List of MOOCs Based Recommended Courses for First Year (Semester-I) MCA Students**

Sr. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	CMC0017	Introduction to Python	Infosys Wingspan (Infosys Springboard)	24h 6m	
2	CMC0018	Linux for Beginners	Infosys Wingspan (Infosys Springboard)	6h 2m	

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
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Master of Computer Applications
MCA

Evaluation Scheme
SEMESTER-II

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	CMCA0202	Database System	Mandatory	3	1	0	30	20	50		100		150	4
2	CMCA0203	Data Structures	Mandatory	3	1	0	30	20	50		100		150	4
3	CMCA0204	Design Thinking – I	Mandatory	3	0	0	30	20	50		100		150	3
4		Departmental Elective-I	Departmental Elective	3	0	0	30	20	50		100		150	3
5	CMCA0201	Cognitive Ability	Mandatory	2	1	0	30	20	50		50		100	3
6	CMCA0255	Object Oriented Techniques using JAVA	Mandatory	0	0	6				50		100	150	3
7	CMCA0253	Data Structures Lab	Mandatory	0	0	2				50		50	100	1
8	CMCA0252	Database System Lab	Mandatory	0	0	2				50		50	100	1
9		Departmental Elective-I Lab	Departmental Elective	0	0	2				25		25	50	1
10	CMCA0257	Workplace Communication Competence 2 Lab	Mandatory	0	0	4				50		50	100	2
		*Massive Open Online Courses	MOOCs											
		TOTAL							**250**	**225**	**450**	**275**	**1200**	**25**

*** List of MOOCs Based Recommended Courses for First Year (Semester-II) MCA Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	CMC0019	Design Thinking	Infosys Wingspan (Infosys Springboard)	3h 31m	
2	CMC0001	Next Gen Technologies	Infosys Wingspan (Infosys Springboard)	10h 14m	0.5

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

List of Departmental Elective Subjects

Sl. No.	Subject Codes	Subject Name	Types of Subjects	Bucket Name	Branch	Semester
1	CMCA0211	Fundamentals of Digital Marketing and Analytics	Departmental Elective	Departmental Elective - 1	MCA	II
2	CMCA0212	Fundamentals of Digital Marketing and Optimization	Departmental Elective		MCA	II
3	CMCA0213	CRM Administration	Departmental Elective		MCA	II
4	CMCA0214	Software Testing	Departmental Elective		MCA	II
5	CMCA0211P	Fundamentals of Digital Marketing and Analytics Lab	Departmental Elective	Departmental Elective – 1 Lab	MCA	II
6	CMCA0212P	Fundamentals of Digital Marketing and Optimization Lab	Departmental Elective		MCA	II
7	CMCA0213P	CRM Administration Lab	Departmental Elective		MCA	II
8	CMCA0214P	Software Testing Lab	Departmental Elective		MCA	II

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Course Code: CMCA0104	Course Name: Discrete Mathematics	L	T	P	C
Course Offered in: MCA First Year		3	1	0	4

Pre-requisite: Basic Knowledge of Mathematics

Course Objectives: To develop mathematical ability in understanding mathematical reasoning, ability to perform combinatorial analysis and knowledge about discrete structures, perform operations on discrete mathematics such as sets, functions and relations, Verify the correctness of an argument using symbolic logic and truth tables. Solve problems using counting techniques and combinatorics, to improve formal reasoning skills acquisition and mathematical knowledge

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Use Mathematical and logical notation to define basic discrete structures such as Sets, Relations, Functions, and Inductions	K2
CO2	Analyze and Apply Concepts of posset, Graphs and Trees	K4
CO3	Identify and prove properties of Algebraic Structures and their applications	K3
CO4	Apply Propositional and predicate logic for logical Reasoning	K3
CO5	Solve Recurrence Relations and Apply Combinatorics Techniques	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	2	-	-	-	1
CO2	3	3	2	1	-	-	-	2
CO3	3	3	2	2	1	-	-	2
CO4	3	3	2	2	-	-	-	2
CO5	3	2	2	3	-	-	-	2

Course Contents / Syllabus

Module 1	SET THEORY, RELATIONS & FUNCTIONS	8 hours

Set Theory: Introduction, Size of sets and cardinals, Venn diagrams, Combination of sets, Multisets, ordered pairs, Set identities and Proofs of some general identities on sets.
Relations & Functions: Definition, Operations on relations, Composite relations, Properties of relations, Equality of relations, Partial order relation and Recursive definition of relation. Functions - Definition, Classification of functions, Operations on functions, recursively defined functions, and Growth of Functions.
Natural Numbers: Introduction, Piano's axioms, Mathematical Induction, Strong Induction, and Induction with Nonzero Base cases.

Module 2	POSSETS, HASSE DIAGRAM, LATTICES AND GRAPH	8 hours

Possets, Hasse Diagram and Lattices: Introduction, Partial order sets, Combination of partial order sets, Hasse diagram, Introduction of lattices, Properties of lattices – Bounded, Complemented, Modular and Complete lattice.
Graphs: Definition and terminology, Representation of graphs, Multigraphs, Bipartite graphs, Planar graphs, Isomorphism and Homeomorphism of graphs, Euler and Hamiltonian paths, Graph coloring
Trees: Definition, Binary tree, Binary tree traversal (BFS and DFS), Binary search tree.

Module 3	ALGEBRAIC STRUCTURES, RINGS AND FIELDS	8 hours

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 and Symmetric groups, Homomorphism, and Isomorphism of groups.
Numerical Differentiation and Integration: Introduction, Numerical Differentiation, Numerical Integration, Trapezoidal rule, Simpson's rules

Module 4	PROPOSITIONAL & PREDICATE LOGIC	8 hours

Propositional & Predicate Logic: Propositions well-formed formula, Truth tables, Tautology, Contradiction, Algebra of propositions, Theory of Inference and Natural Deduction.
Frequency: Chart Different frequency chart like Histogram, Frequency curve, Pi-chart.
Regression analysis: Linear and Non-linear regression, Multiple regressions

Module 5	RECURRENCE RELATIONS & COMBINATORICS	8 hours

Recurrence Relations and Generating Function: Introduction and properties of Generating Function, Growth of functions, Recurrences from algorithms, Simple Recurrence relation with constant coefficients and Linear recurrence relation without constant coefficients. Methods of solving recurrences
Combinatorics: Introduction, Counting Techniques, Pigeonhole Principle, Pólya's Counting Theory.
Testing of Hypothesis: Test of significance, Chi-square test, t-test, F-Test Application to medicine, agriculture etc.
Time series and forecasting: Moving averages, smoothening of curves, forecasting models and methods

Total Lecture Hours	40 hours

Textbook:

S.No	Book Title	Author
1.	Discrete Mathematics and Its Applications	Kenneth H. Rosen, McGraw-Hill,2006
2.	Discrete Mathematical Structures	B.Kolman , R.C. Busby, and S.C. Ross, PrenticeHall,2004

Reference Books:

S.No	Book Title	Author
1.	Discrete and Combinatorial Mathematics: An Applied Introduction	Ralph P. Grimaldi, Pearson Education, 2003
2.	Discrete Mathematical Structures	Bernard Kolman, Robert C. Busby, Sharon Cutler Ross, Pearson Education, 2008
3.	Numerical Methods in Engineering and Science	B.S. Grewal, Khanna Publishers ,2014

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=9AUCdsmBGmA&list=PL0862D1A947252D20&index=10
Module 2	https://www.youtube.com/watch?v=oU60TuGHxe0&list=PL0862D1A947252D20&index=11
Module 3	https://www.youtube.com/watch?v=_BIKq9Xo_5A&list=PL0862D1A947252D20&index=13
Module 4	https://www.youtube.com/watch?v=gs0dQF3pGqM&list=PLmXKhU9FNesTpQNP_OpXN7Write_a ProgramwGx7NWsq
Module 5	https://www.youtube.com/watch?v=Yk6-ZBb9vh4

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Course Code: CMCA0103	**Course Name: Operating Systems**	**L**	**T**	**P**	**C**
Course Offered in: MCA First Year		**3**	**1**	**0**	**4**

Pre-requisite: Students are expected to be familiar with Computer Organization

Course Objectives: Objective of this course is to provide an understanding of the basic structure and functions of an operating system and deliver the skills needed to develop Unix/Linux shell programs.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Describe operating system concepts, functions, and design CPU Scheduling algorithms	K2
CO2	Analyze the issues related to inter process communication like Synchronization and Deadlocks.	K4
CO3	Describe the concepts of Memory Management and Implement disk scheduling algorithms.	K2
CO4	Design and use Linux utilities to create and manage simple file processing operations.	K5
CO5	Implement shell scripts to perform more complex tasks in shell programming environment.	K5

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	2	2	2	-	-	-	1
CO2	3	3	2	2	-	-	-	2
CO3	3	2	2	2	-	-	-	1
CO4	2	2	3	3	2	1	-	2
CO5	2	2	3	3	2	1	-	3

Course Contents / Syllabus

Module 1	**FUNDAMENTAL CONCEPTS OF OPERATING SYSTEM**	**8 hours**

Fundamentals of Operating Systems: Operating System, Operatic System characteristics, Functions of Operating Systems, Types of Operating System, Layered Structure, System call, Kernel, Multiprogramming and Multitasking, Overview of Windows OS, Unix/Linux OS.

Process Management: Process Management: Process Concepts, State Transition Diagram. Types of Schedulers: Long Term, Mid Term, Short Term Process Control Block, Inter process communication

CPU Scheduling: CPU Scheduling Criteria, Pre-emptive and Non-Pre-emptive Scheduling, Scheduling Algorithm: FCFS, SJF, SRTF, Round Robin, Priority Scheduling, Multilevel Queue Scheduling and Multilevel Feedback Queue Scheduling,
Context Switching

Module 2	**PROCESSES AND DEADLOCK**	**8 hours**

Process Synchronization: Critical Section problem & their solutions, Introduction to Semaphores Classical Problems of Synchronization (Producer Consumer Problem, Readers Writer Problem, Dining philosophers' problem)

Dead Locks: Characterization, Deadlock concepts & Handling Techniques (Prevention and Detection & Recovery), Dead Lock Avoidance: Banker's Algorithm.

Module 3	**MEMORY MANAGEMENT**	**8 hours**

Memory Management: Background, Swapping, Contiguous and Non-Contiguous memory allocation, Paging, Segmentation, Segmentation with paging. Virtual Memory: Background, Demand paging, Allocation of frames: First Fit, Best Fit, and Worst Fit, Page replacement algorithms (FCFS, Optimal, LRU), Balady's Anomaly, Thrashing.

Disc Scheduling: FCFS, SSTF, SCAN, C-SCAN, LOOK and C-LOOK

File Management System: Concept and Organization, Access Methods, File System Implementation, Allocation Methods, Free Space Management, File System Security and Protection

Module 4	LINUX ADMINISTRATION	8 hours
Linux administration: Linux Components, Shells, Installation of Linux, Virtualization: Definition, Types, Advantages, Virtualization tools. User Administration, Files: Type, Ownership, Permissions, and manipulations Commands: Internal and External, Directory and File commands, I/O commands, Pipes, Filters, shell commands. System Admin: man, uptime, users, service, pkill, ps		
Module 5	**SHELL PROGRAMMING AND VI EDITOR**	**8 hours**
Shell Programming & VI Editor: Shell Programming - shell script features, shell variables, writing and executing a shell script, positional parameters. Introduction to VI editor, VI editor Models, Invoking VI editor, Configuring the vi environment, the process - parent and child process, process creation, process related commands, branching control structures- if, case etc., Loop control structures– while, until, for, etc., Jumping control structures – break, continue, exit, etc., Integer and Real arithmetic in shell programs		
	Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1	Operating System Concepts Essentials	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley, 2012
2	Modern Operating Systems	Andrew S. Tanenbaum, Herbert Bos, Pearson, 2014
3	Linux for Beginners: An Introduction to the Linux Operating System and Command Line	Jason Cannon, CreateSpace Independent Publishing Platform, 2018
4	A Practical Guide to Linux: Commands, Editors and Shell Programming	Mark G. Sobell, Pearson, 2017

Reference Books:

S. No	Book Title	Author
1	Operating Systems: Internals and Design Principles	William Stallings, Pearson, 2014
2	Operating System: A Design-oriented Approach	Charles Crowley, McGraw-Hill, 1997
3	Operating Systems: A Modern Perspective	Gary J. Nutt, Pearson, 2014
4	Design of the UNIX Operating Systems	Maurice J. Bach, Prentice Hall, 1986

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/playlist?list=PLEAYkSg4uSQ3RTwDexX_T0TU7V9hHM_RO
Module 2	https://www.youtube.com/watch?v=OrM7nZcxXZU
Module 3	https://www.youtube.com/watch?v=xCxdBkFX_ww
Module 4	https://www.youtube.com/watch?v=SjZ16yeUNyc
Module 5	https://www.youtube.com/playlist?list=PL9ooVrP1hQOH3SvcgkC4Qv2cyCebvs0Ik https://www.youtube.com/watch?v=ibHmB4GTuOQ

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Course Code: CMCA0105	**Course Name: Workplace Communication Competence 1**	**L**	**T**	**P**	**C**
Course Offered in: MCA First Year		**3**	**0**	**0**	**3**

Pre-requisite: Comprehension of basic English language

Course Objectives: To improve proficiency in the English language to the lower intermediate level of CEFR (Common European Framework of Reference), To impart business communication skills, to motivate students to look within and create a better version of 'self.' and to introduce the key concepts of ethics, etiquette, and life skills.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Identify key concepts of life-skills.	K3
CO2	Develop effective listening skills.	K3
CO3	Compose clear and concise statements on a variety of subjects.	K6
CO4	Understand and analyze simple written texts.	K4
CO5	Demonstrate clarity while writing.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	2	2	-	-	2	-	2	3
CO2	2	2	-	-	3	-	-	3
CO3	3	2	2	2	3	-	-	2
CO4	2	3	-	2	2	-	-	2
CO5	3	2	-	2	3	-	-	2

Course Contents / Syllabus

Module 1	**INTRODUCTION TO COMMUNICATION**	**8 hours**

Module1.1: Importance of communicating in English
Module1.2: Basics of workplace communication
Module1.3: Levels of communication
Module1.4: Barriers to effective communication

Module 2	**ART OF LISTENING**	**8 hours**

Module2.1: Developing listening skills
Module2.2: Active and Passive Listening Skills
Module2.3: Empathetic listening

Module 3	**SPEAKING TO EXPRESS**	**8 hours**

Module 3.1: Effective Speaking: A Key to Professional Success
Module 3.2: Etiquette & Ethics
Module 3.3: Non-Verbal Cues: Making Verbal delivery effective
Module 3.4: Group Discussion – Dos and Don'ts

Module 4	**READING WITH COGNITIVE SKILLS**	**8 hours**

Module 4.1: Levels of comprehension
Module 4.2: Critical reading
Module 4.3: Acquiring vocabulary & sentence structure from texts

Module 5	**HARNESSING WRITING SKILLS**	**8 hours**

Module 5.1: Honing the writing skills
Module 5.2: Workplace vocabulary

Module 5.3: Pauses in written documents		
		Total Lecture Hours | **40 hours**
Textbook:		
S. No	**Book Title**	**Author**
1	"Technical Communication – Principles and Practices"	Meenakshi Raman & Sangeeta Sharma
2	"ABC Workbook"	NIET Publishing House
Reference Books:		
S. No	**Book Title**	**Author**
1	"Cambridge English Business Benchmark (Pre-intermediate to Intermediate)"	Norman Whitby
2	"Technical Communication: A Practical Guide"	William S. Pfeiffer and Kaye A. Adkins
3	"The Essentials of Technical Communication"	Elizabeth Tebeaux and Sam Dragga,
4	"Listening in the Language Classroom"	John Field,
5	"Speaking: Second Language Acquisition, from Theory to Practice"	William Littlewood
6	"Second Language Writing in Transitional Spaces: Teaching and Learning Across Languages and Cultures"	Viniti Vaish and Guangwei Hu
NPTEL/ YouTube/ Faculty Video Link:		
Module 1	https://www.youtube.com/playlist?list=PLbMVogVj5nJSZB8BV29_sPwwkzMTYXpaH	
Module 2	https://www.youtube.com/watch?v=0HHdBcGSzT0	
Module 3	https://www.youtube.com/playlist?list=PLrpK1inhO61X_ZfHMjPkYq7R09rlR255j	
Module 4	https://archive.nptel.ac.in/courses/109/104/109104126/	
Module 5	https://www.youtube.com/playlist?list=PLrpK1inhO61Wb4eGBX09XpM0lfoZbxuGg	

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Course Code: CMCA0101	**Course Name: Computer System & Organization**	**L**	**T**	**P**	**C**
Course Offered in: MCA First Year		**3**	**1**	**0**	**4**

Pre-requisite of Subject: Basic Knowledge of Mathematics and Computer Fundamentals

Course Objective: The basic concepts and components of digital logic design, the different methods of data representation in computers, Combinational and Sequential circuits, the different micro-operations, and data transfer methods. Understand the design, functionality and taxonomy of CPU, Memory types, the I/O interface, I/O ports, modes of data transfer between CPU and I/O device, 8085 microprocessors

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Apply the concept of number systems, logic gates, Boolean algebra, Minimization techniques	K3
CO2	Define the concept of combinational and sequential circuits.	K2
CO3	Discuss the concept of Register, the working of bus and memory transfer and ALU.	K2
CO4	Describe the hierarchical memory system, cache memory and Input/output interface and modes of data transfer.	K2
CO5	Discuss the 8085-microprocessor architecture, addressing modes, instruction cycle and formats.	K2

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**
CO1	3	2	2	2	-	-	-	2
CO2	3	2	2	2	-	-	-	1
CO3	3	2	2	2	-	-	-	1
CO4	2	2	2	2	-	-	-	1
CO5	3	2	2	2	-	-	-	2

Course Contents / Syllabus

Module 1	**INTRODUCTION TO NUMBER SYSTEM, BOOLEAN ALGEBRA**	**8 hours**

Digital Computers and Number System, Complements, Logic Gates, Boolean Algebra, Map Simplification up to Five variables, Data types, Fixed point representation, Fixed Point Addition & Subtraction, floating point Representation, Booth's Multiplication, IEEE754 Floating point standards.

Module 2	**INTRODUCTION TO COMBINATIONAL CIRCUITS AND SEQUENTIAL CIRCUITS**	**8 hours**

Combinational Circuits – Code Converter, Half Adder, Full Adder, Half Subtractor, Full subtractor, MUX, DEMUX, Encoder and Decode
Sequential Circuits – Latch and Flip Flop – S-R, D, J-K and T, Shift Registers

Module 3	**REGISTER TRANSFER AND ALU DESIGN**	**8 hours**

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Common Bus System, Two Bus Organization, three-bus organization. Arithmetic & Logic unit design, RISC & CISC Architecture

Module 4	**MEMORY MANAGEMENT AND INPUT/OUTPUT**	**8 hours**

Memory Hierarchy, Main Memory (RAM and ROM chips), Associative memory, Cache Memory.
I/O interface, I/O ports, Interrupts, Modes of data Transfer: Programmed I/O, Interrupt Initiated I/O, and Direct memory access (DMA)

Module 5	**8085 MICROPROCESSORs**	**8 hours**

8085: Architecture, General register Organization, Stack Organization, pin diagram, Addressing modes, Instruction formats, instruction cycles and sub cycles (Fetch, decode, execute etc.), Instructions- Data Transfer, Arithmetic, Logical, Branch and Assembly language programming

Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1	Computer System Architecture	M. Morris Mano, Pearson, 2012
2	Digital Design Techniques and Exercises: A Practice Book for Digital Logic Design	Vaibbhav Taraate, Springer Nature Singapore, 2021

Reference Books:

S. No	Book Title	Author
1	Structured Computer Organization	Andrew S. Tanenbaum, Pearson, 2012
2	Computer Organization and Architecture	William Stallings, Pearson, 2015
3	Microprocessor Architecture, Programming and Applications with the 8085	R.S. Gaonkar, Penram International Publishing, 2000

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://onlinecourses.nptel.ac.in/noc20_cs64/preview
Module 2	https://archive.nptel.ac.in/courses/117/106/117106086/
Module 3	https://archive.nptel.ac.in/courses/106/106/106106092/
Module 4	https://onlinecourses.nptel.ac.in/noc20_cs64/preview
Module 5	https://archive.nptel.ac.in/courses/117/105/117105126/

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Course Code: CMCA0102	Course Name: Programming in C	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: Basic knowledge of computers

Course Objectives: The objective of a C programming course is to provide students with a solid foundation in the C programming language. The course aims to familiarize students with the syntax, concepts, and principles of C programming, as well as develop their ability to write efficient and effective C code.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Apply the fundamentals of C programming to recognize tokens, operators, data types in developing basic C programs.	K3
CO2	Implement control structures, loops, functions, recursion, and storage classes to develop structured C programs solving basic computational problems.	K4
CO3	Apply pointers, arrays, and string manipulations to perform memory-efficient operations and solve problems using modular C programming techniques.	K4
CO4	Develop programs using structures, unions, and dynamic memory allocation to handle complex data and optimize memory usage in C.	K4
CO5	Implement file handling, sorting, searching, and command-line argument techniques to manage data input/output efficiently in C programs.	K4

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	1	-	1
CO2	3	3	2	3	2	1	-	2
CO3	3	3	3	3	2	2	-	2
CO4	3	2	3	3	2	2	-	2
CO5	3	3	3	3	3	3	-	3

Course Contents / Syllabus

Module 1	BASIC CONCEPTS OF C PROGRAMMING	8 hours

Introduction to Algorithm and C Program: Programming using C: Concepts of Algorithm and Flowchart, Translator and its types, Applications of C programming, Structure of C program, Overview of compilation and execution process in an IDE, Transition from algorithm to program, Syntax, logical errors and Run time errors, object and executable code **Tokens & Operators:** Keywords, identifiers, constant, Operators and their types, Arithmetic expressions and precedence: Operators precedence and associativity, type conversion, mixed operands.
Data Types & Variables: Basic data types, type modifiers, variable declaration, memory allocation

Module 2	CONTROL STRUCTURES AND FUNCTIONS	8 hours

Conditional Branching: if, else-if, nested if - else, switch statements, use of break, and default with switch **Iteration and loops**: Concept of loops, for, while and do- while, multiple loop variables, use of break and continue statements, nested loop
Functions: Concept of Sub-programming, function, types of functions, passing parameters to functions: call by value Definition
Recursion: Definition, Types of recursive functions, Tower of Hanoi problem
Storage Classes: scope of variable, local and global variables, Nesting of Scope, Auto, Register, Static and Extern

Module 3	ARRAY AND POINTERS	8 hours

Pointers: Defining and declaring pointer, pointer arithmetic and scaling, Pointer Aliasing. call by reference

Arrays: Array notation and representation (one and two dimensional), array using pointers, manipulating array elements,2-D array s used in matrix computation. Sorting and searching algorithms

Strings: Introduction, initializing strings, accessing string elements, Array of strings, Passing strings to functions, String manipulation functions.

Module 4	**DERIVED DATA TYPES AND MEMORY MANAGEMENT**	**8 hours**

Structure: Introduction, Initializing, defining, and declaring structure, accessing members, Operations on individual members, Operations on structures, Structure within structure, Array of structure

Union: Introduction, Initializing, defining, and declaring structure, Accessing members, Operations on individual members, Operations on Union, Difference between Structure and Union

Dynamic Memory Allocation: Introduction, Library functions– malloc (), calloc(), realloc() and free()

Module 5	**FILE MANAGEMENT**	**8 hours**

File Handling: File Types, File operations, File pointer, File opening modes, File handling functions, Command Line Arguments, File handling through command line arguments, Record I/O in files

	Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1	C: The Complete Reference	Herbert Schildt, McGraw-Hill, 2000
2	Programming in ANSI C	E. Balagurusamy, 9th Edition, McGraw-Hill Education India, 2024.
3	Let Us C	Yashavant P. Kanetkar, 20th Edition, BPB Publications, 2024

Reference Books:

S. No	Book Title	Author
1	Modern C, Third Edition	Jens Gustedt, Manning Publications, 2023
2	Head First C: A Brain-Friendly Guide	David Griffiths & Dawn Griffiths, O'Reilly Media, 2012
3	C Programming in Easy Steps	Mike McGrath, In Easy Steps Limited, 2022

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=KnvbUiSxvbM&list=PL98qAXLA6aftD9ZlnjpLhdQAOFI8xIB6e&ab_channel=Programiz
Module 2	https://www.youtube.com/watch?v=JYHpD9huNR4&list=PL98qAXLA6aftD9ZlnjpLhdQAOFI8xIB6e&index=25&ab_channel=Programiz
Module 3	https://www.youtube.com/watch?v=MOeGnamlUP4&list=PL98qAXLA6aftD9ZlnjpLhdQAOFI8xIB6e&index=19&ab_channel=Programiz
Module 4	https://www.youtube.com/watch?v=zmRxC7gYw-g&list=PLBlnK6fEyqRiteqwlMLXYtZ16xXDR7MO0&ab_channel=NesoAcademy
Module 5	https://www.youtube.com/watch?v=UxifZwjd5xU&ab_channel=GateSmashers https://www.youtube.com/watch?v=VM7s1k0s7kk&list=PLzx1ARJOmyed-PYHMduhZDQ4eKXmWJj_T&ab_channel=SmartLogicAcademy

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY
GREATER NOIDA-201306
(An Autonomous Institute)
School of Computer Applications

LAB Course Code: CMCA0153	LAB Course Name: Operating Systems Lab	L	T	P	C
Course Offered in: MCA First Year		**0**	**0**	**4**	**2**

Pre-requisite: Students are expected to be familiar with Computer Organization

Course Objectives: This course gives an ability to students to construct codes for OS API and basics of OS mechanisms and Hands-on and practical experience with usage of the Linux OS and basics of Shell Programming.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Implement Linux commands to understand the concept of virtualization	K4
CO2	Solve the real-world problems using shell programming and shell scripting.	K5
CO3	Analyze process management and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority.	K5
CO4	Implement Process Synchronization and analyze deadlock handling techniques.	K5
CO5	Simulate the continuous and non-continuous memory allocation concepts and analyze disk scheduling algorithms.	K5

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	1	-	-	2
CO2	3	2	3	3	2	-	-	3
CO3	3	3	3	3	-	-	-	2
CO4	3	3	3	3	-	-	1	2
CO5	3	3	3	3	-	-	-	2

List Of Practical's (Indicative & Not Limited To)

1. **File Manipulation Commands:** cat command, cp command, ls command, rm command, mv command, mkdir command, rmdir command, find command, grep command, wc command, sort command, more command, head command and tail command
2. **Status Alter Commands:** chgrp command, chown command & chmod command
3. **Compile Commands:** cc command
4. **Process Commands:** ps command, kill command
5. **Miscellaneous Commands:** Echo command, cal command, date command, whoami command, expr command & test command
6. **Filter Commands:** cut command, paste command, head command & tr command
7. Write a program to create a child process and print the process ids of parent and child process
8. Write a Shell program to check the given number is even or odd.
9. Write a Shell program to find the factorial of a number
10. Write a Shell program to swap the two integers.
11. Write a shell script to calculate the gross salary if basic salary is given. DA is 40% of basic salary and HRA is 60% of basic salary.
12. Write a shell script to reverse the digits of a number.
13. Write a shell script to compute the sum of digits.
14. Write a shell script to convert the contents of files to uppercase, given multiple files on command line.
15. Write a shell script to print the just the time, just the day of month and just the day of week as desired by user.
16. Write a shell script to print a word n times. Taking the n and the word from command line.

17. Write a shell script to print the area and perimeter of a rectangle and area and circumference of a circle. The length, breadth and radius are inputted through keyboard.
18. Write a shell script to delete all lines containing the word "unix" from all files provided as command line arguments.
19. Write a shell script to search a number in the given list of numbers. Number is provided as first argument in command line arguments; the list of numbers follows that.
20. Write a shell script to sort the numbers provided as command line arguments in a descending order.
21. Write a shell script to count the number of negative and positive numbers provided as command line arguments.
22. Write a shell Script to Concatenate Two Strings.
23. Write a shell script to print Fibonacci series.
24. Write a shell script to find whether a year is leap year or not.
25. Write a shell script to find whether a number is prime or not.
26. Write a program Using First-Come, First-Served **(FCFS)** Scheduling to find average turnaround time and average waiting time.
27. Write a program Using **SJF** CPU scheduling algorithm to find average turnaround time and average waiting time.
28. Write a program Using **Priority** CPU scheduling algorithm to find average turnaround time and average waiting time.
29. Write a program Using **Round Robin scheduling** to calculate average turnaround time and average waiting time.
30. Write a Program to execute **Race Condition** of Process Synchronization.
31. Write a program to implement **Producer Consumer** Problem.
32. Write a Program to Implement **Dinning Philosophers** Problem.
33. Write a Program to Implement **Banker's Algorithm**
34. Write a Program to Implement **FIRST FIT, BEST FIT, WORST FIT** Memory Allocation.
35. Write a Program to Implement **FIFO, LRU and Optimal** Page Replacement Algorithm.
36. Write a Program to Implement **FCFS, SSTF** Disk Scheduling Algorithm.
37. Write a Program to Implement **SCAN, CSCAN** Disk Scheduling Algorithm.
38. Write a Program to Implement **LOOK, CLOOK** Disk Scheduling Algorithm.

LAB Course Code: CMCA0151	LAB Course Name: Computer System & Organization Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Basic Knowledge of Mathematics and Computer Fundamentals

Course Objectives: Students will gain practical experience with designing and implementing concepts of gates, Multiplexer, Flip Flops, 8085 microprocessors

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Design and verify logic gate	**K3**
CO2	Design and verify and implement combinational circuit: Half adder, Full adder, Half subtractor, Full subtractor, Code convertor	**K3**
CO3	Design and implement Decoder, Multiplexer	**K3**
CO4	Demonstrate the working of flip-flops	**K2**
CO5	Demonstrate the working of 8085 microprocessor	**K2**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	1	-	-	1
CO2	3	2	3	3	1	1	-	1
CO3	3	2	3	3	1	-	-	1
CO4	3	2	2	3	1	-	-	1
CO5	3	2	2	3	1	1	1	2

List Of Practical's (Indicative & Not Limited To)

1. Verification of the functionality of all logic gates.
2. Implementing HALF ADDER, FULL ADDER using basic logic gates.
3. Implementing HALF SUBTRACTOR, FULL SUBTRACTOR using basic logic gates.
4. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
5. Implementing 3–8-line DECODER.
6. Implementing 4x1 and 8x1 MULTIPLEXERS.
7. Verify the excitation tables of various FLIP-FLOPS.
8. Introduction of 8085 microprocessor.
9. Write a program to add two 8-bit hexadecimal numbers in 8085 microprocessors.
10. Write a program to subtract two 8-bit hexadecimal numbers in 8085 microprocessors.

LAB Course Code: CMCA0155	LAB Course Name: Workplace Communication Competence 1- Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	4	2

Pre-requisite: Comprehension of basic English language

Course Objectives:

- To improve proficiency in the English language to the lower intermediate level of CEFR (Common European Framework of Reference).
- To impart business communication skills.
- To motivate students to look within and create a better version of 'self.'
- To introduce the key concepts of ethics, etiquette, and life skills.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Identify key concepts of life-skills	**K3**
CO2	Develop effective listening skills	**K3**
CO3	Compose clear and concise statements on a variety of subjects	**K6**
CO4	Understand and analyze simple written texts	**K4**
CO5	Demonstrate clarity while writing	**K3**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	-	-	2	-	2	3
CO2	2	2	-	-	3	-	-	3
CO3	3	2	2	2	3	-	-	2
CO4	2	3	-	2	2	-	-	2
CO5	3	2	-	2	3	-	-	2

List of Practical's (Indicative & Not Limited To)

1. The students will be familiarized with the examination pattern. Getting rid of stage fright and developing a sense of freedom and creativity
2. The students will be able to understand the meaning of messages conveyed using body language (through videos & games like Dumb Charades).
3. The students will practice greeting the peers and building rapport with the people around.
4. Developing active listening and accurate communication skills. Students will practice conveying information accurately and understand the importance of clear communication (through activities like Chinese whisper).
5. Students will enhance their reading comprehension abilities, improve vocabulary and language skills, and develop strategies for efficient and effective reading.
6. The students will practice and learn outcome-based writing
7. The students will practice professional introductions.
8. The students will learn to comprehend verbal instructions, pay attention to detail, and develop the ability to follow multi-step directions accurately.
9. The students will practice retention of the information given verbally and re-produce it through speaking.
10. Develop critical thinking skills, analyze the effectiveness of communication practices, and gain insights into real- world communication challenges and their solutions

11. Participants will be exposed to General Service List (GSL) by West and Academic Word List (AWL); the students will be asked to keep a journal of new words learnt every day.
12. The students will practice basic writing skills through sentence construction by understanding the requisites of a good sentence.
13. The students will practice listening to statements and writing exactly what they hear.
14. The students will practice responding effectively to queries/questions related to general everyday subjects (customer care, delivery agents, outlets etc.)
15. The students will be able to remove verbosity from their language. Students will participate in activities based on sample sentences and paragraphs.
16. Participants will listen to their peers reading aloud and write down the gist; and will repeat verbatim what is read.
17. Students will listen to the motivational speech by Dr A. P. J. Abdul Kalam and reflect on it.
18. Students will pair up and have short conversations with each other extracting specific information.
19. Students will learn to give directions, develop spatial awareness, and improve their navigational skills.
20. Students will learn to speak with confidence in public, using various verbal and non-verbal aspects of speech. Students will gain awareness of speaking in a professional environment and enhance their overall communication in English
21. To foster critical thinking, encourage creativity and expression, promote media literacy, and create an enjoyable learning experience by writing reviews.
22. Engaging in realistic scenarios, students will develop their communication abilities, cultural awareness, confidence, and proficiency in the target language.
23. Students will develop the ability to express their opinions, actively listen to others, and engage in constructive group discussions to develop well-rounded perspectives.
24. The students will share their key learnings from the course.

LAB Course Code: CMCA0152	LAB Course Name: Programming in C	L	T	P	C
Course Offered in: MCA First Year		0	0	4	2

Pre-requisite: Basic knowledge of computers

Course Objectives: The objective of a C programming course is to provide students with a solid foundation in the C programming language. The course aims to familiarize students with the syntax, concepts, and principles of C programming, as well as develop their ability to write efficient and effective C code.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Implement and trace the execution of conditional and iteration programs.	K3
CO2	Demonstrate use of arrays, strings, functions, and recursion.	K3
CO3	Solve the complex problem by using array and structure.	K3
CO4	Compare and contrast between Structure and union along with concepts of dynamic memory allocation	K4
CO5	Apply the concepts of File Handling	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	1	1	1	1
CO2	3	3	2	2	2	1	1	2
CO3	3	3	3	3	2	2	1	2
CO4	3	2	3	3	2	2	1	2
CO5	3	3	3	3	2	2	1	3

List Of Practical's (Indicative & Not Limited To)

1) Write a C program that simulates a simple calculator capable of performing basic arithmetic operations
2) Develop a calculator application that performs conversions between different number systems
3) Write a program in C to evaluate the given polynomial equation
4) Write a program (write a program) in C to calculate pow (x,n)
5) Write a program in C to find largest number among three numbers
6) Write a program in C to find roots of a quadratic equation
7) Write a program in C to check leap year. Evaluate all the cases
8) Write a program in C to check whether a number is positive or negative
9) Write a program in C to check whether a character is an alphabet or not
10) Write a program in C to make a simple calculator using switch...case
11) Write a program in C to check whether a number is even or odd
12) Write a program in C to check whether a character is a vowel or consonant

13) Write a program in C to find the largest number among three numbers
14) Write a program in C to check whether a number is positive or negative
15) Write a program in C to calculate the sum of natural numbers
16) Write a program in C to find factorial of a number
17) Write a program in C to generate multiplication table
18) Write a program in C to display Fibonacci sequence
19) Write a program in C to find GCD of two numbers
20) Write a program in C to find LCM of two numbers
21) Write a program in C to display characters from a to z using loop
22) Write a program in C to reverse a number using looping concepts
23) Write a program in C to check whether a number is palindrome or not
24) Write a program in C to check whether a number is prime or not
25) Write a program in C to check Armstrong number
26) Write a program in C to display Armstrong number between two intervals
27) Write a program in C to display factors of a number
28) Write a program in C to calculate the sum of natural numbers
29) Write a program in C to find factorial of a number
30) Write a program in C to convert binary number to decimal and vice-versa
31) Write a program in C to display a diamond-shaped pattern
32) Write a program in C to display Floyd's triangle
33) Write a program in C to display Pascal triangle
34) Write a program in C to print star patterns
35) Write a program in C to print pyramid patterns
36) Write a C program that performs grade calculation for multiple students
37) Design a C program with hierarchical menu system for geometric calculations
38) Write a program in C to display prime numbers between intervals using function
39) Write a program in C to check whether a number can be expressed as sum of two prime numbers
40) Write a program in C to check prime or Armstrong number using user-defined function
41) Develop a menu-driven C program to manage student records

42) Write a program in C to find the sum of natural numbers using recursion
43) Write a program in C to find factorial of a number using recursion
44) Write a program in C to find GCD using recursion
45) Write a program in C to calculate the power using recursion
46) Write a program in C to find the sum of natural numbers using recursion
47) Write a program in C to add two number using recursion
48) Write a program in C to find sum of digit of number using recursion
49) Write a program in C which will remove any given character from a string
50) Write a program in C to find the frequency of characters in a string
51) Write a program in C to count the number of vowels, consonants and so on
52) Write a program in C to remove all characters in a string except alphabets
53) Write a program in C to find the length of a string
54) Write a program in C to concatenate two strings
55) Write a program in C to copy string without using strcpy ()
56) Write a program in C to sort elements in lexicographical order (dictionary order)
57) Write a program in C to find the frequency of characters in a string
58) Write a program in C to count occurrence of a given character in a string
59) Write a program in C to check if two strings are anagram
60) Write a program in C to check a string is palindrome or not
61) C program to check given character is vowel or consonant
62) Write a program in C program to check given character is digit or not
63) Write a program in C program to replace the string space with a given character
64) Write a program in C program to convert lowercase char to uppercase of string
65) Write a program in C program to convert lowercase vowel to uppercase in string
66) Write a program in C program to delete vowels in each string
67) Write a program in C program to count occurrence of vowels & consonants in a string
68) Write a program in C program to print the highest frequency character in a string
69) Write a program in C program to replace first occurrence of vowel with '-' in string
70) Write a program in C program to count alphabets, digits, and special characters

71) Write a program in C program to separate characters in each string
72) Write a program in C program to remove blank space from string
73) Write a program in C program to count blank space from string
74) Write a program in C program to concatenate two strings
75) Write a program in C program to remove repeated character from string
76) Write a program in C program to calculate sum of integers in string
77) Write a program in C program to print all non-repeating character in string
78) Write a program in C program to copy one string to another string
79) Write a program in C program to sort characters of string
80) Write a program in C program to sort character of string in descending order
81) Write a program in C to calculate average using arrays
82) Write a program in C to find largest element in an array
83) Write a program in C to search an element from given array
84) Write a program in C to add two matrices using multi-dimensional arrays
85) Write a program in C to multiply two matrices using multi-dimensional arrays
86) Write a program in C to find transpose of a matrix
87) Write a program in C to access array elements using pointer
88) Write a program in C to find largest number using dynamic memory allocation
89) Write a program in C to calculate average using arrays
90) Write a program in C to find largest element in an array
91) Given an array containing numbers from 1 to 100 with one number missing, write a C program to find the missing number efficiently
92) Given an array containing numbers from 1 to 100 where multiple numbers may be duplicated, write a C program to identify and display all the duplicate numbers
93) Write a program in C to remove duplicate elements form array in C
94) Write a C program to find and display the numbers that appear in Array 1 but are not present in Array 2
95) Write a program in C for, how to compare two array is equal in size or not
96) Write a program in C to find largest and smallest number in array
97) Write a program in C to find second highest number in an integer array
98) Write a program in C to find top two maximum number in array

99)	Write a C program to print array in reverse Order
100)	Write a C program to reverse an Array in two ways
101)	Write a C Program to calculate length of an array
102)	Write a C program to insert an element at end of an Array
103)	Write a C program to insert element at a given location in Array
104)	Write a C Program to delete element at end of Array
105)	Write a C Program to delete given element from Array
106)	Write a C Program to delete element from array at given index
107)	Write a C Program to find sum of array elements
108)	Write a C Program to print all even numbers in array
109)	Write a C Program to print all odd numbers in array
110)	Write a C program to perform left rotation of array elements by two positions
111)	Write a C program to perform right rotation in array by 2 positions
112)	Write a C Program to merge two arrays
113)	Write a C Program to find highest frequency element in array
114)	Write a C Program to Store Information of a Student Using Structure
115)	Develop a C program that Dynamically allocates memory for storing multiple instances of the structure using pointers and malloc (or calloc)
116)	Write a C Program to Add Two Distances (in inch-feet system) using Structures
117)	Write a C program to define a union for student information containing roll number, name, and marks. Demonstrate how memory is shared in a union.
118)	Create a union for employee information with fields: emp_id, salary, and name. Input values for each field and print them to show how union stores only one value at a time.
119)	Demonstrate accessing a union variable through pointer dereferencing.
120)	Use a union within a structure to represent different types of bank accounts (e.g., savings and current). Input account type and show relevant fields using union.
121)	Write a C program to write a sentence to a text file
122)	Develop a C program to read and display the first line of a file
123)	Develop a C program to write record data to a file
124)	Write a C program to Read the last Line from a File

125)	Write a C program to copy one file into another
126)	Write a C program to write a structure into a file and display its content
127)	Write a C program to search a record in a file
128)	Write a program in C to read an existing file
129)	Write a program in C to write multiple lines to a text file
130)	Write a program in C to read the file and store the lines in an array
131)	Write a program in C to find the number of lines in a text file
132)	Write a program in C to find the content of a file and the number of lines in a text file
133)	Write a program in C to count the number of words and characters in a file
134)	Write a program in C to list all files and sub-directories in a directory
135)	Write a program in C to count number of lines in a file
136)	Write a program in C to merge contents of two files into a third file
137)	Write a program in C to count number of lines, words, characters, blank space in a file
138)	Write a program in C to Shutdown Computer in Linux
139)	Create a C program that simulates basic functionalities of an ATM system
140)	Develop a C program to manage the information of workers or employees in an organization using file handling
141)	Design a C program that helps a library in-charge efficiently manage books and customers

Course Code: CMCA0202	Course Name: Database System	L	T	P	C
Course Offered in: MCA First Year		3	1	0	4

Pre-requisite: Students are expected to be familiar with basic computer knowledge, as well as the fundamentals of mathematics and logical reasoning.

Course Objectives: To introduce DBMS concepts emphasizing efficient organization, maintenance, and retrieval of information in relational and non-relational databases.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Understand the basic concepts of DBMS, data models, ER/EER models, and relational algebra/calculus.	K2
CO2	Apply SQL queries to perform data manipulation, constraints, aggregate functions, and normalization techniques.	K3
CO3	Analyze and construct complex SQL queries including nested, joins, set operators, and implement database connectivity.	K4
CO4	Develop PL/SQL programs and manage transactions with concurrency control mechanisms.	K3
CO5	Implement and manage NoSQL databases using MongoDB and understand cloud database concepts.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	-	-	-	2
CO2	3	3	3	3	-	-	-	2
CO3	3	3	3	3	-	-	-	2
CO4	3	3	3	3	-	-	1	2
CO5	3	3	3	3	-	-	-	3

Course Contents / Syllabus

Module 1	INTRODUCTION OF DATABASE & CONCEPTUAL DESIGNING	8 hours

Introduction about the DBMS: Basic Concept: - Introduction of Data, Information, Database, DBMS, database system, structured, semi-structured and unstructured data. Database system Vs File system.

Data models & Types of Data Models: Relational Database: Relation, Tuple, Attribute and Domain, Codd Rules, Design & Implement the ER Diagram

Data Modelling using the Entity Relationship Model: ER model concepts, Degree of relationship, Notations for ER diagram, mapping constraints, reduction of ER diagrams to tables. Extended Entity Relationship Diagram & reduction of EER diagram to tables.

Introduction on SQL: Implements the DDL, DML, DCL & TCL: Introduction on SQL & Types of SQL commands: - DDL, DML, DCL, TCL.

Introduction on Relational Algebra& relational Calculus: Basic of Relation Algebra and Relational calculus

Module 2	BASIC OF SQL & NORMALIZATION	8 hours

Implementation of the Keys: Keys & Types of Keys: - Super key, Candidate Key, Primary Key, Alternative Key Composite Primary key, Foreign Key, unique and Composite Unique key

Implementation of Data Constraint: Data Constraint: - Null, Not Null, Default and check Constraint

Implementation of Aggregate function & clause: Use of Aggregate Function: -Min (), Max (), Count (), AVG (), Sum (). Use of Clause: Where, Group by, Having and Order by

Understand & implement the normalization: Uses of String Functions in SQL, Uses of mathematical functions in SQL. Uses of Advanced Functions in SQL Armstrong's axioms. Functional Dependencies, Normalization & Types of

Normalization,1NF, 2NF, 3NF, BCNF. Multivalued Dependency, Join Dependency. Minimal Cover of FD's, Closure of an attribute, Lossless join decomposition

Different types of functions in SQL: Uses of String Functions in SQL, Uses of mathematical functions in SQL. Uses of Advanced Functions in SQL

Module 3	**INTRODUCTION OF COMPLEX QUERIES**	**8 hours**

Operator & Predicates: Operator & Predicates: - Like, Between, Aliases, Distinct, Limit,

Implementation of Logical operator: And, Or, Not.

Set Theory Operator: Basic Set Operators: Selection, projection, rename, cross product, union, set difference

Derived Operators: Intersection, Division, Join. Inner Join: - Natural Join, Equi Join & Non Equi Join Outer Join: - Left Outer Join, Right Outer Join and Full Outer Join.

Nested Query: Nested Query, Sub Query or Correlated Query: -IN, NOT IN, Exists, Not Exists, All, Any

Implementation the database connectivity: Database connectivity with Java or Python

Module 4	**PL/SQL AND TRANSACTION & CONCURRENCY CONTROL**	**8 hours**

Implementation index and Views: Managing Indexes, Synonyms and Sequences, Managing Views, Managing Data in Different Time Zones

Implementation of PL/SQL: Introduction of PL/SQL, Implementation of PL/SQL Function Procedure, Trigger, Cursor

Implementation of Transaction management & concurrency control: Transaction system: - Life cycle of transaction, ACID Properties. Serial, non-serial schedule. Conflict Serializability. View Serializability. Recoverable Schedule, Cascade less schedule. Cascading rollback. Control Concurrency Techniques: Concurrency Control, Locking Techniques for concurrency control, 2-phase Locking protocol, strict 2 -phase locking protocol, rigorous 2-phase locking protocol

Transaction & Data Control: Grant, Revoke, commit & Rollback

Module 5	**INTRODUCTION OF NoSQL WITH MongoDB**	**8 hours**

Understand NoSQL Concept and implement the CURD operations: Introduction of NoSQL Data Models: Document, Key Value, Column family, Graph. Overview of NoSQL Databases with their Types, Uses& Features of NoSQL Document Databases. CAP theorem, BASE Vs ACID.

Introduction and Features of MongoDB: Sharding, Load Balancing, Indexing, Replication. MongoDB Shell & their commands Mongosh, MongoD, MongoDB Compass. MongoDB Collection, Document, Field & Value. MongoDB Operators, CRUD operations Implement the MongoDB Cursor

Relation and Aggregation in MongoDB: MongoDB Cursor & Methods, Relations in MongoDB, Aggregation in MongoDB

Understand the concept of cloud database: Introduction of Cloud Database. MongoDB Cloud: - Atlas, Cloud Manager.

Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1	Database System Concepts	Korth, Silbertz, Sudarshan, Seventh Edition, McGraw - Hill. (2019)
2	Fundamentals of Database Systems	Elmasri, Navathe , Seventh Edition Addison Wesley. (2017)
3	SQL, PL/SQL The programming language of Oracle	Ivan Bayross , Fourth Edition, BPB Publication. (2010)
4	NoSQL with MongoDB in 24 Hours	Brad Dayley , Sams Publishing; 1st edition (2014)

Reference Books

S. No	Book Title	Author
1	Database Systems: A Practical Approach to Design, Implementation and Management	Thomas Cannolly and Carolyn Begg, Third Edition, Pearson Education, (2007)
2	Database Management Systems	Raghu Ramakrishan and Johannes Gehrke Third Edition, McGraw-Hill (2002)
3	An Introduction to Database Systems	C J Date, Eighth Edition, Pearson. (2004)
4	NoSQLand SQL Data Modeling: Bringing Together Data, Semantics, and Software	First Edition by Ted Hills. (2016)

NPTEL/ YouTube/ Faculty Video Link:	
Module 1	https://archive.nptel.ac.in/courses/106/106/106106220/
Module 2	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
Module 3	https://nptel.ac.in/courses/106106093
Module 4	https://swayam-uat-node1.appspot.com/proc_9i/preview
Module 5	https://www.udemy.com/course/sql-to-nosql-database-handson-with-mongodb/

Course Code: CMCA0203	Course Name: Data Structures	L	T	P	C
Course Offered in: MCA First Year		3	1	0	4

Pre-requisite: Students are expected to have knowledge of programming languages, along with a foundation in mathematics and problem-solving ability.

Course Objectives: Learn the basic concepts of algorithm analysis, along with implementation of linear and non- linear data structures.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Describe the need of data structure and algorithms in problem solving and Analyze Time space trade-off.	K4
CO2	Describe the real-world applications using stack and queue.	K2
CO3	Discuss different Linked list operations.	K3
CO4	Evaluate the real-world applications using non-linear data structures.	K5
CO5	Identify and analyze the computational efficiencies of searching and sorting algorithms in real world problems	K4

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	-	-	-	2
CO2	3	2	2	2	-	-	-	1
CO3	3	2	2	2	-	-	-	1
CO4	3	3	3	3	-	-	-	2
CO5	3	3	3	3	-	-	-	3

Course Contents / Syllabus

Module 1	INTRODUCTION TO DATA STRUCTURES	8 hours

Data Types: Types of Data Structures- Linear & Non-Linear Data Structures, List, Tuple, Set, Dictionary. Arrays: Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array

Analysis of algorithms: Time and Space Complexity of an algorithm, Asymptotic notations (Big Oh, Big Theta and Big Omega).

Module 2	STACK & QUEUES	8 hours

Stacks: Primitive Stack operations: Push & Pop, mutual conversion of Infix, Prefix, Postfix, Evaluation of postfix expression
Recursion: Principles of recursion, Types of Recursions, Problem solving using iteration, Tower of Hanoi, Trade-offs between iteration and recursion.
Queues: Operations on Queue: Create, Insert, Delete, Full and Empty, Circular queues, De queue, and Priority Queue.

Module 3	LINKED LISTS	8 hours

Linked lists: Linked lists: Comparison of Array, List and Linked list Types of linked list: Singly Linked List, Doubly Linked List, Circular Linked List, Polynomial Representation and Addition of Polynomials**.**

Module 4	TREES	8 hours

Trees: Basic terminology, Binary Trees, Binary Tree Representation, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Extended Binary Tree, Tree Traversal algorithms: In-order, Pre-order and Post order. Constructing Binary Tree from given Tree Traversal, Binary Heaps, Heap Operations, Threaded Binary trees, Traversing Threaded Binary trees, AVL Tree, B-Tree.

Module 5	GRAPHS	8 hours

Graphs: Terminology used with Graph, Graph Sorting Techniques: Representations: Adjacency matrices, Adjacency List. Connected Component, Spanning Trees, Prim's and Kruskal's algorithm, Shortest Path algorithms: Dijkstra Algorithm, Floyd Warshall's Algorithm
Hashing: Sorting Algorithms. Hashing: Hash Functions, Collision- Resolution Techniques.

Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1	Data Structures and Algorithms in Python (An Indian Adaptation)	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Wiley Publication
2	DATA STRUCTURES USING PYTHON	12 March 2021, Dr Shriram K. Vasudevan (Author), Mr Abhishek S. Nagarajan (Author), Prof Karthick Nanmaran (Author) Oxford Higher Education, First Edition
3	Problem Solving in Data Structures & Algorithms Using Python	Hemant Jain ,1 January 2022, Third Edition

Reference Books:

S. No	Book Title	Author
1	Data Structure (Mumbai University)	Kiran Gurbani, Krupa Kamdar. Himalaya Publishing House
2	Data Structures with Python: Get Familiar with the Common Data Structures and Algorithms in Python	Harsh Bhasin, BPB Publications, 1 May 2023.
3	Data Structures and Algorithms Using Python.	Sharma, Notion Press,13 April 2023.

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://nptel.ac.in/courses/106/106/106106127/ https://www.youtube.com/watch?v=zWg7U0OEAoE&list=PLBF3763AF2E1C572F
Module 2	https://www.youtube.com/watch?v=4OxBvBXon5w&list=PLBF3763AF2E1C572F&index=22
Module 3	https://www.youtube.com/watch?v=cR4rxllyiCs&list=PLBF3763AF2E1C572F&index=23 https://nptel.ac.in/courses/106/106/106106127/
Module 4	https://www.youtube.com/watch?v=9zpSs845wf8&list=PLBF3763AF2E1C572F&index=24
Module 5	https://www.youtube.com/watch?v=hk5rQs7TQ7E&list=PLBF3763AF2E1C572F&index=25

Course Code: CMCA0204	Course Name: Design Thinking – I	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: None

Course Objectives: The objective of this course is to familiarize students with the design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite their minds to create innovative ideas as develop solutions for real-time problems.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Develop a strong understanding of the design process and apply it in a variety of business settings	K1
CO2	Analyze self, culture, and teamwork to work in a multidisciplinary environment and exhibit empathetic behavior	K3
CO3	Formulate specific problem statements of real-time issues and generate innovative ideas using design tools	K4
CO4	Apply critical thinking skills to arrive at the root cause from a set of likely causes	K4
CO5	Demonstrate an enhanced ability to apply design thinking skills for the evaluation of claims and arguments	K4

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	2	2	1	2
CO2	1	2	2	1	3	1	2	3
CO3	2	3	3	2	2	1	1	2
CO4	2	3	2	2	1	1	1	2
CO5	2	3	3	2	1	1	1	3

Course Contents / Syllabus

Module 1 **INTRODUCTION** **8 hours**

An overview of future skills, introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world.

Case Studies: Mumbai Dabbawallas, Gillette, Singapore, Bengaluru, Bahubali, Google, Embrace Incubator

Activity: Observation, Wicked Problem

Module 2 **ETHICAL VALUES AND EMPATHY** **8 hours**

Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family, society, institution, startup, socialization process. Ethical behavior: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character.

Understanding stakeholders, techniques to empathize with, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, Emotional Intelligence, customer journey maps, classifying insights after Observations, Classifying Stakeholders.

Case Studies: Pure-it, Royal Enfield, Big Basket, Air-bnb.

Activity: Moccasin Walk, Persona, Empathy map, Journey Map

Module 3	PROBLEM STATEMENT AND IDEATION	8 hours

Defining the problem statement, creating personas, Point of View (POV) statements. Research identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, JamBoard.
Case Studies: The Good Kitchen, Flipkart, Uber, Redbus, Big Bazaar
Activity: 5 Why, HMW, Brainstorming, Six Thinking Hats, 30 Circles, paper prototype

Module 4	CRITICAL THINKING	8 hours

Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills- linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.
Case Studies: Byju's, Maggi noodles, Tata Nano
Activity: debate, role play

Module 5	LOGIC AND ARGUMENTATION	8 hours

The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments.
Case Studies: Aadhaar Card, Demonetization, Odd-Even Policy, Jio
Activity: Logical Fallacy Detective, Fact-Checking Challenge

Total Lecture Hours	40 hours

Textbook:

S. No	Book Title	Author
1	Science & Art of Design Thinking	Arun Jain, UnMukt, 2020, Polaris
2	Solving Problems with Design Thinking – Ten Stories of What Works	Jeanne Liedta, Andrew King and Kevin Benett 2013, Columbia Business School Publishing
3	A Foundation Course in Human Values and Professional Ethics Bagaria 2009	First Edition, RR Gaur, R Sangal, G P Bagaria 2009, Excel Books: New Delhi

Reference Books:

S. No	Book Title	Author
1	Design Methods: A Structured Approach for Driving Innovation in Your Organization	Vijay Kumar 2013, John Wiley and Sons Inc, New Jersey
2	Design thinking for strategic innovation: What they can't teach you at business or design school	Mootee, I. (2013) John Wiley & Sons.
3	Basics Design 08: Design Thinking	Gavin Ambrose and Paul Harris, 2010, AVA Publishing SA
4	Design of Business: Why Design Thinking is the Next Competitive Advantage	Roger L. Martin 2009, Harvard Business Press, Boston MA

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://youtu.be/rUUuhnLkJ2s?si=_XCHnDbt_U1z0Frx https://www.youtube.com/watch?v=ldYzbV0NDp8 https://www.youtube.com/watch?v=0Fi83BHQsMA
Module 2	https://www.youtube.com/watch?v=q654-kmF3Pc http://www.uhv.org.in/ https://swayam.gov.in/nd1_noc19_mg60/preview
Module 3	https://www.udemy.com/course/design-thinking-for-beginners/ https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them
Module 4	https://www.forbes.com/sites/sap/2016/08/25/innovation-with-design-thinking-demands-critical-thinking/#340511486908 https://www.criticalthinking.org/pages/defining-critical-thinking/766
Module 5	https://www.udemy.com/course/critical-thinker-academy/ https://swayam.gov.in/nd2_aic19_ma06/preview

Course Code: CMCA0201	Course Name: Cognitive Ability	L	T	P	C
Course Offered in: MCA First Year		2	1	0	3

Pre-requisite: Basic understanding of elementary mathematics

Course Objectives: The objective of this course is to develop students' quantitative aptitude and logical reasoning skills through number theory, analytical puzzles, and business mathematics, enabling them to solve real-world and competitive exam problems with speed, accuracy, and logical thinking.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Apply fundamental number theory concepts such as divisibility, HCF & LCM, remainder theorem, and cyclicity to solve quantitative problems efficiently.	K2, K3
CO2	Solve problems involving logical reasoning and analytical thinking, including direction sense, blood relations, series patterns, and time-based puzzles like clocks and calendars.	K3
CO3	Solve the problems involving Percentage, Ratio, Proportion, Partnership, Problem of ages and coding decoding	K2, K3
CO4	Solve real-life business math problems involving percentages, profit and loss, discounts, interest calculations, averages, mixtures, and ratios using appropriate mathematical methods	K2, K3
CO5	Solve quantitative aptitude problems involving time and work, wages, pipes and cisterns, speed-distance-time, and race-related scenarios, using mathematical formulas and real-world applications.	K2, K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	-	-	-	-	1
CO2	3	3	2	-	-	-	-	1
CO3	3	3	2	-	-	-	-	1
CO4	3	3	3	-	-	-	-	2
CO5	3	3	3	2	-	-	-	2

Course Contents / Syllabus

Module 1	**Quantitative Ability (Basic Mathematics)**	**8 hours**

Number Systems, LCM and HCF, Decimal Fractions, Simplification, Square Roots and Cube, Roots, Average Problems on Ages, Surds & Indices, Percentages, Problems on Numbers

Module 2	**Quantitative Ability (Applied and Engineering Mathematics)**	**8 hours**

Logarithm, Permutation and Combinations, Probability, Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Time & Work, Ratio and Proportion, Area, Mixtures and Allegation

Module 3	**Quantitative Aptitude**	**8 hours**

Work & Wages, Pipes & Cistern, Time & Distance, Percentage, Trigonometry, Height and Distance, Algebras, Age, Simple Interest and Compound interest, Geometry.

Module 4	**Logical Reasoning (Deductive Reasoning)**	**8 hours**

Analogy, Blood Relation, Directional Sense, Number and Letter Series, Coding – Decoding, Calendars, Clocks, Venn Diagrams, Seating Arrangement, Syllogism, Mathematical Operations

Module 5	**Data Interpretation**	**8 hours**

Data Interpretation, Tables, Column, Graphs, Bar, Graphs, Line Charts, Pie Chart, Venn Diagrams

	Total Lecture Hours	**40 hours**

Reference Books:		
S. No	**Book Title**	**Author**
1	Quicker math	M. Tyra (BSC publication co. Pvt. Ltd)
2	Quantitative Aptitude	RS Aggarwal
3	Verbal & Non-Verbal Reasoning	RS Aggarwal
4	Quantitative Aptitude - Quantum CAT	Sarvesh K Verma

Course Code: CMCA0255	Course Name: Object Oriented Techniques using JAVA	L	T	P	C
Course Offered in: MCA First Year		0	0	6	3

Pre-requisite: Understanding of basic Java syntax, familiarity with object-oriented concepts (classes, objects, inheritance, polymorphism), and problem-solving skills

Course Objectives: The objective of this course is to understand the object-oriented methodology, and its techniques to design stand alone and GUI applications using hands-on engaging activities.

Course Outcome: After completion of this course students will be able to:		Bloom's Knowledge Level (KL)
CO1	Define the concepts of object-oriented programming.	K1
CO2	Describe OOP principles and concepts of lambda expressions.	K6
CO3	Analyze packages with different protection level resolving namespace collision and error handling concepts for uninterrupted execution.	K4
CO4	Describe Concurrency control, I/O Streams, and Annotations concepts.	K6
CO5	Explain GUI based application, Generics and Collections in Java to solve the real-world problem.	K5

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	1
CO3	3	3	3	2	-	-	-	2
CO4	2	2	2	2	-	-	-	2
CO5	3	3	3	3	2	-	-	3

Course Contents / Syllabus

Module 1	BASICS OF JAVA PROGRAMMING	8 hours

Object Oriented Programming: Introduction and Pillars of OOP with real life example, JVM architecture and its components.
Control Statements: Decision Making, Looping and Branching, Argument Passing Mechanism: Command Line Argument, Console Input/Output.
Class and Object: Object Oriented Concept in Java, Object Reference, Constructor, Abstraction: Abstract Class, Defining Methods, Static Class and Methods, Garbage Collection and finalize () Method etc.

Module 2	OOPs FEATURES, ARRAYS AND LAMBDA EXPRESS IONS	8 hours

Inheritance: Introduction and Types of Inheritance in Java, Implementing Multiple Inheritance, Interface, and it uses, Access Modifiers, Constructors in inheritance, Use of "this" and "super" keyword
Polymorphism: Introduction and Types, Overloading and Overriding
Lambda expression: Introduction and Working with Lambda Variables
Arrays: Introduction and its Types

Module 3	PACKAGES, EXCEPTION HANDLIN G AND STRING HANDLING	8 hours

Packages: Introduction and Types, Access Protection in Packages, Import and Execution of Packages.
Exception Handling: Introduction and Types, Exceptions vs. Errors, Handling of Exception Finally, Throws and Throw keyword, Multiple Catch Block, Nested Try and Finally Block.
String Handling: Introduction and Types, Operations, Immutable String, Method of String class, String Buffer and String Builder class.

Module 4	CONCURRENCY IN JAVA AND I/O STREAM	8 hours

Threads: Introduction and Types, Creating Threads, Thread Life- Cycle, Thread Priorities, Daemon Thread, Runnable Class, Synchronizing Threads etc.
I/O Stream: Introduction and Types, Common I/O Stream Operations, Interaction with I/O Streams Classes.
Annotations: Introduction, Custom Annotations and Applying Annotations.

Module 5	**V GUI PROGRAMMING, GENERIC S AND COLLECTIONS**	**8 hours**

Programming: Introduction and Types, Swing, Components and Containers, Layout Managers and User- Defined Layout and Event Handling concept.
Generics: Introduction to Generic Classes, Initializing a Generic Object, Generic Cell Driver Class, Generic Methods, Use enumerated type.
Collections: Introduction, Using Method References, Using Wrapper Class, Using Lists, Sets, Maps and Queues, Collection using Generics, Iterators.

	Total Lecture Hours	**40 hours**

Textbook:

S. No	**Book Title**	**Author**
1.	Java: The Complete Reference	McGraw-Hill Education, Herbert Schildt,12th Edition, 2021
2.	Core Java: An Integrated Approach	Dreamtech Press, R. Nageswara Rao,1st Edition, 2008
3.	Programming with Java	McGraw-Hill Education, E. Balagurusamy,6th Edition, 2019

Reference Books:

S. No	**Book Title**	**Author**
1.	Schaum's Outline of Programming with Java	McGraw-Hill Education, John R. Hubbard,2nd Edition, 2004
2.	Core Java Volume I – Fundamentals	11th Edition, Cay S. Horstmann, Prentice Hall, 2018

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=AEo4KgwKYoU
Module 2	https://www.youtube.com/watch?v=5RkikYKPvpc&t=284s
Module 3	https://www.youtube.com/watch?v=bxcZ7cXbDI0&list=PLqleLpAMfxGAEfyXJyF-9UOs9C8dmir_Y
Module 4	https://www.youtube.com/watch?v=jmZfuI3lDK0
Module 5	https://www.youtube.com/watch?v=R0USRU90TOo https://www.youtube.com/watch?v=aXZrz8XKQpE https://www.youtube.com/watch?v=hKhlkx_6HeI&list=PLUDwpEzHYYLu9-xrx5ykNH8wmN1C1qClk

LAB Course Code: CMCA0255	LAB Course Name: Object Oriented Techniques using JAVA Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	6	3

Pre-requisite: Understanding of basic Java syntax, familiarity with object-oriented concepts (classes, objects, inheritance, polymorphism), and problem-solving skills

Course Objectives:

The objective of this course is to understand the object-oriented methodology, and its techniques to design stand alone and GUI applications using hands-on engaging activities.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Implement object-oriented programming concepts.	K3
CO2	Demonstrate the Java programs using OOP principles and implement the concepts of lambda expressions.	K3
CO3	Implement packages with different protection level resolving namespace collision and the error handling concepts for uninterrupted execution of Java program.	K3
CO4	Develop Concurrency control, I/O Streams, and Annotations concepts by using Java program	K5
CO5	Design and develop the GUI based application, Generics and Collections in Java to solve the real-world problem.	K5

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	-	-	-	1
CO2	3	2	2	2	-	-	-	1
CO3	3	3	3	3	-	-	-	2
CO4	3	3	3	3	-	-	-	2
CO5	3	3	3	3	2	-	-	3

List Of Practical's (Indicative & Not Limited To)

1. Write Programs Compile and run first java file Byte Code and class file
2. Program to display default value of all Primitive data types
3. Implement the code using main () method to calculate and print the Total and Average marks scored by a student from the input given through the command line arguments.
4. Assume that four command line arguments name, marks1, marks2, marks3 will be passed to the main () method in the below class with name Total and Avg Marks.
5. Write code which uses if-then-else statement to check if a given account balance is greater or lesser than the minimum balance. Write a class Balance Check with public method check Balance that takes one parameter balance of type double. Use if-then-else statement and print Balance is low if balance is less than 1000. Otherwise, print Sufficient balance.
6. A class Number Palindrome with a public method is Number Palindrome that takes one parameter number of type int. Write a code to check whether the given number is palindrome or not. For example, Command Arguments: 333333 is a palindrome.

7. Write a class Fibonacci Series with a main method. The method receives one command line argument. Write a program to display Fibonacci series i.e. 0 1 1 2 3 5 8 13 21
8. Write a Java Program to find the Factorial of a given number.
9. Java Program to create a class, methods and invoke them inside main method
10. Write a Java program to illustrate the abstract class concept. Create an abstract class Shape, which contains an empty method number Of Sides (). Define three classes named Trapezoid, Triangle and Hexagon extends the class Shape, such that each one of the classes contains only the method number Of Sides (), that contains the number of sides in the given geometrical figure. Write a class Abstract Example with the main() method, declare an object to the class Shape, create instances of each class and call number Of Sides() methods of each class.
11. Java program to illustrate the static field in the class.
12. Java Program to illustrate static class.
13. Java program to explicit implementation of garbage collection by using finalize() method.
14. Java program to implement Single Inheritance.
15. Java program to implement multi-level Inheritance.
16. Java program to implement constructor and constructor overloading
17. Write a java program to access the class members using super keyword.
18. Java program to access the class members using this keyword.
19. Implement an interface named Mountain Parts that has a constant named TERRAIN that will store the String value "off_ road". The interface will define two methods that accept a String argument name new Value and two that will return the current value of an instance field. The methods are to be named: get Suspension, set Suspension, get Type, set Type.
20. Java program to demonstrate nested interface inside a interface
21. Java program to demonstrate nested interface inside a class.
22. Javaprogram implement method overloading.
23. Javaprogram to implement method overriding.
24. Java program to implement lambda expression without parameter.
25. Java program to implement lambda expression with single parameter.
26. Java program to implement lambda expression with multi parameter.
27. Java program to implement lambda expression that iterate list of objects
28. Java program to define lambda expressions as method parameters.
29. Write a class Count Of Two Numbers with a public method compare Count Of that takes three parameters one is arr of type int[] another two are arg1 and arg2 are of type int and returns true if count of arg1 is greater than arg2 in arr. The return type of compare Count of should be boolean. Assumptions: arr is never null arg1 and arg2 may be same
30. Java program to show the multiplication of two matrices using arrays.
31. Java Program to search an element using Linear Search
32. Java program to search an element using Binary Search
33. Java Program to sort element using Insertion Sort
34. Java Program to sort element using Selection Sort – Largest element Method

35. Java program to Sort elements using Bubble Sort
36. Java program to create user defined package.
37. Java Program to create a sub- classing of package.
38. Implement the following: Import package. *; import package. classname; Using fully qualified name.
39. Implement and demonstrate package names collision in java.
40. Java program to handle and Arithmetic Exception Divided by zero
41. Java Program to implement User Defined Exception in Java
42. Java program to illustrate finally block
43. Java program to illustrate Multiple catch blocks
44. Java program for creation of illustrating throw
45. Java program to print the output by appending all the capital letters in the input string.
46. Java program that prints the duplicate characters from the string with its count.
47. Java program to check if two strings are anagrams of each other
48. Java Program to count the total number of characters in a string
49. Java Program to count the total number of punctuation characters exists in a String
50. Java Program to count the total number of vowels and consonants in a string
51. Java Program to show. equals method and == in java
52. Given a string, return a new string made of n copies of the first 2 chars of the original string where n is the length of the string. The string may be any length. If there are fewer than 2 chars, use whatever is there. If input is "Wipped" then output should be "WiWiWiWiWi".
53. Given two strings, a and b, create a bigger string made of the first char of a, the first char of b, the second char of a, the second char of b, and so on. Any leftover chars go at the end of the result. If the inputs are "Hello" and "World", then the output is "HWeolrllod".
54. Java program to show the usage of string builder.
55. Java program to show the usage of string buffer.
56. Creating and Running a Thread
57. Implementing Runnable Interface
58. Synchronizing Threads with lock
59. Synchronizing Threads without lock
60. Java program to implement even and odd threads by using Thread class.
61. Java program to implement even and odd threads byusing Runnable interface.
62. Java program to synchronize the threads byusing Synchronize statements and Synchronize block.
63. Demonstrate the concept of type annotations in the JAVA programming language.
64. Java program to implement that read a character stream from input file and print it into output file.
65. Write a Java program that reads a text file and adds line numbers to each line. The program should create a new file with the line numbers added to the beginning of each line.
66. Java program to implement that merge the content of two files (file1.txt, file2.txt) into file3.txt.
67. Write a Java program that reads two binary files and compares them byte by byte to determine if they are identical. Display a message indicating whether the files are the same or different.

68. Write a Java program that reads the contents of one file and copies them to another file.
69. Write a Java program that reads a text file and counts the number of words in it.
70. Write a Java program that reads a text file and counts the frequency of each word in it.
71. Program to create a frame with three buttons.
72. Program to display message with radio buttons.
73. Program to display "All the Best" in 5 different colors on screen.
74. Program to implement event handling in a button “OK”
75. Java Program to implement Border Layout
76. Java Program to implement Grid Layout
77. Java Program to implement Box Layout
78. Java Program to implement Card Layout
79. Java program to implement Generic class
80. Java program to illustrate Generic methods
81. Java program to implement wild card in generics
82. Java program to implement of methods of Hash Set
83. Java Program to implement methods available in Hash Map class
84. Program to add, retrieve, and remove element from Array List
85. Create a method which can accept a collection of country names and add it to Array List with generic defined as String and return the List.
86. Create a method which can create a Hash Set containing values 1-10. The Set should be declared with the generic type Integer. The method should return the Set.
87. Develop a java class with a method store Even Numbers (int N) using Array List to store even numbers from 2 to N, where N is a integer which is passed as a parameter to the method store Even Numbers (). The method should return the Array List (A1) created.
88. Create a method that accepts the names of five countries and loads them to an array list and returns the list.
89. Java program to implement auto boxing
90. Java program to implement unboxing

LAB Course Code: CMCA0253	LAB Course Name: Data Structures Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Students are expected to have knowledge of programming languages, along with a foundation in mathematics and problem-solving ability.

Course Objectives: Learn to implement linear and non-linear data structures.

Course Outcome: After completion of this course students will be able to:		Bloom's Knowledge Level (KL)
CO 1	Ability to understand a systematic approach to organizing, writing, and debugging C programs	**K2**
CO 2	Ability to implement sorting and searching algorithms using relevant data structures	**K4**
CO 3	Implement Stack and Queue and linked list linked list.	**K5**
CO 4	Ability to implement linear and non-linear data structure operations using C programs	**K5**
CO 5	Solve complex problems using non-linear data structures like tree and graph along with the understanding of searching and sorting	**K5**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	-	-	-	1
CO2	3	3	3	3	-	-	-	2
CO3	3	3	3	3	-	-	-	2
CO4	3	3	3	3	-	-	-	2
CO5	3	3	3	3	-	-	-	2

List Of Practical's (Indicative & Not Limited To)

1. Construct a Code to find the maximum element in an array.
2. Construct a Code to calculate the sum of all elements in an array
3. Construct a Code to reverse the elements of an array.
4. Construct a Code to check if an array is sorted in ascending order.
5. Construct a Code to count the occurrence of a specific element in an array.
6. Construct a Code creation and traversal of 2D Array in row major and column major order
7. Construct a code to print the transpose of a given matrix using function
8. Program to find if a given matrix is Sparse or Not and print Sparse Matrix
9. Construct a code to Implement Linear Search
10. Construct a code to implement Binary Search
11. Implementation of stack using a list
12. Construct a python code to Infix to postfix conversion using a stack

13. Construct a code for Balanced parentheses checker using a stack
14. Implement Reverse a string using a stack.
15. Implement Binary Search using Recursion.
16. Construct a python program to print Fibonacci Series using Recursion.
17. Queue implementation using a list
18. Construct a code for Simulating a printer queue using a queue.
19. Construct a code for Implementing a circular queue.
20. Implement queue using stack
21. Create a single linked list and perform basic operations (insertion, deletion, traversal).
22. Create a double linked list and perform basic operations (insertion, deletion, traversal)
23. Create a circular linked list and perform basic operations (insertion, deletion, traversal).
24. Reverse a single linked list.
25. Check if a linked list is palindrome.
26. Find the middle element of a single linked list.
27. Find the middle element of a double linked list.
28. Merge two sorted single linked lists.
29. Detect and remove a loop in a circular linked list.
30. Construct a code to Insert, Delete, and search and update a data in Binary Search Tree (BST)
31. Construct a code for Tree Traversal (Preorder, Inorder, Postorder)
32. Construct a code Count the number of Leaves in a Binary Tree
33. Construct a code to find the Height of a Binary Tree
34. Construct a code to print all Paths from the Root to Leaf Nodes in a Binary Tree
35. Construct a code to convert a Binary Tree to its Mirror Tree
36. Construct a code to convert a Binary Tree to its Mirror Tree
37. A program to check if a Binary Tree is a Binary Search Tree (BST)
38. Construct a code to check if a Binary Tree is a Balanced Binary Tree
39. Construct a code to represent graph using adjacency matrix and adjacency list
40. Implement BFS and DFS algorithm.
41. Implement the minimum cost spanning tree

42. Implement bubble sort in a non-recursive way.
43. Implement selection sort in a non-recursive way.
44. Implement insertion sort in a non-recursive way.
45. Implement Merge sort in a non-recursive way.
46. Implement Merge sort in a recursive way.
47. Implement Quick sort in a recursive way.
48. Array-based Student Performance Analysis System
49. Design a project based on stack data structure to create a web history checker.
50. Design a dynamic Music Playlist using Linked List
51. Design Decision Tree Classifier for Disease Diagnosis using tree data structure.
52. Design Road Network Navigation: Implementing a navigation system to find the shortest path between locations using road networks.

LAB Course Code: CMCA0252	LAB Course Name: Database System Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Students are expected to be familiar with basic computer knowledge, as well as the fundamentals of mathematics and logical reasoning.

Course Objectives: The objective of the course is to introduce about database management systems, with an emphasis on how to organize, maintain and retrieve -efficiently, and effectively - information in relational & non- relational databases

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO 1	Design ER and EER diagram of database for solving the real-world problems.	**K2**
CO 2	Apply and analyze the Structured Query Language (SQL) to solve the complex queries and implement normalization.	**K6**
CO 3	Implement the operators in complex queries and apply database connectivity for different applications	**K6**
CO 4	Discuss PL/SQL programs to solve complex problems in databases	**K2**
CO 5	Design and implement relational and non-relational database for the need of the real-world project.	**K5**

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	-	-	-	2
CO2	3	3	3	3	-	-	-	2
CO3	3	3	3	3	1	-	-	2
CO4	3	3	3	2	-	-	-	2
CO5	3	3	3	3	2	1	-	3

List Of Practical's (Indicative & Not Limited To)

1. Creating ER Diagram for company Database. Company databases have entities like employee, departments, projects, and dependents also implement the relationship and cardinalities between the entities with their relevant attribute
2. Design an ER diagram for a travel agency that includes entities such as travelers, bookings, destinations, and itineraries. Also implement the relationship and cardinalities between the entities with their relevant attribute
3. Convert Company ER Model to Relational Model (Represent entities and relationships in tabular form, represent attributes as columns, identifying keys).
4. Convert Travel Agency ER Model to Relational Model (Represent entities and relationships in tabular form, represent attributes as columns, identifying keys).
5. **Data Definition Language Queries:**
   Create Tables STUDENT, BOOK, TRANS.
   STUDENT (Roll no, Name, Branch, Year, Section, Hostel, F_name, Address) BOOK (Bookid, Title, Author, Publisher, Cost, Copies)
   TRANS (Roll no, Bookid, date issue, date return, fine)

1. Add a new attribute state in student table
2. Remove attribute address from student table
3. Modify the data type of state attribute
4. Change the name of attribute hostel to resident
5. Change a table's name, student to stud
6. Use truncate to delete the contents of trans table
7. Remove the book table from database

6. Data Manipulation Language Queries

1. Insert at least 10 records in tables student, book, and trans
2. Show the contents in tables student, book, and trans
3. Find the name and branch of all students
4. Find the name and roll no of all students who stay in hostel
5. Find all distinct branches of students
6. Delete the record of the student whose roll no is 204001
7. Delete all records of student table
8. Delete all records of students whose section starts with capital A.
9. Find the student names which have 'lk' in any position
10. Find the student's name where 'R' is in the second position
11. Find the name of student whose name starts with 'V' and ends with 'A'
12. Change the State of all students to 'BOMBAY'
13. Change the state of student 'Vandana' to 'Goa'
14. Apply arithmetic operators on cost column of book table for the book which has book id = 1101

7. Queries with Constraints

1. Create the book table with Primary Key Constraint
2. Create trans table with foreign key Constraint
3. Create an Employee table with UNIQUE Constraint
4. Create Employee Table with Check Constraints
5. Create Supplier table with Default Constraint

8. **Queries on TCL**

1. Create Save points
2. Rollback to Save Points
3. Use Commit to save on

9. **Aggregate Functions:**

1. Find the minimum, maximum, average and sum of costs of books
2. Count the total number of books present
3. Retrieve the average cost of all books authored by 'navathe'

10. **String, Math and Advanced Functions**

Implement the Following Functions:

- ASCII()
- CHAR_LENGTH()
- CONCAT()
- LCASE()
- LOWER()

- REPEAT()
- REVERSE()
- STRCMP()
- ABS(X)
- MOD(X,Y)
- SIGN(X)
- POWER(X,Y)
- ROUND(X)
- SQRT(X)
- BIN()
- COALESCE()
- IF()
- LTRIM
- RTRIM
- LPAD
- RPAD
- INITCAP

11. Queries on GROUP BY, HAVING AND ORDER BY Clauses

1. Display total costs of books by each author
2. Find the branch and the number of students in that branch for branches which have more than 1 student
3. Find all books sorted by title in ascending order and cost in descending order
4. Find the branch and the number of students in that branch

12. Queries on Operators

1. Find the title, author and cost of books which have cost equal to or greater than 200 and less than or equal to 600.
2. Find the name, rollno and branch of students who are in 'CSE' branch or 'IT' branch
3. Find the title, author, and cost of book for which cost is between 200 and 600
4. Find the title and author of book, which has the word 'NET' anywhere in its title.
5. Find the bookid and title of books with title either 'OS' or 'DBMS'
6. List the students who issued books on '1st may2000', '12 JAN 2021','17 dec 2000','10 Jan 2021'
7. Display all books which have cost more than the cost of all books authored by 'Yash'
8. Find all the distinct costs of books

13. Join Operators

1. Perform Inner join on two tables
2. Perform Natural Join on two tables
3. Perform Left Outer Join on tables
4. Perform Right Outer join on tables
5. Perform Full Outer Join on tables

14. Set Theory Operators

1. Show the use of UNION operator with union compatibility
2. Show the use of intersect operator with union compatibility

3. Show the use of minus operator with union compatibility
4. Find the cartesian product of two tables

15. Queries on Set Theory Operators

1. List all books except 'Navathe' and 'Tannenbaum' in ascending order of costs
2. Display all books that have not been issued so far
3. To display the students name who have been issued DBMS book by NAVATHE and OS book by TANNENBAUM.
4. To display the students name who have been issued DBMS book by NAVATHE OR OS book by TANNENBAUM

16. Complex Queries

1. Display all books that have been issued so far
2. To display all the students of CSE IN year 2021 who are staying in the hostel.
3. To display students name who have issued OS book by Tannenbaum
4. To display the names of students who have not issued any book so far
5. To display the names of students who have issued at least one book so far.
6. To display students, name along with the book issued to them
7. Find the names of students who have paid fine Rs1000 for the book 'OS in Depth'.
8. Retrieve the name of students who have issued the book which has the maximum cost.
9. Retrieve the names of students who have issued all books written by 'Korth'

17. Queries on Views

1. Create a view of student table
2. Find roll no and name from the created view where hostel is 'YES'
3. Create a view selecting roll no, name, branch, year and section from student table
4. Insert a row in the created view
5. Find all data in the created view
6. Update the created view by changing the name to 'GOGUL' for student whose roll no is 101
7. Compare the data of created view and the original table student
8. Delete the record of student whose roll no is '101' from the created view
9. Remove the view from database

18. Queries on Sequence, Index

1. Set the column to ROWNUM of a table
2. Create a sequence and set a column of a table to the created sequence.
3. Create an Index on the customer table

19. PL/SQL Programs

1. Write a PL/SQL Code to add two numbers
2. Write a PL/SQL code for Fibonacci series
3. Write a PL/SQL Code for greatest of 3 numbers
4. Write a PL/SQL code for area and circumference of a circle

20. PL/SQL Programs on Cursors

1. Write a Program using CURSOR to display ssn and salary of 1st record of employee
2. Write a program using cursors to display the ssn and salary of all employees and then print the count of employees

21. PL/SQL Programs on Triggers, Procedures and Functions

1. Write a Program using TRIGGER on UPDATE
2. Write a command to See the effect of trigger
3. Write a Program using PROCEDURE to increase the salary by Rs.1000 for Employee whose ssn is passed as an argument.
4. Write a procedure to update the address of an employee whose ssn and address are passed as arguments and the procedure returns the name of employee whose address is updated.
5. Write a function to return the total number of employees
6. Write a function to return the department number for which the department name is passed
7. Write a function to find the total sum of salaries of all employees.
8. Write a procedure to insert record in the department table
9. Write a code using EXCEPTION

22. PL/SQL Programs on Implicit Cursors

1. Insert a record using %ROWTYPE
2. Write a code using %NOTFOUND, %FOUND, %ROWCOUNT
3. Write a code using %TYPE

23. Mongo DB Queries

1. Create a collection.
2. Insert documents into Created Collection
3. Use insertMany() to insert more records
4. View the inserted records, raw and formatted
5. Select all documents in collection
6. Find count of all customers
7. Show the records which have age equal to 18
8. Find all records which have fees between 2500 and 4500
9. retrieve all documents from the cust collection where status equals either "A" or "P"
10. Retrieve all documents where grade is equal to ‘F’ AND (fees is less than 3000 OR name starts with letter ‘J’)
11. Retrieve all documents where grade is equal to F OR fees is less than 4000
12. Update record with id 1, incrementing their fees by 50
13. Update the record of jack, set address to ‘Delhi’ and phoneno to ‘11221122’
14. Delete all records which have fees greater than 3000
15. Display only the grade and fees.
16. Get the grade, fees and custname of all records and sort by custname in ascending order.
17. Sort the Customers on their fees by descending order and get only first 2 records only
18. Update the postal code of 1st record and view it
19. Select from the cust collection all documents where the grade equals "F":
20. Retrieve the document with exact value ‘5’
21. Retrieve documents where grade field contains values in given set.
22. Retrieve documents where grade field does not contain values in given set.

23. Retrieve all documents where grade is equal to "f" and fees is greater than or equal to 2000 and less than or equal to 4000.
24. Retrieve all documents which have grade not "F" nor "P."
25. Retrieve all documents where fees are not greater than or equal to 3000
26. Retrieve all documents where fees exist and is greater than or equal to 3000
27. Retrieve all documents which have fees type double
28. Retrieve all documents that have fees of type number
29. Retrieve all documents when we divide fees by 200 and remainder is 100
30. Retrieve all documents that have regular expression 'o' in the custname field
31. Retrieve all documents that have fees 2000 or 4300

24. Connectivity with Database using Java or Python

25. Case Study

Implementation of case Study on different domain

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Voice-based Transport Enquiry System
6. SMS-based Remote Server Monitor system
7. Banking System

LAB Course Code: CMCA0257	LAB Course Name: Workplace Communication Competence 2	L	T	P	C
Course Offered in: MCA First Year		0	0	4	2

Pre-requisite: Comprehension of basic English language. The students should have completed Workplace Communication Competence course in first semester

Course Objectives: To improve proficiency in Business English to the intermediate level of CEFR (Common European Framework of Languages), to introduce the key concepts of life skills and train for career enhancement and to impart Business Communication Skills

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Apply key concepts of life-skills and train for career roles	K4
CO2	Enhance effective listening skills	K6
CO3	Acquire fluency and spontaneity while speaking professionally	K3
CO4	Understand and analyze complex written texts	K4
CO5	Compose clear and detailed texts on a variety of topics	K6

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	3	-	2	2	2	3
CO2	-	2	-	-	3	-	-	2
CO3	-	2	2	-	3	-	-	2
CO4	2	2	2	-	-	-	-	2
CO5	2	2	3	-	-	-	-	2

List Of Practical's

1. Students will know the course structure and examination pattern. Students will know how to meet, greet, and strike a conversation.
2. Students will learn through listening to conversations and understand common vocabulary and expressions in short, clear dialogues.
3. Students will learn to speak on personal interest and practice using professional phrases.
4. Students will listen to their peers reading aloud, write down the gist, and repeat what is read.
5. The students will understand and learn how to draft proper responses to different professional chat messages.
6. Students will practice listening to given audio clips and understand the importance of clear communication and active listening.
7. Students will demonstrate effective communication, active listening, and adaptability in various scenarios
8. Students will practice sample questions and answers for placements – offline & online.
9. Students will develop and improve their critical thinking and practice analytical writing.
10. Students will be provided with workplace situations and practice building their vocabulary by learning to use a variety of words.
11. Students will be practicing their active listening by analyzing TED Talks on subjects related to technology/science.

12. Students will engage in meaningful conversations, build connections, and create a positive networking atmosphere
13. The students will practice common interview questions.
14. Students will learn to write coherent sentences. They will also practice writing sentences using professional adjectives for specific purposes.
15. Students will enhance their listening skills, by listening to native speakers and learn to convey information accurately.
16. The students will practice professional writing skills through verbal prompts.
17. Students will enhance their ability to express their opinions, actively listen to others, and engage in constructive discussions to develop well-rounded perspectives.
18. Students will practice and enhance their reading skills, through reading select blog posts on technology and innovative businesses.
19. Students will learn to write about their career objectives, qualifications, and key skills in the form of a professional profile
20. The students will develop spontaneous thinking, and the ability to express their ideas effectively.
21. Students will practice effective communication strategies, develop empathy, and understand, and improve their speaking skills and ability to handle real-life situations through role-playing exercises.
22. The students will hone their presentation skills to develop and enhance effective speaking and non-verbal skills.
23. The students will learn co-ordination and improve their group presentation skills.
24. The students will discuss their key take away from the course.
Required Software and Tools
Software: - British Council English Score Mobile App

Course Code: CMCA0211	Course Name: Fundamentals of Digital Marketing and Analytics	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: Students should be able to think creatively.

Course Objectives: The course aims to equip learners with foundational skills in digital marketing and analytics, covering strategies, tools, metrics, and analytics techniques essential for effective digital marketing campaign planning, execution, and optimization.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Develop proficiency in interpreting marketing strategies in the digital age and provide fundamental knowledge for working in an online team.	K2
CO2	Discuss various concepts of data analytics pipeline.	K2
CO3	Evaluate the productivity of digital marketing channels for business success.	K3
CO4	Prepare candidates for global exposure of digital marketing practices to make them employable in a high growth industry.	K2
CO5	Learn basic concepts and understand association rules mining.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	3	1	1	2
CO2	3	3	2	3	-	-	-	2
CO3	2	3	3	2	-	2	-	3
CO4	2	2	3	2	2	2	2	3
CO5	3	3	2	3	-	-	-	2

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Module 1	Fundamentals of Digital marketing	8 hours

Fundamental s of Digital marketing: Fundamentals of Digital marketing & Its Significance, Traditional marketing Vs Digital Marketing, Evolution of Digital Marketing, Digital Marketing Landscape, Key Drivers, Digital Consumer & Communities, Gen Y & Netizen's expectation & influence with respect to Digital Marketing.

Module 2	Introduction to Data Analytics	8 hours

Introduction to Data Analytics: Sources and nature of data, classification of data (structured, semi structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics.
Data Analytics Lifecycle: Need key roles for successful analytic projects, various phases of data analytics lifecycle discovery, data preparation, model planning, model building, communicating results, operationalization

Module 3	Prepare Data for Exploration and Stakeholder	8 hours

Prepare Data for Exploration and Stakeholder: Data analysts, balance needs and expectations, managing stakeholder expectations, communication with your team.
Datatypes and structures: Generate data, Collection of data, analysis for data, Bias, credibility, privacy, ethics, and access-data analysts work, data is unbiased and credible, different types of bias in data, importance of data ethics and data privacy.

Module 4	Organizing and protecting your data	8 hours

Organizing and protecting your data Databases: Where data lives- databases, access them and extract, filter, and sort the data, metadata and its different types and how analysts use them

Organizing and protecting your data: Organizing data and keeping it secure, analysts use file naming conventions.
Engaging in the data community: How to manage your online presence, benefits of networking with other data analytics professionals.

Module 5	**Introduction to Data Mining**	**8 hours**

Introduction to Data Mining: Introduction, what is Data Mining, Definition, KDD, Challenges, Data Mining Tasks, Data Preprocessing, Data Cleaning, Missing data, Dimensionality Reduction, Feature Subset Selection, Discretization and Binarization, Data Transformation; Measures of Similarity and Dissimilarity- Basics.

Total Lecture Hours **40 hours**

Textbook:

S. No	Book Title	Author
1.	Digital Marketing. Oxford University Press	Vandana, Ahuja
2.	Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment	Eric Greenberg, & Kates, Alexander. McGraw-Hill Education
3.	E-Commerce: Strategy, Technologies, and Applications. McGraw-Hill Education	McGraw-Hill Education", Whiteley, David
4.	Data Mining: Concepts and Techniques. Morgan Kaufmann	Han, Jiawei, Pei, Jian, & Kamber, Micheline,3rd Edition, 2011

Reference Books:

S. No	Book Title	Author
1.	Basics of Data Analytics	Richa Mishra, Dr. Nirvikar Katiyar, & Apoorv Mishra, Notion Press, 2021
2.	Data Analytics: Become a Master in Data Analytics	Richard Dorsey, Independently Published, 2020
3.	Introduction to Data Mining (2nd ed.)	Tan, Pang-Ning, Steinbach, Michael, Karpatne, Anuj, & Kumar, Vipin Pearson, 2018.

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=68B3N0x3cPI&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=1
Module 2	https://www.youtube.com/watch?v=3iSKFCKLUsI&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=2
Module 3	https://www.youtube.com/watch?v=67lO4HtJitg&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=8
Module 4	https://www.youtube.com/watch?v=fYSvrZD4G38&list=PLbRMhDVUMnge625uLkVoqfS-uK-KJTBgp&index=14
Module 5	https://www.youtube.com/watch?v=GauClv1HsZA&list=PLbRMhDVUMnge625uLkVoqfS-

Course Code: CMCA0212	Course Name: Fundamentals of Digital Marketing and Optimization	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: Students are expected to be able to inspect any site and know the keyword of any site.

Course Objectives: Understand how digital and social media have disrupted the way businesses sell to consumers, help students to Recognize how marketers use the customer journey model to influence purchase decisions on digital platforms using digital content and tools, identify the benefits and advantages to a business of using social media to engage an audience, Build, manage, and sustain an active social media community.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Describe importance of digital marketing.	K2
CO2	Reorganize how marketers use Google SEO projects to influence purchasing and selling decisions on digital platforms using digital content and tools.	K1
CO3	Analyze the benefits of integrating traditional and digital marketing with Google SEO for sells and purchasing marketing strategies.	K3
CO4	Analyze the benefits of search advertising for a business that uses social media to target an audience.	K3
CO5	Implement an active social media community by using social media advertising.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	-	-	-	2
CO2	3	3	3	3	2	-	-	3
CO3	2	3	3	2	1	-	1	3
CO4	2	3	3	3	-	2	-	3
CO5	2	2	3	3	3	2	1	3

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Module 1	Social media and Digital Marketing Fundamental	8 hours

Digital Marketing Landscape: Digital Consumer Behavior, The Digital Customer Journey, The Digital Opportunity, Digital and Your Organization, Business Growth and Digital. Digital Marketing Principles: Key Digital Marketing Concepts, Traditional and Digital Marketing, 3i Principles, Integrating Traditional and Digital Marketing, Tools for Digital Marketing

Module 2	Social media and Social Content Strategy	8 hours

Content Marketing for Social: Content Marketing, Content Types, Social Media Platforms, Content Creation Tools, Influencer Marketing, eBook and Whitepapers Social Media and Business Strategy: Social Media Platforms, Key Concepts of Social Media, Types and Primary Uses of Social Media Platforms, Benefits of Social Media to Business, Role of Social Media , Social Media Platforms for Business: Social Media Marketing Concepts, Key Social Media Platforms, Setting up Social on Key Platforms, The Value of Building a Social Media Community

Module 3	Social Content Strategy and Promotion	8 hours

Social Content Strategy: Content Seeding, Social Media Formats, Content Promotion, Content Optimization, Influencer Marketing, Word of Mouth Marketing, Measurement and Tracking, Content Promotion Strategy, Audience Segmentation Facebook Marketing Fundamentals: Introduction to Facebook, The Value to Marketers, Page Management, Facebook Live, Messenger Facebook Ads and Marketing: Facebook Ads, Ads Manager, Strategy Process, Buying Channels and Ad Auctions

Module 4	Instagram and Snapchat Marketing	8 hours

Instagram and Snapchat - Social Apps: Introduction to Social Apps, Differentiating Social Apps, Basic Features, Instagram: Video, stories, live, Instagram Posts, Snapchat Meanings, Snapchat Story, Basic Features Instagram, and Snapchat Marketing: Instagram Account Overview, Audience Development, Advertising Overview, 3V Advertising, Ads Manager, Snap Ads, Instagram Analysis, Snapchat Analysis, Campaign Setup, Snapchat Geo filters

Module 5	**Twitter LinkedIn and YouTube Marketing**	**8 hours**
Twitter Marketing: Twitter Concepts, Platform Features, Profile Promotion and management, Hashtags, Analysis and Reporting. LinkedIn and Social Selling: Social Selling and Personal Branding, The Benefits of Personal Branding, LinkedIn Concepts, Features and Functions, LinkedIn Social Plugins, LinkedIn Analytics. YouTube and Social Video Marketing: Misconceptions and Benefits, Platform Features, Channel Setup, Channel Promotion, Channel Management, YouTube Native Formats.		
	Total Lecture Hours	**40 hours**

Textbook:

S.No	Book Title	Author
1.	Digital Marketing Essentials You Always Wanted to Know (Self-Learning Management Series)	Vibrant Publishers, 2021.
2.	Digital Marketing (3rd Edition)	Seema Gupta, McGraw-Hill Education, 2021
3.	Digital Marketing for Beginners: A Road Map to Successful Career in Digital Marketing	V. Venkata Krishna, Independently Published, 2022

Reference Books:

S.No	Book Title	Author
1	Fundamentals of Digital Marketing	Puneet Singh Bhatia. Pearson Education India, 2017
2	Digital Marketing: Strategy, Implementation and Practice (7th Edition)	Dave Chaffey & Fiona Ellis-Chadwick, Pearson Education, 2019
3	Fundamentals of Digital Marketing	Philip Kotler & Sarmad Saleem, Redshine Publication, 2021
4	Digital Marketing for Dummies	Ryan Deiss & Russ Henneberry, Wiley, 2020
5	Digital Marketing: Cases from India	Rajendra Nargundkar & Romi Sainy, Sage Publications India, 2022

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=vlRm8tqAYCs&list=PLNfnAKZ4ZsaoIFGUO3GWTHEI73S_QV56rB&index=2
Module 2	https://www.youtube.com/watch?v=emUpshX-ToI
Module 3	https://www.youtube.com/watch?v=xNz4MmHxf0Y
Module 4	https://www.youtube.com/watch?v=8d8sI-3Bcc8
Module 5	https://www.youtube.com/watch?v=KcxD7oFWlvo

Course Code: CMCA0213	Course Name: CRM Administration	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: Basic Knowledge of Computer Science

Course Objectives: Understand the concepts of Sales force App. Understand the concepts of Lightning Experience. Familiarize with concepts administration. Learn Admin Essentials in Lightning Experience

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Describe the working of Trailhead.	K2
CO2	Describe the importance of Salesforce and its features.	K2
CO3	Implement the validations in Data modelling.	K3
CO4	Describe the importance of user management.	K2
CO5	Identify and implement Security concepts in Industry.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	-	2	-	-	-	2
CO2	3	2	1	2	-	-	-	2
CO3	3	3	3	3	-	-	1	2
CO4	2	2	1	2	1	-	2	2
CO5	3	3	2	3	-	-	3	3

Course Contents / Syllabus

Module 1	Introduction	8 hours

Salesforce Platform Basics, User Management, Data Modelling, Data Management, Identity Basic, Data Security, Lightning Experience Customization, Lightning APP Builder Salesforce Mobile App Customization, User Engagement, Formulas and Validation, Data Security, Pick list Administration.

Module 2	Lightning & Sales force App Experience Customization	8 hours

Formula and Validation, Accounts and Contacts for Lightning Experience, Lead and Opportunity for Lightning Experience, Product Quotes and Contracts, Campaign Basic

Module 3	Salesforce Administration	8 hours

Service Cloud for lightning Experience, Sales force mobile app customization, App Exchange basic Duplicate Management Lightning Experience for Salesforce Classic Users, Chatter Administration for Lightning Experience, Reports and Dashboards for lightning experience, Lightning experience customization, Lightning experience rollout, Salesforce flow, Lightning experience report dashboard Specialist

Module 4	Lightning Experience	8 hours

Prepare Your Salesforce Org for Users, Customize an Org to Support a New Business Unit, Protect Your Data in Salesforce, Customize a Sales Path for Your Team, customize a Salesforce Object, Import and Export with Data Management Tools

Module 5	Learn Admin Essentials in Lightning Experience	8 hours

Learn about the custom object and custom field in Salesforce Lightning, uses of Custom Object and Custom field in Lightening, Workflow in Lightning, Update Record Field using Workflow, Send Email alert using Workflow, Data Loader in Salesforce Lightning.

	Total Lecture Hours	40 hours

Textbook:

S. No	Book Title	Author
1.	Digital Marketing for Dummies	Ryan Deiss, Russ Henneberry, John Wiley & Sons, 2020
2.	Youtility	Jay Baer, Portfolio, 2013
3.	Epic Content Marketing	Joe Pulizzi, McGraw-Hill Education, 2013

Reference Books:

S. No	Book Title	Author
1	Customer Relationship Management	S. Shajahan, Himalaya Publishing House, 2012

2	Customer Relationship Management	Alok Kumar Rai, Oxford University Press , 2015
3	Customer Relationship Management	Jagdish N. Sheth & Others, McGraw-Hill, 2002
4	CRM: A Strategic Approach	Kumar V., Excel Books, 2014
5	Customer Relationship Management	Peeru Mohamed & Sagadevan, PHI Learning, 2016

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=bxtqhfyoTjY&list=PLaGX30v1lh1BaUKgXa05gqrOP0vUg__6i&index=1
Module 2	https://www.youtube.com/watch?v=ZkQwm-6lsIw&list=PLaGX-_30v1lh1BaUKgXa05gqrOP0vUg_6i&index=3
Module 3	https://www.youtube.com/watch?v=iWbVm_o9Z0Q&list=PLaGX-_30v1lh1BaUKgXa05gqrOP0vUg_6i&index=8
Module 4	https://www.youtube.com/watch?v=oG5y-ynaREY&list=PLaGX-_30v1lh1BaUKgXa05gqrOP0vUg_6i&index=11
Module 5	https://www.youtube.com/watch?v=8DefDrWgcJY&list=PL-gW8Fj5TGrqly1oIz8ljs-_kHbahm4ydl

Course Code: CMCA0214	Course Name: Software Testing	L	T	P	C
Course Offered in: MCA First Year		3	0	0	3

Pre-requisite: Basic Knowledge of Computer and able to work in MS Excel.

Course Objectives: Give examples of why testing is necessary. Identify typical objectives of testing. Distinguish between error, defect, and failure. Explain the impact of context on the test process.

Course Outcome: After completion of the course, the student will be able to		Bloom's Knowledge Level (KL)
CO1	Describe the concepts of software testing.	K1
CO2	Demonstrate how different development and testing practices, and different constraints on testing, may apply in optimizing testing to different Contexts.	K2
CO3	Apply test management principles for resources, strategies, planning, project control, and risk management.	K3
CO4	Apply different testing techniques of software testing.	K3
CO5	Discuss how testing activities and work products align with project objectives, measures, and targets.	K2

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	1	1	2	2
CO2	2	3	2	3	2	1	2	2
CO3	2	2	3	2	2	3	2	2
CO4	3	3	2	3	1	1	1	1
CO5	2	3	3	2	2	2	2	2

Course Contents / Syllabus

Module 1	**INTRODUCTION**	**8 hours**

Fundamentals of Testing: What is Testing, Typical Objectives of Testing, Testing and Debugging, why is Testing Necessary? Quality Assurance and Testing, Errors, Defects, and Failures, Defects, Root Causes and Effects, Seven Testing Principles, Test Process, Traceability between the Test Basis and Test Work Products, The Psychology of Testing-Human Psychology and Testing, Tester's, and Developer's Mindsets.

Module 2	**TESTING THROUGHOUT THE SOFTWARE DEVELOPMENT LIFE CYCLE**	**8 hours**

Software Development Life Cycle Models, Software Development and Software Testing, Software Development Life Cycle Models in Context, Test Levels— Component Testing, Integration Testing, System Testing, Acceptance Testing, Test Types- Functional Testing, Non- functional Testing, White-box Testing, Change-related Testing.

Module 3	**STATIC TESTING**	**8 hours**

Static Testing Basics--Work Products that Can Be Examined by Static Testing, Benefits of Static Testing, Differences between Static and Dynamic Testing, Review Process--Work Product Review Process, Roles and responsibilities in a formal review, Review Types, Applying Review Techniques, Success Factors for Reviews.

Module 4	**TEST TECHNIQUES**	**8 hours**

Categories of Test Techniques- Categories of Test Techniques and Their Characteristics, Black-box Test Techniques, Equivalence Partitioning, Boundary Value Analysis, Decision Table Testing, State transition Testing, Use Case Testing, White-box Test Techniques, Statement Testing and Coverage, Decision Testing and Coverage, The Value of Statement and Decision Testing, Checklist-based Testing.

Module 5	**TEST MANAGEMENT**	**8 hours**

Test Organization, Independent Testing, Tasks of a Test Manager and Tester, Test Planning and Estimation, Purpose and Content of a Test Plan, Test Strategy and Test Approach, Test Execution Schedule, Factors Influencing the Test Effort, Test Estimation Techniques, Test Monitoring and Control, Metrics Used in Testing, Configuration Management, Risks and Testing, Defect Management, Tool Support for Testing

Total Lecture Hours	**40 hours**

Textbook:

S. No	Book Title	Author
1.	Software Engineering: A Practitioner's Approach	Roger S. Pressman, McGraw-Hill, 2014
2.	Software Testing: Principles and Practices	Srinivasan Desikan, Pearson, 2006
3.	Effective Software Testing: A Developer's Guide	Maurício Aniche, Addison-Wesley, 2019

Reference Books:

S. No	Book Title	Author
1	Software Testing: Principles and Practices	Srinivasan Desikan, Gopalaswamy Ramesh, Pearson, 2006
2	Foundations of Software Testing	Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black, Cengage Learning, 2008
3	Software Testing	Yogesh Singh, Cambridge University Press, 2011
4	Introduction to Software Testing	Paul Ammann, Jeff Offutt, Cambridge University Press, 2008
5	Software Testing and Quality Assurance	Kshirasagar Naik, Priyadarshi Tripathy, Wiley, 2011

NPTEL/ YouTube/ Faculty Video Link:

Module 1	https://www.youtube.com/watch?v=sbW4RThXNL8
Module 2	https://www.youtube.com/watch?v=T0TynxN77oY&t=46s
Module 3	https://www.youtube.com/watch?v=Qc-a0tBpdQQ
Module 4	https://www.youtube.com/watch?v=BSjRmiYP7vg
Module 5	https://www.youtube.com/watch?v=NiDe8lj-wGs

LAB Course Code: CMCA0211P	LAB Course Name: Fundamentals of Digital Marketing and Analytics Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Basic Knowledge of Computer Science

Course Objectives: To provide hands-on experience in applying digital marketing strategies and using analytics tools. Students will learn to analyze data, optimize campaigns, and implement digital marketing techniques for practical scenarios.

Course Outcome: After completion of the course, the student will be able to.		Bloom's Knowledge Level (KL)
CO1	Prepare spreadsheet for data manipulation, formula creation, and advanced functions like CONCATENATE, VLOOKUP, HLOOKUP, MATCH, and COUNTIF.	K3
CO2	Develop skills in sorting, filtering, text-to-columns, and data validation to effectively analyze and interpret data for marketing insights.	K5
CO3	Create, format, and interpret various types of charts to visualize data, enhance presentations, and support decision-making in digital marketing campaigns.	K5
CO4	Utilize PivotTables for summarizing, analyzing, and presenting complex data sets, including customization, manipulation, and integration with Pivot Charts.	K4
CO5	Prepare spreadsheets for navigation, sheet protection, macro recording,	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	3	-	-	-	2
CO2	3	3	3	3	-	-	-	2
CO3	2	3	2	3	-	-	-	2
CO4	3	3	3	3	-	-	-	2
CO5	2	1	2	3	-	1	-	2

List Of Practical's (Indicative & Not Limited To)

1. Creating Formulas: Using Formulas, Formula Functions – Sum, Average, if, Count, max, min, Proper, Upper, 1er, Using AutoSum

2. Columns & Rows: Selecting Columns & Rows, Changing Column Width & Row Height, Autofitting Columns & Rows, Hiding/Unhiding Columns & Rows, Inserting & Deleting Columns & Rows, Cell, Address of a cell, Components of a cell – Format, value, formula, Use of paste and paste special

3. Functionality Using Ranges: Using Ranges, Selecting Ranges, Entering Information into a Range, Using AutoFill

4. Concatenate, VLOOKUP, H lookup, Match, Count if, Text, Trim

5. Spreadsheet Charts: Creating Charts, Different types of charts, Formatting Chart Objects, Changing the Chart Type, Showing and Hiding the Legend, Showing and Hiding the Data Table

6. Data Analysis: Sorting, Filter, Text to Column, Data Validation

7. PivotTables: Creating PivotTables, manipulating a PivotTable, Using the PivotTable Toolbar, Changing Data Field, Properties, displaying a PivotChart, Setting PivotTable Options, Adding Subtotals to PivotTables

8. Spreadsheet Tools: Moving between Spreadsheets, Selecting Multiple Spreadsheets, Inserting and Deleting Spreadsheets Renaming Spreadsheets, Splitting the Screen, Freezing Panes, Copying and Pasting Data between Spreadsheets, Hiding, Protecting worksheets

9. Making Macros: Recording Macros, Running Macros, Deleting Macros

LAB Course Code: CMCA0212P	LAB Course Name: Fundamentals of Digital Marketing and Optimization Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Students are expected to be able to inspect any site and know the keyword of any site.

Course Objectives: Develop a basic display campaign and allocate ad dollars for success. Examine the pricing models for display and evaluate the best possible choice for your campaign.

Course Outcome: After completion of the course, the student will be able to.		Bloom's Knowledge Level (KL)
CO1	Identify the role that social marketing plays in the digital landscape and marketing mix.	K2
CO2	Explain the differences between, and the convergence of, paid, earned, and owned media.	K2
CO3	Identify and incorporate individual social and mobile platforms into a digital marketing strategy.	K1
CO4	Apply On Page SEO for upgrading ranking.	K3
CO5	Apply Technical SEO for upgrading ranking.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	2	-	-	-	2
CO2	3	3	2	2	-	-	-	2
CO3	3	3	3	3	2	-	-	3
CO4	3	3	3	3	-	-	-	3
CO5	3	3	3	3	-	-	-	3

List Of Practical's (Indicative & Not Limited To)

1. Basic Explanation and Setups:
   a. Name servers, theme & plugins setup
   b. Basic SEO, How Search Engine Works?
   c. Crawling, Indexing, Ranking
   d. GSC, Google Analytics, GTM, Google Alerts
2. Content Frameworks:
   a. Keyword (Explanation, Research, Ranking factor)
   b. Keyword Classification, Finding Right Keyword
   c. Competitive Keyword Research Content framework
3. On Page:
   a. Element Explanation
   b. Title Tag, Header Tags
   c. Meta Description, The Body
   d. URL Structure, Images
4. Technical SEO Part – I
   a. Elements Explanation
   b. Site Architecture, Website Structure
   c. Understand Google Crawlability
   d. Robots.txt, Sitemaps, Mobile SEO, AMP
5. Technical SEO Part –II

a. WordPress Speed Optimization
b. CDN c. Structured Data
d. Security

LAB Course Code: CMCA0213P	LAB Course Name: CRM Administration Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Creative thinking and which is being used by the creative talent in your business areas.

Course Objectives:

To make the students understand the organizational need, benefits and process of creating long-term value for individual customers. To disseminate knowledge regarding the concept of e-CRM and e- CRM technologies. To enable the students, understand the technological and human issues relating to implementation of Customer Relationship Management in the organizations.

Course Outcome: After completion of the course, the student will be able to.		Bloom's Knowledge Level (KL)
CO1	Describe the working of Trailhead.	K2
CO2	Describe the importance of Salesforce and its features.	K2
CO3	Implement the validations in Data modelling.	K3
CO4	Describe the importance of user management.	K2
CO5	Identify and implement Security concepts in Industry.	K2, K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	-	2	-	-	-	2
CO2	3	2	1	2	-	-	-	2
CO3	3	3	3	3	-	-	1	2
CO4	2	2	1	2	1	-	2	2
CO5	3	3	2	3	-	-	3	3

List Of Practical's (Indicative & Not Limited To)

1. Quick Start: Lightning App Builder
2. Prepare Your Salesforce Org for Users
3. Customize an Org to Support a New Business Unit
4. Protect Your Data in Salesforce
5. Customize a Sales Path for Your Team
6. Setup the service Console
7. Build a discount approval process
8. Quick start process builder
9. Build a simple f1
10. Build a battle station App
11. Customize a Salesforce Object
12. Create Reports and Dashboards for Sales and Marketing Managers
13. Improve Data Quality for Your Sales and Support Teams
14. Create a Process for Managing Support Cases

Mode of Evaluation

LAB Course Code: BMCA0214P	LAB Course Name: Software Testing Lab	L	T	P	C
Course Offered in: MCA First Year		0	0	2	1

Pre-requisite: Basic Knowledge of Computer and able to work in MS Excel.

Course Objectives:

To equip students with practical skills in testing methodologies, tools, and techniques, to develop expertise in test case design, execution, automation, defect tracking, and performance testing for robust software development.

Course Outcome: After completion of the course, the student will be able to.		Bloom's Knowledge Level (KL)
CO1	Apply effective test cases for various programming constructs and application functionalities.	K3
CO2	Identify and document potential causes of failures in software applications, such as matrix multiplication.	K1
CO3	Prepare testing based on user interfaces and performance metrics for web applications, particularly focusing on registration and login pages.	K3
CO4	Apply security testing techniques to ensure the robustness of web applications against potential vulnerabilities.	K3
CO5	Write detailed system specifications, identify bugs, and create test cases for complex systems like ATM and banking applications.	K3

CO-PO Mapping (Scale 1: Low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	1	1	1	2
CO2	3	3	2	2	1	1	1	2
CO3	2	3	3	3	2	1	2	3
CO4	2	3	3	3	1	1	3	3
CO5	3	3	3	2	2	2	2	3

List Of Practical's (Indicative & Not Limited To)

1. Write the Test cases for programs in any language which demonstrate the working of the fol1ing constructs i) do. While ii) while iii) if…else iv) switch v) for.
2. Write down the possible reasons for failure of Matrix multiplication.
3. Write the Test cases based on UI of Registration Page in Online Banking System.
4. Write the Test cases based on Terms and Conditions field of Registration Page.
5. Write the Test cases based on Performance in Registration Page.
6. Write the Test cases for Functionality in Registration Page.
7. Write the Test cases based on Security in Registration Page.
8. Write the Test cases for Functionality in Login Page.
9. Write the Test cases based on UI in Login Page.
10. Write the Test cases based on Performance in Login Page.
11. Write the Test cases based on Security in Login Page.

12. Write system specifications for ATM and make report on various bugs.
13. Write the test cases for banking application in respect of Registration Page and Login Page.

Mode of Evaluation

CIE			PE	Total
PS1 5	PS2 10	PS3 10	(If mentioned in curriculum)	
25			25	50