Guru Nanak Institute of Technology

(NAAC 'A+' Accredited Autonomous Institute)

(Affiliated to Maulana Abul Kalam Azad University of Technology)

Curriculum and Syllabus for MCA under Autonomy

Regulation 25

(NEP-2020 implemented)

Dept. of Computer Applications

(Effective from 2025-26 admission batch)

Objective:
To conduct software industry, corporate sector, academia, research-oriented MCA program following the AICTE model and NEP2020 for MCA

Eligibility:
Candidates with the following eligibility can take admission in the 2-year MCA program approved by AICTE:

1. Students who have passed Bachelor of Computer Application or Bachelor's degree in Computer Science Engineering or equivalent degree
2. Students who have passed Bachelor of Science, Bachelor of Commerce or Bachelor of Arts with mathematics at 10+2 or at the graduation level with additional bridge courses as per the norms of the concerned university
3. Candidates must have obtained at least 50 percent marks, or 45 percent marks in the case of candidates belonging to reserved categories, in the qualifying examination

Duration:
2 Years (4 Semesters)

Program Educational Objectives (PEOs)

PEO	PEO Statement
PEO1	Students will be practitioners and leaders capable of solving real life technological problems.
PEO2	Students will be professionals, innovators or entrepreneurs working in technology development, deployment or engineering system implementation in the industry.
PEO3	Students will perform in their profession with social awareness and responsibility, contributing to the nation's economic prosperity.
PEO4	Students will be successful in pursuing higher studies and taking part in research and development activities.

Program Specific Outcomes (PSOs)
The post-graduates of Master of Computer Application Program will demonstrate:

PSO	PSO Statement
PSO1	Students will be able to comprehend, exhibit, analyse and explain the fundamental design and working principle of the emerging computing model connected to the field of Information Technology.
PSO2	Students will be able to use modern tools, programming languages, adapt emerging technologies relevant to Computer Application and devise optimized solutions by applying the significant domain expertise of MCA.
PSO3	Students will be able to manage projects and resources in a team, apply quality assurance principles to ensure the reliability, robustness, and performance of MCA solutions through testing, debugging and continuous improvement processes.
PSO4	Students will be able to employ and exhibit continuous learning encompassing the latest MCA implications, uphold ethical principles, augmented by research and entrepreneurial aptitude, making significant societal contributions.

POs as per NBA Revised SAR 2025

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Paper Code Convention: MCAXYZ
X = 1/2/3/4 (semester),
Y = 0/9/8 (theory/practical/project/viva/bridge course),
Z= 1/2/3/4/5(paper id)
PE: Professional Elective
OE: Open Elective

NEP 2020 Implementation:

- **Core(Major):** In depth study of a particular stream/discipline.
- **Minor:** It includes vocational courses which will help students with job-oriented skills.
- **Value Added Courses (VAC):** Indian knowledge system, freedom of India, Environmental science, AI, 3D machining, big data, ML, Deep Learning, health, wellness, etc.
- **Inter-disciplinary Course:** It will broaden the intellectual experience form part of liberal arts and science education.
- **Ability Enhancement Course (AEC):** It is enabling core linguistic skills, communication, debate discussion skill.
- **Skill Enhancement Course (SEC):** It includes internship, dissertation, practical skills, hands on training in, soft skills to enhance employability skills.

Semester I							
Sl. No.	**Category**	**Course Code**	**Paper Title**	**Theory/ Practical/Sessional (T/P/S)**	**Credit Point**	**Weekly hrs (L+T+P)**	**Marks (Exam + IA)**
1	Core	MCA101	Programming for Problem Solving using C	T	4	(3+1+0)	(70+30)
2	Core	MCA102	Relational Database Management System	T	4	(3+1+0)	(70+30)
3	Core	MCA103	Computer Organization and Architecture	T	4	(3+1+0)	(70+30)
4	Inter-disciplinary Course	MCA104	Discrete Mathematics and Graph Theory	T	4	(3+1+0)	(70+30)
5	Minor	MCA105	Elective I	T	3	(3+0+0)	(70+30)
6	Core	MCA191	Programming for Problem Solving using C Lab	P	2	(0+0+4)	(60+40)
7	Core	MCA192	Relational Database Management System Lab	P	2	(0+0+4)	(60+40)
8	Ability Enhancement Course (AEC)	MCA181	Soft Skill and Interpersonal Development	S	2	(0+0+4)	(60+40)
Total					**25**	**31**	**800**
List of Elective I							
	Minor	MCA105A	Environment and Ecology				
	Minor	MCA105B	Management and Accountancy				
	Minor	MCA105C	Constitution of India				
	Minor	MCA105D	Stress Management through Yoga				
	Minor	MCA105E	Values and Ethics in Profession				
	Minor	MCA105F	Managerial Economics				

Course Name: Programming for Problem Solving using C
Course Code: MCA101
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: The prerequisite for Programming for Problem Solving using C is basic knowledge of mathematics and logical reasoning skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: Develop problem-solving skills using the C programming language by introducing fundamental programming concepts, algorithms, and structured programming techniques.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand and differentiate among different programming languages for problem solving.
CO2	Apply the concept of C Language for programming to solve mathematical and logical problems.
CO3	Analyze various features of C programming language to find optimum solution of mathematical and logical problems.
CO4	Evaluate expressions in C programming for solving mathematical and logical problems.
CO5	Design and develop modular programs using control structure, selection structure and file.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3	-	-	2	-	-	-	1	2	-	-	1
CO2	2	2	3	2	-	-	-	-	-	-	2	-	-	-	-
CO3	2	2	-	2	-	-	-	-	-	-	2	-	2	-	-
CO4	3	2	1	3	-	-	-	-	-	-	3	3	-	-	2
CO5	3	3	3	3	-	-	-	-	-	-	3	3	-	-	2

Course Contents:

Module 1: Fundamentals of Computer [8]

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system. Arithmetic– Addition and Subtraction (using1's complement and, 2'scomplement). Representation of Characters-ASCII Code Basics of Compiler, Interpreter and Assembler Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudo code. Some basic examples.

Module 2: Introduction to C Programming [7]

Overview of Procedural vs Structural language; History of C Programming Language. Variable and Data Types: The C characterize identifiers. And keywords, data type & sizes, variable names, declaration, statements. Operators & Expressions: Arithmetic operators, relational operators, logical operators, increment and decrement operators, bitwise operators, assignment operators, conditional operators, ternary operator, special operators-type conversion, C expressions, precedence and associativity. Input and Output: Standard input and output, formatted output–print f, formatted input scan f.

Module 3: Branch and Loop [7]

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder. Switch Case, nested switch statement, break and continue statement; switch-case, concept of go to statement and Loops - while, for, and do while; Concept of nested loop.

Module 4: Program Structures [6]

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function, call by value and call by reference. Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and lifetime of variables C pre-processor: Pre-processing directive and macro, parameterized macro.

Module 5: Array and Pointer [6]

Arrays: One dimensional array, Two-dimensional arrays, Passing an array to a function Pointers: Pointers, Pointer and Array, Pointer and functions. Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String. Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module 6: Structures, Unions and Enum [3]

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and Enum, difference between structure and union.

Module-7: File in C [3]

Files handling- opening and closing a file in different mode, formatted and unformatted files, command line arguments, f open, f close, f get c, f put c, f print f, f scan f function.

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. KanetkarY.-LetusC,BPBPublication,15thEdition
3. Programming in ANSI C – E BALAGURUSAMY

Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

Course Name: Relational Database Management System
Course Code: MCA102
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: Logic of programming language, Basic concepts of data structure and algorithms

Course Objectives: The objectives of the course are to make the students able to-

O1: To develop conceptual understanding of database management system for solving different industry level problems & to learn its applications.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand Database Management System, explain fundamental elements of a database management system.
CO2	Compare the basic concepts of relational data model, entity-relationship model, file organization and use appropriate index structure.
CO3	Apply efficient query optimization techniques, suitable transaction management, concurrency control mechanism and recovery management techniques..
CO4	Analyze the database design techniques and improve the design by normalization.
CO5	Design entity-relationship diagrams to represent simple database application scenarios, translate entity-relationship diagrams into relational tables, populate a relational database and formulate SQL queries on the data.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	1	1	-	-	-	-	-	-	-	3	3	-	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
CO5	2	3	1	1	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Module I: Introduction: [4L]

Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module II: Entity-Relationship and Relational Database Model [10L]

Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications of the Database.

Module III: SQL and Integrity Constraints [6L]

Concept of DDL, DML, DCL. Basic Structure, set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module IV: Relational Database Design [8L]

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF, Case Study.

Module V: Internals of RDBMS [7L]

Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling.

Module VI: File Organization & Index Structures [5L]

File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes.

Text Books:

1. Henry F. Korth and Silberschatz Abraham, “Database System Concepts”, Mc.Graw Hill.
2. Elmasri Ramez and Novathe Shamkant, “Fundamentals of Database Systems”, Benjamin Cummings Publishing. Company.

Reference Books

3. Fundamentals of Database Systems”, Ramez Elmasri, Shamkant B.Navathe, Addison Wesley Publishing.
4. Ramakrishnan: Database Management System, McGraw-Hill

Course Name: Computer Organization and Architecture
Course Code: MCA103
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: Concept of basic components of a digital computer, Basic concept of Fundamentals & Program structures.

Course Objectives: The objectives of the course are to make the students able to-

O1: To enable students to apply, analyse, develop, evaluate, and design advanced concepts of computer organization and architecture, including instruction execution, arithmetic operations, control signals, memory operations, data transfer methods, addressing modes, interrupts, logic circuits, pipeline performance, bus architectures, and timing diagrams, for solving complex computational problems.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Explain digital signals, Boolean algebra, K-maps, and the Von Neumann model.
CO2	Design and analyze combinational circuits (adders, subtractors, encoders/decoders, MUX/DEMUX).
CO3	Design and analyze sequential circuits (latches, flip-flops, registers, counters).
CO4	Describe basic computer organization, instruction formats, addressing modes, and control.
CO5	Differentiate RISC/CISC and explain pipelining/parallelism concepts. Explain I/O organization (DMA, interrupts) and memory hierarchy (cache, virtual memory).

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2		-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO3	3	3	-	3	-	-	-	-	-	-	-	3	3	-	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	-	1
CO5	3	2	3	3	-	-	-	-	-	-	-	2	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-

Course Contents:

Module 1: Digital Principles [4]

Digital signals, digital logic, digital computers, Von Neumann architecture; Boolean laws and theorems; K-Map (2–4 variables), don't-care, SOP/POS.

Module 2: Number Systems & Codes [4]

Decimal, binary, octal, hexadecimal; conversions; binary arithmetic; BCD addition/subtraction; octal/hex arithmetic; binary/decimal codes; error detecting/correcting codes; ASCII, EBCDIC, Excess-3, Gray code.

Module 3: Combinational Circuits [4]

Half/full adders, subtractors, decoders, encoders, multiplexers, demultiplexers.

Module 4: Sequential Circuits [4]

Latches and flip-flops (SR, D, JK, T, JK master-slave).

Module 5: Registers & Counters [4]

4-bit registers with parallel load; shift registers (bi-directional with parallel load); 4-bit synchronous/asynchronous binary counters.

Module 6: Basic Computer Organization & Design [4]

Instruction codes; computer registers/instructions; timing and control; instruction cycle; memory-reference instructions; I/O interrupt; complete computer description; design of basic computer; accumulator logic.

Module 7: Central Processing Unit [4]

General register organization; stack organization; instruction formats; addressing modes; data transfer/manipulation; program control; RISC vs CISC.

Module 8: Pipeline & Vector Processing [4]

Parallel processing; pipelining; arithmetic pipeline; instruction pipeline; RISC pipeline.

Module 9: Input–Output Organization [4]

Peripheral devices; I/O interface; asynchronous data transfer; modes of transfer; priority interrupt; DMA; I/O processor (IOP).

Module 10: Memory Organization [4]

Memory hierarchy: main/auxiliary/associative memory; cache memory; virtual memory; memory management hardware.

Text Books:

1. Donald P. Leach, Albert Paul Malvino, Goutam Saha — Digital Principles & Applications, Tata McGraw-Hill, 2011.
2. M. Morris Mano - Computer System Architecture, Pearson/PHI, 3rd Ed.

Reference Books

3. William Stallings — Computer Organization and Architecture, Pearson/PHI, 6th Ed.
4. Andrew S. Tanenbaum — Structured Computer Organization, PHI/Pearson, 4th Ed.

5. M. V. Subramanyam — Switching Theory and Logic Design, Laxmi Publications.
6. Ikvinderpal Singh — Computer Organization Architecture, Khanna Book Publishing.

Course Name: Discrete Mathematics and Graph Theory
Course Code: MCA104
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: The prerequisite for this course is a solid understanding of high school–level algebra and basic logical reasoning skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: To introduce the fundamental concepts and techniques of some advanced courses might suggest calculus or programming, these are not strictly necessary for a beginner. Core concepts like set theory and the understanding of propositions are fundamental and are often built into the discrete math course itself.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Interpret the problems that can be formulated in terms of graphs and trees. Explain network phenomena by using the concepts of connectivity, independent sets, cliques, matching, graph colouring.
CO2	Achieve the ability to think and reason abstract mathematical definitions and ideas relating to integers through concepts of well-ordering principle, division algorithm, greatest common divisors and congruence.
CO3	Apply counting techniques and the crucial concept of recurrence to comprehend the combinatorial aspects of algorithms.
CO4	Analyse the logical fundamentals of basic computational concepts. Compare the notions of converse, contrapositive, inverse etc. in order to consolidate the comprehension of the logical subtleties involved in computational mathematics.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	3	2	-	-	-	-	-	-	-	3	2	-	1
CO2	2	3	3	3	-	-	-	-	-	-	-	3	2	-	2
CO3	3	3	3	2	-	-	-	-	-	-	-	3	2	-	2
CO4	3	3	2	3	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Module 1: Logic and Proofs [4]

Propositional logic, Propositional equivalences, Predicates and quantifiers, Nested quantifiers, Rules of inference

Module 2: Principles of Mathematical Induction [4]

The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module 3: Sets and Sequence [10]

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Fuzzy set, Basic properties of fuzzy set.

Module 4: Counting and Combinatorics [8]

Counting, Sum and product rule, Principle of Inclusion Exclusion. Pigeon Hole Principle, Counting by Bijections. Double Counting. Linear Recurrence relations - methods of solutions. Generating Functions. Permutations and Combination

Module 5: Algebraic Structure [8]

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings,

Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Module 6: Graph and Tree [7]

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances

Text Books:

1. S.B. Singh, Discrete Structures, Khanna Book Publishing, Delhi
2. Kandel& Baker- Discrete Mathematics for Comp. Scientists & Mathematicians, Mott, PHI

Reference Books

3. C.L.Liu- Discrete Mathematical Structure, C.L.Liu,TMH
4. G.S.RAO- Discrete Mathematical Structure, New Age International
5. DeoNarsingh - Graph Theory with Applications To Engineering And Computer Science, PHI Learning
6. Arumugam, Ramachandran- Invitation to Graph Theory, Scitech Publications (India)

Course Name: Management and Accountancy
Course Code: MCA105B
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for Management and Accountancy is a basic understanding of business fundamentals and elementary knowledge of mathematics.

Course Objectives: The objectives of the course are to make the students able to-

O1: Provide students with a comprehensive understanding of the fundamental principles and functions of management—planning, organizing, staffing, directing, and controlling—and their application in organizational decision-making. It also aims to develop competence in accounting practices by preparing trial balances, final accounts, and financial statements for sole proprietorships, while enabling students to analyse financial performance through ratio analysis, fund flow statements, and budgetary control techniques. Furthermore, the course equips learners to apply costing and marginal costing concepts, including break-even analysis, for evaluating cost structures and supporting effective business decisions.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Explain the fundamental principles and functions of management, including planning, organizing, staffing, directing, and controlling, along with their relevance in organizational decision-making.
CO2	Demonstrate understanding of accounting principles by preparing trial balances, final accounts, and financial statements for sole proprietorship concerns.
CO3	Analyse financial performance using ratio analysis, fund flow statements, and budgetary control techniques to support managerial decisions.
CO4	Apply costing and marginal costing concepts, including break-even analysis, to evaluate cost structures and enhance business decision-making.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	-	-	1	-	-	1	-	3	2	1	-	3
CO2	-	2	-	-	-	1	-	-	1	-	3	-	1	2	3
CO3	-	2	-	-	-	1	-	-	1	-	3	2	3	3	1
CO4	-	2	-	-	-	1	-	-	1	-	3	-	-	3	2

Course Contents:

Module 1: Introduction to Management [8]

Nature, meaning, and importance of management, Evolution of management thought – Classical, Neo-classical, and Modern approaches, Functions of management – Planning, Organizing, Staffing, Directing, Controlling. Roles and responsibilities of managers, Nature and purpose of planning, Types of planning – Strategic, Tactical, Operational, Steps in planning process, Decision-making process – Types, techniques, and tools, Management by Objectives (MBO)

Module 2: Principles of Accounting [8]

Nature and Scope of Accounting, Double Entry System of Accounting, Introduction to Basic Books of Accounts of Sole Proprietary Concern, Closing of Books of Accounts and Preparation of Trial Balance.

Module 3: Final Accounts [4]

Trading, Profit and Loss Accounts and Balance Sheet of Sole Proprietary Concern with Normal Closing Entries. (with numerical problems)

Module 4: Ratio Analysis [8]

Meaning, Advantages, Limitations, Types of Ratio and Their Usefulness. (Theory only), Fund Flow Statement: Meaning of The Term Fund, Flow of Fund, Working Capital Cycle, Preparation and Inter-Preparation of Statement.

Module 5: Costing [6]

Nature, Importance and Basic Principles. Budget and Budgetary Control: Nature and Scope, Importance Method of Finalization, and Master Budget, Functional Budgets.

Module 6: Marginal Costing [6]

Nature, Scope, Importance, Construction of Break Even Chart, Limitations and Uses of Break Even Chart, Practical Applications of Marginal Costing.

Text Books:

1. S.N. Maheswari & S. K. Maheswari, "Introduction to Financial Accountancy", Vikas Publication.
2. S.N. Maheswari & S. K. Maheswari, "Advanced Accountancy", Vikas Publication.

Reference Books

3. Management: Principles, Processes and Practices – Anil Bhat & Arya Kumar, Oxford University Press.
4. Principles of Management – P.C. Tripathi & P.N. Reddy, McGraw Hill Education.

Course Name: Constitution of India
Course Code: MCA105C
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for Constitution of India is a basic understanding of civics, governance, and the fundamental structure of the Indian political system.

Course Objectives: The objectives of the course are to make the students able to-

O1: Provide an understanding of the importance of the Constitution by exploring the structure of the executive, legislature, and judiciary, along with the philosophy of fundamental rights and duties. It also aims to familiarize students with the autonomous nature of key constitutional bodies such as the Supreme Court, High Courts, Comptroller and Auditor General of India, and

the Election Commission of India, while offering insights into central–state relations and the functioning of financial and administrative bodies.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Explain the historical evolution, features, and philosophy of the Indian Constitution.
CO2	Interpret the Fundamental Rights, Duties, and Directive Principles in real-life contexts.
CO3	Analyze the structure, powers, and functions of the Union, States, and Judiciary.
CO4	Examine constitutional amendments, emergency provisions, and their impact on governance.
CO5	Apply constitutional values and ethics in professional decision-making and societal responsibilities.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	–	–	–	–	–	–	1	2	–	2	–
CO2	2	1	3	3	–	–	–	–	–	–	1	2	2	3	–
CO3	2	3	1	3	–	–	–	–	–	–	3	2	2	3	–
CO4	2	3	1	3	–	1	2	2	–	–	3	3	2	2	–
CO5	1	2	–	–	–	3	2	3	2	3	2	3	2	2	–

Course Contents:

Module 1: Introduction & Philosophy of Constitution [6]

Historical background & making of the Constitution, Salient features & preamble philosophy

Basic structure doctrine

Module 2: Fundamental Rights, Duties & Directive Principles [8]

Fundamental Rights – scope, limitations, case studies, Directive Principles of State Policy (DPSPs)

Fundamental Duties & relevance to modern professionals

Module 3: Union & State Government Structure [8]

Union Government – President, Prime Minister, Council of Ministers, Parliament – composition, powers, law-making process, State Government – Governor, Chief Minister, State Legislature

Module 4: Judiciary, Federalism & Emergency Provisions [8]

Supreme Court & High Courts – composition, powers, judicial review, Federalism – Centre–State relations, Finance Commission, GST Council, Emergency provisions – National, State, Financial Emergencies

Module 5: Amendments, Governance & Contemporary Issues [10]

Constitutional amendments & landmark judgments, Election Commission, UPSC, CAG – role in democracy, Local self-government (73rd & 74th amendments), Application of constitutional ethics in IT & corporate governance, Constitutional Rights of the self

Text Books:

1. **D.D. Basu –** *Introduction to the Constitution of India*
2. **M. P. Jain –** *Indian Constitutional Law*
3. **Subhash C. Kashyap –** *Our Constitution*.

Reference Books

4. Durga Das Basu – Shorter Constitution of India
5. P. M. Bakshi – The Constitution of India
6. Granville Austin – The Indian Constitution: Cornerstone of a Nation

Course Name: Stress Management through Yoga
Course Code: MCA105D
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for *Stress Management through Yoga* is a basic awareness of physical fitness and an interest in learning yoga practices for mental and emotional well-being.

Course Objectives: The objectives of the course are to make the students able to-

O1: To understand the Philosophy of Life, to acquire knowledge about rejuvenation of Life force and its Methods. To gain knowledge on Bio-magnetism and mind concepts. To understand the importance of meditation and types of meditation. To attain knowledge on special meditation techniques.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the philosophy of life.
CO2	Acquire knowledge about rejuvenation of Life force and its Methods
CO3	Gain knowledge on Bio-magnetism and mind concepts.
CO4	Understand the importance of meditation and types of meditation.
CO5	Attain knowledge on special meditation techniques.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	2	3	-	-	-	-	-	-	1	2	2	3	1
CO2	2	2	3	3	-	-	-	-	-	-	2	2	1	3	3
CO3	2	3	2	3	-	1	2	-	-	-	3	2	3	1	2
CO4	2	3	2	3	-	1	2	-	-	-	3	2	3	1	3
CO5	3	3	2	3	-	1	2	2	-	-	3	2	3	2	3

Course Contents:

Module 1: Physical Health and Physical Structure [3]

Purpose of Life – Philosophy of Life: - Three bodies: Maintenance of cell structure – Uniform circulation of bio-magnetism

Module 2: Rejuvenation of Life Force [8]

Life force – structure – life force circulation – purpose of kayakalpa exercise – Life without disease, youthfulness, postponing death – Philosophy of kaykalpa – physical body, sexual vital fluid, life force, Bio – magnetism, Mind, Old age and death – Necessity of Kayakalpa exercises - Kayakalpa practice – Aswini Mudra, Ojas breath – Benefits of KayaKalpa – Sex and Spirituality – Value of Sexual Development – Jeeva Samadhi – Intensifying the sexual vital fluid – Practices of Siddhars.

Module 3: Streamlining of Mind and Bio- Magnetism [7]

Mind – Bio – magnetic wave –imprints – Five Kosas – Three stages of Mind – Greatness of Guru – Benefits of meditation – Mental frequency reduction – Physical transformations of bio-magnetism.

Module 4: Meditation [6]

Purpose of Meditative life – Simplified Kundalini Yoga – Meditation on life force – Agna Explanation – Mooladhara activation – Thuriya Meditation –Thuriyatheetham meditation.

Module 5: Special Meditations [6]

Panchabootha Navagraha meditation - Panchendria meditation - Nine Center meditation.

Text Books:

1. Rejuvenation of Life-force and streamlining of Mind - VISION, Vethathiri Publications, Erode
2. Bio - Magnetism, Vethathiri maharishi, Vethathiri Publication, Erode, 1st Ed – Apr 1993, 2 Ed – Mar 1995

Reference Books

3. Sound Health through Yoga, Chandrasekaran.K, Premkalyan Publications, Sedapati, 1999.
4. Health and Nature, Dr. Madhuram Sekar, Narmadha Publications, Chennai.

Course Name: Values and Ethics in Profession
Course Code: MCA105E
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for Values and Ethics in Profession is a basic understanding of human values, social responsibility, and professional behaviour.

Course Objectives: The objectives of the course are to make the students able to-

O1: Inculcate human values that help individuals grow into responsible human beings with well-rounded personalities, while also instilling professional ethics to ensure ethical conduct and the responsible discharge of professional duties.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Illustrate different aspects of human values, ethics, engineers' responsibility and duties
CO2	Explain different principles, different theories and laws of engineering ethics and social experimentation
CO3	Identify different factors in the light of Engineers' responsibility towards safety and risk
CO4	Correlate ethics of different work environment.
CO5	Explain the need for intellectual property rights.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	–	–	–	–	–	3	2	3	2	2	3	–	–	–	3
CO2	–	2	–	–	–	3	2	2	2	2	3	–	–	–	3
CO3	–	–	2	2	2	3	2	2	2	2	3	2	2	2	3
CO4	–	–	–	–	–	3	2	3	2	2	3	–	–	–	3
CO5	–	–	–	2	2	2	3	2	2	2	3	–	2	2	2

Course Contents:

Module 1: Human values [6]

Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character

Module 2: Principles for harmony [6]

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness

Module 3: Engineering ethics and social experimentation [9]

History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism —Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.

Module 4: Engineers' responsibility towards safety and risk for sustainable development [6]

Voluntary v/s Involuntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer –Designing for Safety – Risk-Benefit Analysis-Accidents.

Module 5: Engineers' duties and rights [8]

Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage-Price Fixing-Whistle Blowing

Module 6: Global issues [5]

Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics - Intellectual Property Rights

Text Books:

1. Professional Ethics & Human Values, Premvir Kapoor, Khanna Publishing House, Delhi (AICTE Recommended Textbook).
2. A text book on professional Ethics & Human values, R.S. Naagarazan, New Age international Publishing.
3. Engineering Ethics, M. Govindarajan, S. Natarajan , V.S. Senthilkumar, Prentice Hall India.

Reference Books

4. Human value and professional Ethics, Jayshree Suresh, B.S. Raghvan, S. Chand Publishing
5. Ethics in Science and Engineering, James G. Speight & Russel Foote, Wiley.

Course Name: Managerial Economics
Course Code: MCA105E
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for Managerial Economics is a basic understanding of microeconomics, mathematics, and analytical reasoning skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: Acquaint students with the basic principles of economics, develop their decision-making skills through the application of these principles, and enable them to evaluate and analyse various business projects effectively.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Apply the appropriate engineering economics analysis method for problem solving
CO2	Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.
CO3	Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate facilities and systems.
CO4	Evaluate the profit of a firm, carry out the breakeven analysis and employ the tool to make production decision.
CO5	Discuss and solve advanced economic engineering analysis problems including taxation and inflation.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	-	2	-	-	-	1	-	-	1	-	3	2	1	-	3
CO2	-	2	-	-	-	1	-	-	1	-	3	-	1	2	3
CO3	-	2	-	-	-	1	-	-	1	-	3	2	3	3	1
CO4	-	2	-	-	-	1	-	-	1	-	3	-	-	3	2
CO5	-	2	-	-	-	1	-	-	1	-	3	3	3	3	3

Course Contents:

Module 1: Introduction to Economics [4]

Managerial Economics-Relationship with other disciplines -Firms: Types, Objectives and Scope of Economics, Managerial Decision Analysis

Module 2: Demand-Supply Framework & Equilibrium [8]

Demand and Supply: Determinants of demand, movements vs. shift in demand curve, Determinants of Supply, Movement along a supply curve vs. shift in supply curve; Market equilibrium and price determination. Elasticity of demand and supply, Application of demand and supply. Consumer Theory: Ordinal Utility theory: (Indifference curve approach): Consumer's preferences; Indifference curves; Budget line; Consumer's equilibrium.

Module 3: Theory of Production and Costs [8]

concept of Production function, types of Production function, Laws of return to scale and variable Proportion, Cost Function, Types of Cost Function, Different Cost curves, Relation between Average and marginal cost, Relationship between Short Run costs and Long Run costs, Cost volume profit analysis and application

Module 4: Selected Macroeconomic Principles [8]

Introduction to Macroeconomic Variables – Circular Flow of Income – Closed and Open Economy Models - Saving-Investment Identity. National income and different technique to measure of national income inflation: Inflation – Causes, Measurement, Effect, Measures to Control Inflation.

Module 5: Financial Accounting and Financial management [6]

Accounting Basic concept of Journal, Trading A/C, Profit& Loss A/C, Balance Sheet and the concept of time value of money (application of all factors of time value of money) & Capital budgeting technique.

Module 6: Market Structure [6]

Classification of Different Markets (Concepts only) – Perfect Competition, Monopoly, Monopolistic Competition, Monopsony and Oligopoly. Perfect Competition: Assumption; Theory of a firm under perfect competition; Demand and Revenue; Equilibrium of the firm in the short run and long run. Monopoly: Short-run and long-run equilibrium of monopoly firm; Price discrimination.

Text Books:

1. Economics, by Lipsey and Chrystal, Oxford university Press
2. Modern Accountancy, Vol.-I-, by Hanif &Mukherjee, Tata Mgrow Hill

Reference Books

3. Modern Economic Theory, by K.K. Dewett, S.Chand Principles of Economics, by H.L. Ahuja, S. Chand
4. Engineering Economics, by R. Paneer Seelvan, PHI
5. Economics for Engineers, by Dr. Shantanu Chakraborty & Dr. Niranjana Singha Roy, Law Point Publication

Course Name: Programming for Problem Solving using C Lab
Course Code: MCA191
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2

Pre requisites: Number system, Boolean Algebra

Course Objectives: The objectives of the course are to make the students able to-

O1: To develop an understanding of the design, implementation, and compilation of a C program, to gain the knowledge about pointers, a fundamental for understanding data structure issues, to understand the usage of user defined data type for application development.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Apply the conception of data type, variable declaration to solve the problem.
CO2	Analyze the conception of data handling to solving problem and identify and correct syntax errors / logical errors as reported during compilation time and run time.
CO3	Create program using Arrays, Pointers, Structures, Union and Files. for solving different problem both recursive and non-recursive method.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	2	2	--	--	--	2	2	2	3	2	2	2
CO2	2	2	3	2	2	--	--	2	2	2	2	3	2	2	2
CO3	2	2	3	2	3	2	2	--	2	2	2	3	2	2	2

Course Contents:

Module 1:

Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module 2:

Problem based on

a) Basic data types

b) Different arithmetic operators.

c) Printf( ) and scanf( ) functions.

Module 3:

Problem based on conditional statements using

a) if-else statements, b) different relational operators, c) different logical operators

Module 4:

Problem based on

a) for loop

b) while loop

c) do-while loop

Module 5:

Problem based on

a) How to write a menu driven program using switch-case statement

b) How to write a function and passing values to a function

c) How to write a recursive function.

Module 6:

Problem based on a) How to use array (both I-Dand2-D), b) How to pass an array to a function.

Module 7:

Problem based on manipulation of strings in different way.

Module 8:

Problem based on

a) How to handle compound variables in C

b) How to handle file in C

c) How to use command line argument in C

Text Books:

4. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
5. KanetkarY.-LetusC,BPBPublication,15thEdition

Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

Course Name: Relational Database Management System Lab
Course Code: MCA192
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2

Pre requisites: Basic knowledge of database concepts, data models, and SQL.

Course Objectives: The objectives of the course are to make the students able to-

O1: The objective of this course is to enable students to understand database design through ER modelling, implement relational models using RDBMS software such as Oracle, MySQL, or PostgreSQL, and practice SQL commands for creating, manipulating, and retrieving data. It further aims to develop proficiency in applying PL/SQL concepts for writing procedures, functions, cursors, and triggers, while equipping students to build complete database applications with proper integrity constraints and exception handling.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Design relational databases from ER models using SQL DDL with integrity constraints.
CO2	Apply DML and DQL queries for data manipulation, joins, subqueries, and aggregation.
CO3	Develop PL/SQL programs using cursors, procedures, functions, and triggers.
CO4	Implement packages and exception handling for building robust database applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1	-	-	-	-	-	-	-	3	2	-	2
CO2	3	3	1	1	-	-	-	-	-	-	-	3	3	-	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	-	3
CO5	2	3	1	1	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Unit 1: Database Creation & DDL/DML

ERD to Relational Model implementation, Table creation, altering schema, applying constraints (Primary Key, Foreign Key, Unique, Not Null, Check), Using data dictionary views for verification, Creating Views and Materialized Views, DML operations: Insert, Update, Delete.

Unit 2: Query Processing & Retrieval (DQL)

Basic Select queries with conditions, sorting, and pattern matching, Joins: Equi, Non-Equi, Natural, Self, Inner, Outer, Set Operations: Union, Intersect, Minus, Single row and group functions, Aggregation with Group By, Having, Rollup, and Cube, Nested Subqueries and Correlated Subqueries.

Unit 3: PL/SQL Programming

Control structures: IF-THEN-ELSE, Loops, Stored Procedures and Functions, Cursors: Implicit, Explicit, Parameterized, Triggers: Before, After, instead of; row-level and statement-level, Transaction validation and rollback using triggers, Packages and Exception Handling.

Unit 4: Mini Project

Design and implement a complete database system for a real-life application using SQL & PL/SQL concepts.

Text Books:

1. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle.
2. Ramez Elmasri, Shamkant Navathe, Fundamentals of Database Systems.

Reference Books

3. Abraham Silberschatz, Henry Korth, S. Sudarshan, Database System Concepts.
4. Thomas Connolly, Carolyn Begg, Database Systems: A Practical Approach to Design, Implementation, and Management.

Course Name: Soft Skill and Interpersonal Development
Course Code: MCA181
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2

Pre requisites: Basic ability of soft skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: Enhance students' soft skills and interpersonal abilities by developing effective communication, teamwork, leadership, and conflict management skills. It aims to build self-confidence, emotional intelligence, and a positive attitude while fostering professional etiquette, time management, and problem-solving capabilities to prepare students for personal growth and successful careers.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Define, identify, and display verbal and nonverbal skills and communication behaviors and etiquette.
CO2	Discover, compare, demonstrate corporate interpersonal communication skills in the global business context.
CO3	Correlate, summarize and interpret goals of personal development, creative problem solving and decision-making.
CO4	Analyze, evaluate and apply skills involved in Group Discussion, Presentation and Personal Interview.
CO5	Understanding, analyzing and applying traits of business leadership, decision making, teamwork and conflict management. Develop, design and apply modalities of corporate etiquette and behavioral style in a global business context.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	–	–	–	2	2	3	3	–	3	1	2	1	2
CO2	2	1	–	–	–	2	2	3	3	–	3	2	1	2	1
CO3	–	3	–	–	–	2	2	3	3	–	3	–	3	–	3
CO4	–	3	–	–	–	2	2	3	3	–	3	–	3	–	3
CO5	–	–	–	–	–	3	2	3	3	–	3	–	–	1	1

Course Contents:

Module 1: Soft Skills and Interpersonal Communication [8]

An Introduction – Definition and Significance of Soft Skills; Process, Importance and measurement of Soft Skill Development. Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills (emails, reports, memos, proposals); corporate communication styles –assertion, persuasion, negotiation. Cross-cultural and digital communication etiquette.

Module 2: SWOT Analysis and Creative Problem-Solving [10]

Personal SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats). Organizational SWOT—Case Study. Aligning self-perception with goals and potential. Setting SMART Goals (Specific, Measurable, Achievable, Relevant, Time-bound). Role of Beliefs, Values, Attitudes, and Virtues in Shaping Behaviour. Importance of Creativity in Problem-Solving and Decision-Making). Techniques to Enhance Creative Thinking (Brainstorming, Mind Mapping, Lateral Thinking). Applying Creative Thinking to Personal and Professional Challenges

Module 3: Corporate Communication Skills [10]

Public Speaking Skills; Essentials of Public Speaking-Content and Techniques: Facing an Audience; Developing Self-Confidence Group Discussion—Concept and Skills of Group Discussion; Procedures and Assessment Rubrics. Interview Skills; Interview Preparation Checklist; Body Language in an Interview; Facing the Interview Questions. Presentation Skills; Preparing for a Presentation; Types of Presentation; Presentation Styles; Persuading a Corporate Audience.

Module 4: Non-Verbal Communication and Personality Development [6]

Elements of Non-Verbal Communication; Body Language. Situational and Cultural variations; Body Language in the workplace. Stress and Time Management; Adaptability Skills; Negotiation skills; Team building. Case Studies.

Module 5: Business Etiquette and Teamwork [6]

Workplace and Communication Etiquette: Personal etiquette, social distancing, appearance, dress, manner, gestures and postures; Concept of Teams and Teamwork; Teamwork Styles; Team Leadership essentials. Leadership Case Studies.

Text Books:

1. Shreya Bagchi. Soft Skills for Success. Chennai: Notion Press, 2021.
2. S. P. Dhanvel, English and Soft Skills. Hyderabad: Orient Blackswan, 2021.
3. Nella Braddy Henney. The Book of Business Etiquette. Lector House, 2021.

Reference Books

4. Gerard Assey. Professional Business Etiquette and Grooming: A Survival Skill to Give You A Competitive Edge.Amazon Digital Services, 2022.
5. Cyrus M. Gonda. Master of Business Etiquette. Embassy Books, 2016.
6. Lesikar et al. Business Communication-Connecting in a Digital World. 13th edition. New Delhi:Tata Mc Graw-Hill, 2017.

Semester: 2nd

Semester II							
Sl. No.	**Category**	**Course Code**	**Paper Title**	**Theory/ Practical/Sessional (T/P/S)**	**Credit Point**	**Weekly hrs (L+T+P)**	**Marks (Exam + IA)**
1	Core	MCA201	Python Programming	T	4	(3+1+0)	(70+30)
2	Core	MCA202	Data Structures	T	4	(3+1+0)	(70+30)
3	Core	MCA203	Operating Systems	T	4	(3+1+0)	(70+30)
4	Core	MCA204	Data Communication & Computer Networks	T	4	(3+1+0)	(70+30)
5	PE	MCA205	Elective II(NPTEN)	T	3	(3+0+0)	(70+30)
6	Core	MCA291	Python Programming Lab	P	2	(0+0+4)	(60+40)
7	Core	MCA292	Data Structure Lab	P	2	(0+0+4)	(60+40)
8	Core	MCA293	Operating System Lab (Unix)	P	2	(0+0+4)	(60+40)
Total					**25**	**31**	**800**
List of Elective II							

	Minor	MCA205A	Numerical and Statistical Analysis	
	Minor	MCA205B	Computer Graphics	
	Minor	MCA205C	Probability and Statistics	
	Minor	MCA205D	Introduction to Cyber Security	
	Minor	MCA205E	Introduction to IOT	
	Minor	MCA205F	Automata Theory & Computational Complexity	

Course Name: Python Programming
Course Code: MCA201
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites:

Course Objectives: The objectives of the course are to make the students able to-

O1: To introduce the fundamental concepts and features of Python programming and equip students with practical coding skills for problem-solving. To develop an understanding of structured and object-oriented programming in Python, and expose students to real-world applications and emerging areas such as data analysis, web development, and automation.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Describe the basic concepts of Python programming, including syntax, data types, operators, control structures, and functions.
CO2	Apply Python constructs such as loops, functions, recursion, file handling, and exception management to develop efficient programs.
CO3	Analyze and implement object-oriented programming principles in Python using classes, inheritance, polymorphism, and abstraction for modular and reusable code.
CO4	Evaluate and utilize advanced Python features, libraries, and frameworks (e.g., NumPy, Pandas, Tkinter, Flask) to build real-world applications and automation solutions.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	--	--	--	--	--	--	1	1	2	3	1
CO2	2	1	3	3	--	--	--	--	--	--	1	2	1	3	3
CO3	2	3	1	3	--	--	--	--	--	--	2	2	3	1	3
CO4	2	3	1	3	--	1	2	2	--	--	2	2	3	1	2

Course Contents:

Module 1: Introduction to Python Programming [6]

History and features of Python, Installing Python, Writing and executing Python programs, Basic syntax, identifiers, keywords, and indentation rules. Variables, data types (numbers, strings, lists, tuples, dictionaries, sets), and type conversion, Input/Output operations, comments, and basic coding standards.

Module 2: Control Structures and Functions [6]

Decision making: if, if-else, if-elif-else statements, Loops: for, while, nested loops, break, continue, pass, Functions: Defining functions, arguments (positional, keyword, default, variable-length), return values, Lambda functions, scope of variables (local, global, nonlocal), Recursion in Python.

Module 3: Data Structures and String Handling [8]

Lists: Creation, indexing, slicing, operations, list comprehension, Tuples and Sets: Properties, operations, and use cases, Dictionaries: Key-value pairs, dictionary methods, nested dictionaries, String handling: String methods, slicing, formatting, regular expressions (RegEx), Iterators and Generators in Python.

Module 4: File Handling and Exception Management [6]

File operations: Opening, reading, writing, appending, closing files, Handling text and binary files, Exception handling: try, except, else, finally, raise, Creating custom exceptions.

Module 5: Object-Oriented Programming in Python [7]

Classes and objects, constructors (**init** method), Attributes and methods, class variables vs. instance variables, Inheritance: Single, multiple, and multilevel inheritance, Method overriding, polymorphism, encapsulation, abstraction, Special methods **(str, len**, operator overloading).

Module 6: Advanced Python and Applications [7]

Modules and Packages: Importing modules, math, random, date time, os, sys, Virtual environments and pip package management, Python standard libraries (collections, iter tools, func tools), Introduction to NumPy and Pandas for data analysis, Python in real-world applications: Web scraping, simple GUI (Tkinter), basics of Flask/Django, and automation scripts.

Text Books:

1. Russell, Lutz, M. 2013. *Learning Python*, 5th edition, O'Reilly Media.
2. Zelle, J. 2017. *Python Programming: An Introduction to Computer Science*, 3rd edition, Franklin, Beedle & Associates.

Reference Books

3. Downey, A. 2015. *Think Python: How to Think Like a Computer Scientist*, 2nd edition, O'Reilly Media.
4. Ramalho, L. 2015. *Fluent Python*, 1st edition, O'Reilly Media.

Course Name: Data Structures
Course Code: MCA202
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: The prerequisite for Data Structures is a basic understanding of programming fundamentals and problem-solving using a high-level language such as C.

Course Objectives: The objectives of the course are to make the students able to-

O1: Introduce the concepts of abstract data types, data structures, and performance measurement with an emphasis on analysing the time and space complexities of algorithms. It covers the implementation of linear data structures such as stacks, queues, and lists along with their applications, as well as non-linear structures including trees and graphs. The course also explores various search structures like hashing, binary search trees, red-black trees, splay trees, and B-trees, in addition to introducing different internal sorting techniques and analysing their computational efficiency.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Different kinds of data structures are suited to different types of applications, and some are highly specialized for specific tasks.
CO2	Manage large amounts of data efficiently, such as large databases and internet indexing services
CO3	Use efficient data structures which are a key to designing efficient algorithms
CO4	Use some formal design methods and programming languages which emphasize on data structures, rather than algorithms, as the key organizing factor in software design.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	1	-	-	-	-	-	1	3	-	-	-
CO2	2	1	3	3	2	-	-	2	-	-	1	3	3	-	-
CO3	2	3	1	3	2	-	-	-	-	-	3	1	2	3	1
CO4	3	3	1	3	3	1	2	2	-	-	3	2	1	3	3

Course Contents:

Module 1: Foundations of Data Structures & Linear Representation [7]

Introduction: Data, Data Type, Abstract Data Type (ADT), and Data Structure, Algorithms & Programs: Basics of pseudo-code, performance measurement, Algorithm Complexity: Time & Space analysis, Order Notations (Big-O, Ω, Θ),Memory Representations: Row-major,

Column-major, Sparse matrices, Array Representation of Polynomials, Linked Lists: Singly, Doubly, Circular, Linked list representation of polynomial, Applications of Linked Lists in real systems (e.g., memory management).

Module 2: Stack, Queue & Recursion [7]

Stack: Implementations (array & linked list), applications (expression evaluation, undo/redo),Queue: Simple, Circular Queue, Dequeue (array & linked list implementations),Recursion: Principles, role of stack in recursion, tail vs non-tail recursion, Practical Use-cases: Parsing, backtracking, job scheduling,(NEW) Priority Queue & Applications in Operating Systems (process scheduling).

Module 3: Trees & Advanced Trees [9]

Tree Terminologies, Representation (array, linked list),Binary Trees: Traversals (pre, in, post), Expression Trees, Threaded Binary Tree: Concepts & Non-recursive traversals, Binary Search Trees: Operations (insertion, deletion, searching),Balanced Trees: AVL Trees (insert/delete with examples),B-Trees & B+ Trees (used in DBMS, indexing),(NEW) Introduction to Tries (Prefix Trees) for fast string searching, Applications of Trees in Compilers, Databases, and File Systems.

Module 4: Graphs & Applications [7]

Graph Representations: Adjacency matrix, Adjacency list, Graph Traversals: BFS, DFS, Classification of Edges in DFS, Minimum Spanning Trees: Prim's and Kruskal's Algorithm, Shortest Path Algorithms: Dijkstra's Algorithm, Introduction to Bellman-Ford, Real-world Applications: Social Networks, Navigation Systems, Web Crawling.

Module 5: Searching, Sorting & Hashing [6]

Searching: Sequential, Binary, Interpolation Search, Sorting: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort, Heap Sort, Intro to Hybrid Sorting (e.g., TimSort – used in Python/Java), Hashing: Hash functions, Collision resolution (chaining, open addressing), Applications of Hashing in Databases, Compilers, Blockchain.

Text Books:

1. Data Structures and Algorithms in Python – Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley.
2. A Common-Sense Guide to Data Structures and Algorithms in Python (Vol. 1)– Jay Wengrow, Pragmatic Bookshelf.

Reference Books

3. Fundamentals of Data Structures in C, E. Horowitz, Sartaj Sahni and Susan Anderson, W. H. Freeman and Company
4. Data Structure Using C & C++, Tanenbaum, PHI
5. Data Structures & Program Design in C, 2nd Ed, Kruse, Tondo & Leung, PHI
6. Mastering Algorithms with C. Loudon, SPD/O'REILLY
7. Data Structures and Algorithm, R. S. Salaria, Khanna Publishing

Course Name: Operating Systems
Course Code: MCA203

Contact: (3:1:0)

Total Contact Hours: 40

Credit: 4

Prerequisites: Basic knowledge of computers, Basic knowledge of programming

Course Objectives: The objectives of the course are to make the students able to-

O1: To introduce the fundamental concepts and techniques of Artificial Intelligence and equip students with practical problem-solving skills using classical and modern AI algorithms. To develop understanding of various AI learning and expose students to real-world AI applications and emerging areas.

CourseOutcome:

After successfulcompletionofthecourse,thestudentswillbeableto:

CO1	Analyze the structure and basic architectural components involved in OS.
CO2	Demonstrate competence in recognizing and using operating system features.
CO3	Understand and analyze theory and implementation of different operating system aspect.
CO4	Apply knowledge of different operating system algorithms.

CO-POMapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	--	--	--	--	--	--	1	1	2	3	1
CO2	2	1	3	3	--	--	--	--	--	--	1	2	1	3	3
CO3	2	3	1	3	--	--	--	--	--	--	3	2	3	1	3
CO4	2	3	1	3	--	1	2	2	--	--	3	2	3	1	2

Course Contents:

Module 1: Introduction to Operating System [3]

Importance of OS, Basic concepts and terminology, types of OS, different views, journey of a command execution, design and implementation of OS, system call, virtual machine

Module 2: Process Management[16]

Process: Concept and views, OS view of processes, OS services for process management, scheduling algorithms, performance evaluation; Inter-process communication and synchronization, mutual

exclusion, semaphores, hardware support for mutual exclusion, queuing implementation of semaphores, classical problem of concurrent programming, critical region and conditional critical region, monitors, messages, deadlocks, In-process communication & synchronization.

Module 3: Memory Management [5]

Memory management –paging, swapping, contiguous memory allocation, page replacement algorithm, design issues for paging system, segmentation, virtual memory, demand paging, Thrashing

Module 4: Storage Management [6]

Resource manager, file management, processor management, device management, Scheduling algorithm and performance evaluation., File systems, security and protection mechanism, Input/output systems, processes and processors in distributed system Performance measurement, monitoring and evaluation .

Module 5: Protection and Security [3] Security and protection, policies and mechanism, authentication, protection and access control, formal models of protection, cryptography, worms and viruses.

Module 6: Distributed Systems [7]

Multiprocessor system, classification and types, OS functions and requirements, introduction to parallel computing, multiprocessor interconnection synchronization, distributed OS - rationales, algorithms for distributed processing, OS services and kernel, Multiprogramming and time sharing, Processor scheduling. Performance measurement and monitoring –measures, evaluation techniques, bottlenecks and saturation, feedback loops.

Text Books:

1. Operating Systems, Galvin & Silberschatz, John Wiley
2. Modern Operating System, 2nd Ed, Tanenbaum, PHI
3. Systems Programming & Operating Systems, Dhamdhere, TMH

Reference Books

1. Systems Programming, Donovan, TMH
2. UNIX and Shell Programming, Yashavant P. Kanetkar, BPB Publications

Course Name: Data Communication & Computer Networks
Course Code: MCA204
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: The prerequisite for Data Communication & Computer Networks is a basic understanding of computer fundamentals, operating systems, and problem-solving skills in programming.

Course Objectives: The objectives of the course are to make the students able to-

O1: Provide students with a fundamental understanding of data communication and the various types of computer networks, while offering practical experience in designing communication protocols and exposure to the TCP/IP protocol suite.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Illustrate the network topologies, model and architecture.
CO2	Apply different networking device, protocol for problem solving
CO3	Analyze different networking functions in different layer of OSI and TCP/IP Model.
CO4	Evaluate the optimal route for communication and idea about routing algorithms for data transmission.
CO5	Design network architecture and implement in practical field of work.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	3	2	2	1	-	-	-	-	-	-	3	-	-	-
CO2	3	3	2	2	3	-	-	2	-	-	-	3	3	-	-
CO3	3	3	2	3	2	-	-	-	-	-	-	3	3	-	2
CO4	3	3	2	3	3	-	-	2	-	-	-	-	2	-	2

Course Contents:

Module 1: Introduction [4]

Introduction to Data Communication, Components of Communication, Direction of data flow (simplex, half duplex, full duplex), Network topology, categories of network (LAN, MAN, WAN).

Module 2: Protocol and Standard [4]

Layered Task, The OSI model, TCP/ IP protocol suite, Comparison of OSI and TCP/IP model, Protocols used in various layers. Physical, Logical and Port Addressing.

Module 3: Internetworking [10]

Internetworking concept, IPv4 and IPv6 Addressing, IPv4 protocol, IPv6 protocol, transition from IPV4 to IPV6, Address Mapping,(ARP and RARP), ICMP; Error Reporting, Unicast and Multicast Routing protocol, Distance Vector routing, Link state routing, Path vector routing, Transmission Control Protocol(TCP), User Datagram Protocol(UDP).Three way handshaking

Module 4: Quality of Service [6]

Data traffic, Congestion, Principle of congestion control (Open Loop and Close Loop), Quality of service, Leaky bucket and Token bucket Algorithm, Techniques to improve QoS, Integrated services, Differentiated service, QoS in Frame Relay, QoS in ATM

Module 5: Application Layer protocols [8]

Name Space, Domain Name System, Distribution of Name Space, Remote Logging, Electronic Mail and File Transfer, WWW, Web document and HTTP, Network Management, Simple Network Management Protocol (SNMP)

Module 6: Network Security [8]

Concept of Cryptography, Symmetric Key Cryptography, Diffie-Hellman key agreement, Man in the middle attack, DES, AES, Asymmetric Key Cryptography, RSA, Security Services, Digital Signature, Key Management, IP Security, SSL/TLS, PGP, Firewalls

Text Books:

8. Computer Networks, Andrew S. Tanenbaum, Pearson Education, Fourth edition
9. Data and Computer Communication, William Stallings, Prentice Hall, Seventh edition.

Reference Books

10. High speed Networks and Internets, William Stallings, Pearson education.

11. Behrouz A Forouzan,- Data communication & Networking, TMH
12. Kelvin R Fall, W. Richard Stevens-TCP/IP Illustrated Volume1, Addison Wesley
13. Cryptography and Network Security – Atul Kahate- McGraw-Hill

Course Name: Numerical and Statistical Analysis
Course Code: MCA205A
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: Basic knowledge of mathematics (calculus, algebra) and introductory programming.

Course Objectives: The objectives of the course are to make the students able to-

O1: Equip students with a strong foundation in numerical methods, precision, and error analysis, while enabling them to apply techniques of interpolation, integration, and approximation for problem solving. It focuses on solving algebraic, linear, and differential equations using suitable numerical approaches, and introduces both basic and advanced concepts of statistics and probability. The course further emphasizes the application of statistical and numerical techniques to address real-life engineering and scientific problems effectively.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Apply the concepts of numerical errors, floating-point arithmetic, error propagation, interpolation, and approximation methods for estimation of unknown values.
CO2	Apply probability concepts, statistical measures, and probability distributions in solving applied problems.
CO3	Analyze numerical integration, differentiation techniques, and methods for solving systems of linear, nonlinear, and algebraic equations.
CO4	Analyze inferential statistics and numerical schemes for solving ordinary differential equation.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	3	2	2	3	2	-	-	-	-	2	1	3	2	2	3
CO2	2	3	2	2	1	1	-	-	-	2	2	2	3	2	2
CO3	3	2	3	3	2	-	-	-	-	2	1	3	2	3	3

CO4	2	3	3	2	2	1	-	-	-	3	2	2	3	3	2

Course Contents:

Module 1: Approximation in Numerical Computation [2]

Truncation and rounding errors; fixed and floating-point arithmetic; propagation of errors.

Module 2: Interpolation & Approximation [4]

Newton forward/backward interpolation; Lagrange's and Newton's divided difference interpolation.

Module 3: Numerical Integration [5]

Trapezoidal rule; Simpson's 1/3 rule; Weddle's integration; Gaussian quadrature; error terms.

Module 4: Numerical Solution of Linear Equations [5]

Gauss elimination method; LU factorization method; Gauss-Seidel iterative method, SOR method.

Module 5: Numerical Solution of Algebraic Equations [6]

Bisection method; Regula-Falsi method; Newton-Raphson method; Iteration method; Secant method.

Module 6: Numerical Solution of Ordinary Differential Equations [6]

Euler's method; Runge-Kutta methods; Taylor's series method; Predictor-Corrector methods; finite difference method.

Module 7: Introduction to Statistics & Probability [9]

Measures of central tendency and dispersion; probability concepts; distributions (Binomial, Poisson, Normal); moment generating functions; law of large numbers; Central Limit Theorem.

Module 8: Least Square Curve Fitting [3]

Linear & non-linear curve fitting; correlation and regression basics.

Text Books:

1. Shishir Gupta & S. Dey, *Numerical Methods*, McGraw Hill Education Pvt. Ltd.

2. C. Xavier, *C Language and Numerical Methods*, New Age International Publishers.

Reference Books

3. Dutta & Jana, Introductory Numerical Analysis, PHI Learning.
4. Sancheti, D. S. & Kapoor, V. K., *Statistics: Theory, Method & Application*, Sultan Chand & Sons.

Course Name: Computer Graphics
Course Code: MCA205B
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisites: The prerequisite for Computer Graphics is a basic knowledge of linear algebra, geometry, and programming fundamentals.

Course Objectives: The objectives of the course are to make the students able to-

O1: The objective of the Computer Graphics course is to provide students with a strong foundation in both the theoretical and practical aspects of graphical systems. It focuses on the fundamental concepts, mathematical techniques, and algorithms necessary for generating and manipulating computer graphics.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the basic computer graphics and Identify different media representations of different multimedia data and data formats, windows, clipping and view-ports object representation.
CO2	Apply the concept of geometric, mathematical and algorithmic concepts
CO3	Create effective programs using concepts of curves and necessary for programming computer graphics.
CO4	Analyse windows, clipping and view-ports object representation in relation to images displayed on screen.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	-	-	-	-	-	-	3	2	-	-	3
CO2	2	3	2	2	-	-	-	-	-	-	3	3	-	-	3
CO3	2	2	3	2	-	-	-	-	-	-	3	3	2	-	3
CO4	3	2	3	3	-	-	-	-	-	-	3	3	3	-	3

Course Contents:

Module 1: Introduction [7]

Overview of Computer Graphics, Computer Graphics Application and Software, Description of some graphics devices, Input Devices for Operator Interaction, Active and Passive Graphics Devices, Display Technologies, Storage Tube Graphics Displays, Calligraphic Refresh Graphics Displays, Raster Refresh (Raster-Scan) Graphics Displays, Cathode Ray Tube Basics, Color CRT Raster Scan Basics, Video Basics, The Video Controller, Random Scan Display Processor, LCD displays.

Module 2: Graphics Primitives [6]

Points, Lines and Circles as primitives, Scan conversion algorithms for primitives, Output primitives: Points and lines, line drawing algorithms, mid-point circle and ellipse algorithms. Filled area primitives: Scan line polygon fill algorithm, boundary-fill and flood-fill algorithms.

Module 3: 2D Transformation and Viewing [8]

Transformations (translation, rotation, scaling), matrix representation, homogeneous coordinates, composite transformations, pivot point Transformations, reflection and shearing, viewing pipeline and coordinates system, window-to-viewport transformation, clipping including point clipping, line clipping(Cohen-Sutherland, Midpoint Subdivision line clipping algorithm), Sutherland-Hodgman Polygon Clipping. Weiler-Atherton Algorithm.

Module 4: 3D Transformations [5]

Translation, rotation, scaling shearing **&** reflection. Rotation about an arbitrary axis in space, Reflection through an arbitrary plane; General parallel projection transformation; clipping, viewport clipping, 3D viewing.

Module 5: Curve [4]

Spline representations, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygon rendering methods. Illumination models: Basic Models, Displaying Light Intensities, halftone patterns and Dithering Techniques.

Module 6: Hidden surfaces [5]

The Depth Buffer Algorithm, Properties that help in reducing efforts, Scan Line coherence algorithm Depth comparison, A- buffer & Z-buffer algorithm, back faces detection, BSP tree

method, The Painter's algorithm, scan-line algorithm; Hidden line elimination. Visible surface detection methods: Classification, back-face detection, depth-buffer, scan-line, depth sorting.

Module 7: Color & shading models [5]

Light & Color Model, Shading Models for Polygons, Interpolative Shading Models, Texture, Reflectance properties of surfaces, Ambient, Specular and Diffuse reflections, Atmospheric attenutation, Phong's model, Gouraud shading, some examples.

Text Books:

1. Donald Hearn & M. Pauline Baker, "Computer Graphics with OpenGL", Third Edition, 2004, Pearson Education, Inc. New Delhi.
2. Ze-NianLi and Mark S. Drew, "Fundamentals of Multimedia", First Edition, 2004, PHI Learning Pvt. Ltd., New Delhi.

Reference Books

3. D. Hearnand M. P. Baker, Computer Graphics, Pearson Education.
4. D. P. Mukherjee, D. Jana, Computer Graphics: Algorithms and Implementations, Pentice HallofIndia.

Course Name: Probability and Statistic
Course Code: MCA205C
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisites: The prerequisite for Probability and Statistics is a basic knowledge of high school–level mathematics, particularly algebra and calculus.

Course Objectives: The objectives of the course are to make the students able to-

O1: Disseminate the prospective engineers with the knowledge of probabilistic approaches and applied statistics.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the properties related probability distribution and applied statistics.
CO2	Apply the concept of geometric, mathematical and algorithmic concepts
CO3	Explain the theoretical working of the concepts of probability distribution and applied statistics.
CO4	Analyse the real-world problems using the underlying principles of both probabilistic and statistical approaches.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	-	-	-	-	-	-	-	-	1	3	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	1	3	1	2	2
CO3	3	3	1	1	-	-	-	-	-	-	2	2	2	3	-
CO4	3	3	1	1	-	-	-	-	-	-	2	1	2	2	2

Course Contents:

Module 1: Probability and Random Variables [10]

Discrete and continuous random variables, probability mass function, probability density function and cumulative distribution functions, mathematical expectation, Moments, Moment generating functions, Binomial, Poisson and Normal distributions

Module 2: Two Dimensional Random Variables [9]

Joint distributions, Marginal and conditional distributions, Covariance, Correlation and linear regression, T-Transformation of random variables, Central limit theorem (for independent and identically distributed random variables)

Module 3: Sampling Theory & Estimation of Parameters [12]

Sampling Theory: Random Sampling, Parameter & Statistics, Standard error of statistic, Distributions of the sample mean and the sample variance for a Normal population, Central Limit Theorem, Chi-Square distributions, t distributions

Estimation of Parameters: Unbiased and consistent estimators, Point estimation, Interval estimation, Maximum likelihood estimation of parameters (Binomial, Poisson and Normal), Confidence intervals and related problems.

Module 4: Testing of Hypothesis [9]

Simple and Composite hypothesis, critical and acceptance regions, Level of significance, Type I and Type II errors, power of the test, the most powerful test and Neyman-Pearson Fundamental

Lemma, one sample and two sample tests for means and proportions, $\chi 2$ - test for goodness of fit and its applications.

Text Books:

1. Das, N.G, Probability and Statistics, The McGraw Hill Companies.
2. Gupta S. C. and Kapoor V. K., Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
3. Goon A.M., Gupta M. K. and Dasgupta, B., *Fundamental of Statistics*, The World Press Pvt. Ltd.
4. Kreyszig, E., *Advanced Engineering Mathematics*, 9thEdition; John Wiley & Sons, 2006.

Reference Books

5. Lipschutz, S.and Lipson, M., Schaum's Outline in Probability (2ndEd.); McGraw Hill Education.
6. Soong, T. T., Fundamentals of Probability and Statistics for Engineers; Wiley Publications.
7. Spiegel, M. R.,*Theory and Problems of Probability and Statistics (Schaum's Outline Series)*; McGraw Hill Book Co.

Course Name: Introduction to Cyber Security
Course Code: MCA205D
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: The prerequisite for Introduction to Cyber Security is a basic understanding of computer fundamentals, networks, and logical reasoning skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: Equip students with the knowledge and skills to secure systems, protect personal and organizational data, and safeguard computer networks. It enables learners to design and implement effective security solutions, understand key concepts in cryptography, governance, and compliance, and develop appropriate cybersecurity strategies and policies. The course also emphasizes principles of web security and the use of forensic tools to monitor, analyse, and respond to various cyberattacks, fostering both academic expertise and practical proficiency in cybersecurity.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the policy issues related to electronic filing of documents.
CO2	Identify the importance of lawful recognition for transactions through electronic data interchange and other means of electronic communication.
CO3	Analyse the effectiveness of the prevailing information security law practices.
CO4	Judge the architecture that can cater to the needs of the social information security.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	-	1	1	-	2	-	1	-	-	-	1	-	-	1
CO2	1	3	2	1	-	2	-	2	-	-	-	2	-	-	2
CO3	1	2	2	2	-	1	-	2	-	-	-	1	-	-	1
CO4	1	2	2	2	1	3	-	3	-	-	-	1	-	-	1

Course Contents:

Module 1: Introduction [2]

Introduction to Cyber Space, Information Systems, Need for Cyber Security

Module 2: Cyber Attacks [3]

Introduction to Cyber Attacks, Classification of Cyber Attacks, Classification of Malware, Threats

Module 3: Intrusion Detection and Prevention [3]

Vulnerability Assessment Intrusion Detection Systems Intrusion Prevention Systems

Module 4: Authentication Methods [3]

Introduction to User Authentication Methods Biometric Authentication Methods, Biometric systems.

Module 5: Security Models [3]

Different Security Models and Security Mechanisms Information Security and Network Security Operating System Security

Module 6: Online Security [3]

Web Security Email Security, Mobile Device Security, Cloud Security

Module 7: IoT & Social Media Security [4]

IoT Security, Cyber Physical System Security Social Media Security

Module 8: Security and Virtual Currency [4]

Virtual Currency, Block Chain Technology Security Auditing

Module 9: Cyber Crimes [5]

Introduction, Different Types of Cyber Crimes, Scams and Frauds, Analysis of Crimes, Human Behavior, Stylometry, Incident Handling, Investigation Methods, Criminal Profiling, Cyber Trails

Module 10: Digital Forensics [5]

Digital Forensics, History, Challenges, Branches of Digital Forensics, Digital Forensic Investigation Methods, Reporting, Management of Evidence

Module 11: Cyber Law [5]

Cyber laws, Cyber terrorism, Information Technology Act 2000 and Amendments, Evidentiary value of Email/ SMS, Cybercrimes and Offenses dealt with IPC, RBI Act and IPR Act in India, Jurisdiction of Cyber Crime, Cyber Security Awareness Tips

Text Books:

1. Fundamentals of Cyber Security By Mayank Bhushan, BPB Publications
2. Information Security& Cyber Laws, Gupta & Gupta, Khanna Publishing House

Reference Books

3. Data communication and Networking by Behrouz A. Forouzan, Mc Graw Hill Education (India) Pvt. Ltd.
4. Nina Gobole & Sunit Belapune. Cyber security, Pub: Wiley India.

Course Name: Introduction to IOT
Course Code: MCA205E
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: Operating System, Wireless Sensor Networks, Computer Networks, Cryptography, Communication Technology, Python Programming Language, and Cloud computing.

Course Objectives: The objectives of the course are to make the students able to-

O1: Learn and understand Internet of Things (IoT) in detail and identifies the application potentials of this technology.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the basic concepts of IoT and its architectures
CO2	Apply the concepts of IoT to design different smart tools
CO3	Analyze different issues in the domain of IoT and understand the practical applications of IoT
CO4	Evaluate and analyze different solution for the real life problems of IoT

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	2	3	1	2	-	-	-	-	-	-	-	3	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	3	2	-	1
CO3	1	3	2	3	-	-	-	-	-	-	-	2	3	-	3
CO4	3	3	1	2	-	-	-	-	-	-	-	2	3	-	3

Course Contents:

Module 1: Wireless Sensor Network [4]
Network and Communication aspects, Wireless medium access issues, MAC protocol, Routing protocols, Sensor deployment and Node discovery, Data aggregation and dissemination, Topology, Connectivity, Single-hop and Multi-hop communications.

Module 3: Fundamental of IoT [4]
The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet, Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

Module 3: IoT and M2M [5]
Main design principles and needed capabilities, IoT architecture outline, standards, M2M and IoT Technology Fundamentals, Devices and gateways, Local and wide area networking, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT Architectural Overview, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module 4: IoT Architecture [6]
Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module 5: IoT Privacy, Security and Governance [7]
Introduction, Overview of Governance, Privacy and Security Issues, Access Control, Authentication and Authorization, Distributed trust in IoT, Secure Platform design, Smart Approach. Data Aggregation for the IoT in smart cities, Intrusion detection and prevention, Security attacks and functional threats.

Module 6: IoT Layers Architecture [6]
PHY/MAC Layer - 3GPP MTC, IEEE 802.11, IEEE 802.15, Wireless HART, Z-Wave,
Bluetooth Low Energy, Zigbee Smart Energy, DASH7; Network Layer - IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP; Transport Layer - TCP, MPTCP, UDP, DCCP, SCTP TLS, DTLS; Session Layer - HTTP, CoAP, XMPP, AMQP,
MQTT; Service Layer - oneM2M, ETSI M2M, OMA, BBF.

Module 7: IoT Applications for Value Creations [4]
Introduction, IoT applications for industry: Future Factory Concepts, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Big Data and Serialization, IoT for Retailing Industry, Oil and Gas Industry, Real-time monitoring and control of processes - Deploying smart machines, smart sensors, and smart controllers with proprietary communication and Internet technologies, Remote control operation of energy consuming devices.

Text Books:

1. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education; First edition.
2. Internet of Things fundamentals, David, Pearson Education.

Reference Books

3. Getting Started with The Internet of Things: Connecting Sensors and Microcontrollers to the Cloud, Cuno Pfister O'Reilly
4. Internet of Things (A Hands-On-Approach), Vijay Madisetti and ArshdeepBahga, Orient Blackswan Private Limited - New Delhi; First edition.

Course Name: Automata Theory & Computational Complexity
Course Code: MCA205F

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: The prerequisite for Automata Theory & Computational Complexity is a basic understanding of discrete mathematics, logic, and fundamental programming concepts.

Course Objectives: The objectives of the course are to make the students able to-

O1: Provide students with a formal framework for computation through the study of automata, grammars, and languages, enabling them to understand and design finite automata, context-free grammars, and pushdown automata. It further aims to develop the ability to analyse the relationship among formal languages, grammars, and machines, while exploring fundamental concepts of computability, decidability, and complexity classes.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Understand the formal notation for strings, languages, and automata.
CO2	Design finite automata and regular expressions to recognize regular languages.
CO3	Develop context-free grammars and analyse pushdown automata for CFLs.
CO4	Analyse Turing machines and their relation to unrestricted grammars and decidability.
CO5	Distinguish between decidability and analyse complexity classes P, NP, and NP-complete problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	-	-	-	-	-	-	2	2	1	2	1
CO2	2	3	2	2	-	-	-	-	-	-	2	1	2	3	1
CO3	3	2	3	2	-	-	-	-	-	-	2	2	3	2	2
CO4	2	2	3	3	1	-	-	-	-	-	3	3	2	2	3
CO5	3	2	3	3	1	2	-	-	-	-	2	2	3	2	3

Course Contents:

Module 1: Introduction [6]

Fundamentals of formal languages: Alphabets, strings, and languages. Concept of grammars and production rules. Derivations in grammars and examples. Classification of languages and grammars – Chomsky hierarchy (Regular, Context-Free, Context-Sensitive, and Recursively Enumerable).

Module 2: Regular Languages and Finite Automata [8]

Regular expressions and languages, DFA and equivalence with REs, NFA and equivalence with DFA, Regular grammars and equivalence with finite automata, Properties of regular languages, pumping lemma, minimization of finite automata.

Module 3: Context-Free Languages and Pushdown Automata [8]

CFGs and CFLs, Chomsky & Greibach normal forms, Nondeterministic PDA and equivalence with CFG, Parse trees, ambiguity, pumping lemma for CFLs, deterministic PDA, closure properties.

Module 4: Turing Machines [10]

Basic TM model, Turing-recognizable and decidable languages, closure properties, Variants of TMs, nondeterministic TMs and equivalence with deterministic TMs, Unrestricted grammars and equivalence with TMs, TMs as enumerators, Context-Sensitive Languages, LBAs and relation with CSLs.

Module 5: Decidability [4]

Decidability, decidable vs undecidable languages, Halting problem of TMs.

Module 6: Complexity [4]

Growth rate of functions, Classes P & NP, Polynomial time reduction, NP completeness, Cook's Theorem, SAT problem, Church–Turing Thesis.

Text Books:

1. Hopcroft, J. E., Motwani, R., Ullman, J. D. Introduction to Automata Theory, Languages, and Computation. Pearson.
2. Lewis, H. R., Papadimitriou, C. H. Elements of the Theory of Computation. Pearson.

Reference Books

3. Introduction to Languages and the Theory of Computation by John C. Martin

Course Name: Python Programming Lab
Course Code: MCA291
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2

Pre requisites: The prerequisite for Python Programming Lab is a basic understanding of programming fundamentals and logical problem-solving skills.

Course Objectives: The objectives of the course are to make the students able to-

O1: To provide hands-on experience in Python programming by implementing fundamental concepts, control structures, functions, and data structures. To develop problem-solving skills through practical exercises in object-oriented programming, file handling, and exception management, and to expose students to real-world applications using advanced Python libraries, data analysis tools, GUI development, and automation scripts.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Implement basic Python programs to practice syntax, data types, operators, control structures, and functions through hands-on exercises.
CO2	Apply programming constructs such as loops, recursion, file handling, and exception management to solve computational problems in a lab environment.
CO3	Develop modular and reusable programs by implementing object-oriented programming concepts including classes, inheritance, polymorphism, and abstraction.
CO4	Design and test real-world applications using advanced Python libraries, data analysis tools (NumPy, Pandas), GUI frameworks (Tkinter), and automation scripts.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	1	2	3	3	--	--	--	--	--	--	1	1	2	3	1
CO2	2	1	3	3	--	--	--	--	--	--	1	2	1	3	3
CO3	2	3	1	3	--	--	--	--	--	--	3	2	3	1	3
CO4	2	3	1	3	--	1	2	2	--	--	3	2	3	1	2

Course Contents:

Module 1: Basics of Python [5]

Writing and executing simple Python programs, Practice with input/output, variables, and basic data types, Programs on operators, type conversion, and simple expressions.

Module 2: Control Structures and Functions [5]

Programs using decision-making (if, if-else, if-elif-else), Loop-based problems (factorial, Fibonacci, prime numbers), Functions with different types of arguments, Programs on recursion and lambda functions.

Module 3: Data Structures and String Handling [6]

Programs using lists (sorting, searching, list comprehension), Programs with tuples, sets, and dictionary operations, String manipulation (palindrome, word frequency, pattern matching), Simple applications of iterators and generators.

Module 4: File Handling and Exception Management [6]

Programs to read/write text and binary files, Student record management system using files, Programs demonstrating exception handling (try, except, else, finally), Creating and handling user-defined exceptions.

Module 5: Object-Oriented Programming in Python [7]

Programs on class and object creation, Constructor (**init)** and method demonstrations, Inheritance and polymorphism examples, Programs using operator overloading and encapsulation.

Module 6: Advanced Python and Applications [7]

Programs using built-in libraries (math, random, datetime, os), Mini projects with NumPy and Pandas (data analysis tasks), GUI programs using Tkinter (simple calculator, notepad), Small real-world applications (web scraping, automation scripts).

Text Books:

1. Taneja, S. & Kumar, N. 2018. *Python Programming: A Practical Approach*, Pearson Education India.
2. Reddy, R. Nageswara. 2018. *Core Python Programming*, Dreamtech Press.

Reference Books

3. Balagurusamy, E. 2017. *Introduction to Computing and Problem Solving using Python*, McGraw Hill Education India.
4. Padmanabhan, T. 2016. *Programming with Python*, Springer India.

Course Name: Data Structure Lab
Course Code: MCA292
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2

Pre requisites: The prerequisite for Data Structures lab is a basic understanding of programming fundamentals and problem-solving using a high-level language such as C.

Course Objectives: The objectives of the course are to make the students able to-

O1: Introduce the concepts of abstract data types, data structures, and performance measurement with an emphasis on analysing the time and space complexities of algorithms. It covers the implementation of linear data structures such as stacks, queues, and lists along with their applications, as well as non-linear structures including trees and graphs. The course also explores various search structures like hashing, binary search trees, red-black trees, splay trees, and B-trees, in addition to introducing different internal sorting techniques and analysing their computational efficiency.

Course Outcome:

After successful completion of the course, the students will be able to:

CO1	Different kinds of data structures are suited to different types of applications, and some are highly specialized for specific tasks.
CO2	Manage large amounts of data efficiently, such as large databases and internet indexing services
CO3	Use efficient data structures which are a key to designing efficient algorithms
CO4	Use some formal design methods and programming languages which emphasize on data structures, rather than algorithms, as the key organizing factor in software design.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4

CO1	1	2	3	3	1	-	-	-	-	-	1	3	-	-	-
CO2	2	1	3	3	2	-	-	2	-	-	1	3	3	-	-
CO3	2	3	1	3	2	-	-	-	-	-	3	1	2	3	1
CO4	3	3	1	3	3	1	2	2	-	-	3	2	1	3	3

Course Contents:

Module 1: Implementation of data structure operations (Insertion, deletion, traversing, searching) on array. Linear search, Binary search.

Module 2: Implementation of stack, queue operation using array. Pop, Push, Insertion, deletion, Implementation of circular Queue, post fix expression evaluation.

Module 3: Implementation of linked lists: Single linked list, circular linked list, double linked list, doubly circular linked list.

Module 4: Implementation of stack and queue using linked list. Merging two linked list, Linked list representation of a polynomial, polynomial addition, polynomial multiplication.

Module 5: Tree: creating Binary Search tree, recursive and non-recursive traversal of BST, deletion in BST, calculating height of a BST, building AVL tree.

Module 6: Implementation of sorting techniques: selection, bubble, quick sort, insertion sort, merge sort, heap sort,

Module 7: Implementation of priority queue. Hash table implementation.

Module 8: Implementation of Graph: representation, searching, BFS, DFS.

Text Books:

1. Data Structures and Algorithms in Python – Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Wiley.
2. A Common-Sense Guide to Data Structures and Algorithms in Python (Vol. 1)– Jay Wengrow, Pragmatic Bookshelf.

Reference Books

3. Fundamentals of Data Structures in C, E. Horowitz, Sartaj Sahni and Susan Anderson, W. H. Freeman and Company
4. Data Structure Using C & C++, Tanenbaum, PHI
5. Data Structures & Program Design in C, 2nd Ed, Kruse, Tondo & Leung, PHI
6. Mastering Algorithms with C. Loudon, SPD/O'REILLY
7. Data Structures and Algorithm, R. S. Salaria, Khanna Publishing

Course Name: Operating System Lab (Unix)
Course Code: MCA293
Contact: (0:0:4)
Total Contact Hours: 40
Credit: 2
Prerequisites: Basic knowledge of computers, Basic knowledge of programming

Course Objectives: The objectives of the course are to make the students able to-

O1: The course aims to familiarize students with the fundamentals of Operating Systems, with emphasis on UNIX/LINUX, by introducing basic commands, process, memory, file and directory management concepts, and enabling them to develop simple programs and perform essential administrative tasks in the LINUX environment.

Course Outcome:

After successfulcompletionofthecourse,thestudentswillbeableto:

CO1	Understand gcc compiler, and Makefiles
CO2	Understand the high-level structure of the Linux kernel both in concept and source code
CO3	Acquire a detailed understanding of one aspect (the scheduler) of the Linux kernel
CO4	Apply knowledge of different operating system algorithms.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2	3	-	-	-	-	-	-	2	2	-	1
CO2	2	3	2	3	3	-	-	-	-	-	-	3	3	-	1
CO3	3	3	3	3	3	-	-	-	2	-	-	3	3	-	3

Course Contents:

Module 1: Shell programming

Creating a script, making a script executable, shell syntax (variables, Conditions, control

structures, functions and commands).

Module 2: Implement the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Module 3: Starting new process, replacing a process image, duplicating a process image, waiting for a process, Zombie Process, Orphan Process.

Module 4: Implement all file allocation strategies : Sequential ,Indexed ,Linked

Module 5: Implement Semaphores

Module 6: Implement Paging Technique of memory management.

Module 7: Implement Banker's Algorithm for Deadlock avoidance, an Algorithm for Deadlock Detection

Module 8: Implement all page replacement algorithms: FIFO, LRU, LFU

Module 9: Signal : Implement Signal Handling, Blocking, Suspending, Delivering Signals, Various Signal Related Functions

Reference Books

1. Yashavant P. Kanetkar, UNIX Shell Programming, 1st edition, BPB Publications Beej's Guide

to Unix IPC

2. W. Richard Stevens, UNIX Network Programming, 2nd edition, Prentice Hall