Curriculum and Syllabus [Regulation-25]

Incorporating Guidelines of NEP2020

Master in Computer Application

(Effective From 2025-2026 Admission Batch)

JIS College of Engineering

(NAAC 'A' Accredited An Autonomous Institute)

(Affiliated to Maulana Abul Kalam Azad University of Technology)

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA101	Programming for Problem Solving using C	3	1	0	4	4
2	ENGG	Core	MCA102	Relational Database Management System	3	1	0	4	4
3	ENGG	Core	MCA103	Computer Organization and Architecture	3	1	0	4	4
4	SCI	Inter-disciplinary Course	MCA104	Discrete Mathematics and Graph Theory	3	1	0	4	4
5	ENGG	Minor	MCA105A	Environment and Ecology	3	0	0	3	3
			MCA105B	Management and Accountancy					
			MCA105C	Constitution of India					
			MCA105D	Stress Management through Yoga					
			MCA105E	Values and Ethics in Profession					
			MCA105F	Managerial Economics					
B. PRACTICAL									
1	ENGG	Core	MCA191	Programming for Problem Solving using C Lab	0	0	4	4	2
2	ENGG	Core	MCA192	Relational Database Management System Lab	0	0	4	4	2
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	Ability Enhancement Course (AEC)	MCA181	Soft Skill and Interpersonal Development	0	0	2	2	2
Total of Theory, Practical								**29**	**25**

1st Year 2nd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Core	MCA201	Python Programming	3	1	0	4	4
2	ENGN	Core	MCA202	Data Structures	3	1	0	4	4
3	SCI	Core	MCA203	Operating Systems	3	1	0	4	4
4	SCI	Core	MCA204	Data Communication & Computer Network	3	1	0	4	4
5	VAC(PE)	Minor	MCAE205A	Numerical and Statistical Analysis	3	0	0	3	3
			MCAE205B	Computer Graphics					
			MCAE205C	Probability and Statistics					
			MCAE205D	Introduction to Cyber Security					
			MCAE205E	Introduction to IOT					
			MCAE205F	Automata Theory & Computational Complexity					
B. PRACTICAL									
1	ENGG	Core	MCA291	Python Programming Lab	0	0	4	4	2
2	ENGG	Core	MCA292	Data Structure Lab	0	0	4	4	2
3	ENGG	Core	MCA293	Operating System Lab (Unix)	0	0	4	4	2
Total of Theory, Practical								**31**	**25**

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA301	Software Engineering	3	1	0	4	4
2	ENGG	Core	MCA302	Artificial Intelligence	3	1	0	4	4
3	ENGG	Core	MCA303	Object Oriented Programming with JAVA	3	1	0	4	4
4	VAC(PE)	Minor	MCAE304A	Basic Data Science	3	0	0	3	3
			MCAE304B	Image Processing					
			MCAE304C	Cloud Computing					
			MCAE304D	Web Technology					
			MCAE304E	Android Application Development					
			MCAE304F	Web Enabled JAVA Programming					
			MCAE304G	Generative AI					
5	VAC(PE)	Minor	MCAE305A	Machine Learning	3	0	0	3	3
			MCAE305B	Data Warehousing and Data Mining					
			MCAE305C	Introduction to Big Data Analytics					
			MCAE305D	Cryptography					
			MCAE305E	Operation Research and Optimization Techniques					
			MCAE305F	Pattern Recognition					
			MCAE305G	Information Retrieval					
B. PRACTICAL									
1	ENGG	Core	MCA393	Object Oriented Programming with JAVA Lab	0	0	4	4	2
2	ENGG	Core	MCAE394	Elective III Lab	0	0	4	4	2
3	PRJ	PROJECT	MCA381	Minor Project and Viva-voce	0	0	8	8	3
C. MANDATORY ACTIVITIES / COURSES									
Total of Theory, Practical								**32**	**25**

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA401	Design and Analysis of Algorithm	3	1	0	4	4
2	VAC(OE)	Minor	MCAO401A	Deep Learning	3	0	0	3	3
			MCAO401B	Bioinformatics					
			MCAO401C	Information Theory & Coding					
			MCAO401D	Blockchain Technology					
			MCAO401E	Intelligent Control					
			MCAO401F	Design of Embedded Systems					
			MCAO401G	Business Analytics					
			MCAO401H	Robotics					
			MCAO401I	Multimedia					
			MCAO401J	Distributed System					
			MCAO401K	Big Data Analytics					
			MCAO401L	Social Networks					
B. PRACTICAL									
1	PRJ	PROJECT	MCA481	Major Project Dissertation	0	0	12	12	12
2	PRJ	PROJECT	MCA482	Major Project Viva-voce	0	0	4	4	4
3	PRJ	Skill Enhancement Course (SEC)	MCA483	Grand Viva	0	0	2	2	2
C. MANDATORY ACTIVITIES / COURSES									
Total of Theory, Practical								**25**	**25**

Department of Computer Application

JIS College of Engineering

R25 (MCA)

Curriculum & Syllabus for MCA Under Autonomy

Incorporation of NEP 2020

First Year Curriculum Structure (Effective from 2025-26 admission batch)

1st Year 1st Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA101	Programming for Problem Solving using C	3	1	0	4	4
2	ENGG	Core	MCA102	Relational Database Management System	3	1	0	4	4
3	ENGG	Core	MCA103	Computer Organization and Architecture	3	1	0	4	4
4	SCI	Inter-disciplinary Course	MCA104	Discrete Mathematics and Graph Theory	3	1	0	4	4
5	ENGG	Minor	MCA105A	Environment and Ecology	3	0	0	3	3
			MCA105B	Management and Accountancy					
			MCA105C	Constitution of India					
			MCA105D	Stress Management through Yoga					
			MCA105E	Values and Ethics in Profession					
			MCA105F	Managerial Economics					
B. PRACTICAL									
1	ENGG	Core	MCA191	Programming for Problem Solving using C Lab	0	0	4	4	2
2	ENGG	Core	MCA192	Relational Database Management System Lab	0	0	4	4	2
C. MANDATORY ACTIVITIES / COURSES									
1	Mandatory Course	Ability Enhancement Course (AEC)	MCA181	Soft Skill and Interpersonal Development	0	0	2	2	2
Total of Theory, Practical								**29**	**25**

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 problem.
CO3	Analyze various features of C programming language to find optimum solution of mathematical and logical problem.
CO4	Evaluate expressions in C programming for solving mathematical and logical problem.
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.

CO6 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 constitutional foundations of liberty and freedom from a civil rights perspective.

CO2 Analyse the evolution of Indian opinion on the role of modern intellectuals in shaping civil and economic rights during early nationalism.

CO3 Evaluate the influence of socialism, particularly after the Bolshevik Revolution, on the drafting of the Indian Constitution.

CO4 Interpret the relevance of constitutional values in the context of India's nationhood and democratic development.

CO-PO Mapping:

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

Course Contents:

Module 1: History of Making of the Indian Constitution [5]

History Drafting Committee, (Composition & Working)

Module 2: Philosophy of the Indian Constitution [5]

Preamble Salient Features

Module 3: Contours of Constitutional Rights & Duties [5]

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Module 4: Organs of Governance [5]

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

Module 5: Local Administration [5]

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Module 6: Election Commission [5]

Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

Reference Books

3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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 Demonstrate effective verbal, non-verbal, and written communication skills in professional and social contexts.

CO2 Apply interpersonal skills such as teamwork, leadership, and conflict resolution to function effectively in diverse groups.

CO3 Develop self-confidence, emotional intelligence, and a positive attitude for personal and professional growth.

CO4 Utilize professional etiquette, time management, and problem-solving techniques to enhance workplace effectiveness.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction to Soft Skills

The Skills of Interpersonal Communication. 2. Team Behavior. 3. Time Management Skills

Module 2: Verbal Ability - Reading

Enhancing reading speed and vocabulary enhancement through intensive practice of placement test-based reading passages.

Module 3: Verbal Ability Test Patterns

Introducing Verbal Ability tests—Test Question Types: Synonyms and Antonyms, Error Spotting /Sentence Improvement, Analogies and Para Jumbles.

Module 4: Group Discussion and Personal Interview

Basics of Group Discussion—Intensive practice on answering interview-based questions common in placement interviews.

Text Books:

1. Meenakshi Raman and Sangeetha Sharma. Technical Communication. 3rd edition.
2. New Delhi: Oxford University Press, 2015.
3. Mark Ibbotson. Cambridge English for Engineering. Cambridge: Cambridge University Press,2008.

Reference Books

4. Mark Ibbotson. Professional English in Use: Engineering. Cambridge: ,2009.
5. John Seeley. Writing Reports. Oxford: Oxford UniversityPress,2002.
6. DianaBooher.E-writing:21stCenturyTools forEffectiveCommunication.Macmillan,2007.
7. Michael Swan. Practical English Usage. Oxford: OUP, 1980.

1st Year 2nd Semester									
Sl. No.	**Broad Category**	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
					L	**T**	**P**	**Total**	
A. THEORY									
1	ENGG	Core	MCA201	Python Programming	3	1	0	4	4
2	ENGN	Core	MCA202	Data Structures	3	1	0	4	4
3	SCI	Core	MCA203	Operating Systems	3	1	0	4	4
4	SCI	Core	MCA204	Data Communication & Computer Network	3	1	0	4	4
5	VAC(PE)	Minor	MCAE205A	Numerical and Statistical Analysis	3	0	0	3	3
			MCAE205B	Computer Graphics					
			MCAE205C	Probability and Statistics					
			MCAE205D	Introduction to Cyber Security					
			MCAE205E	Introduction to IOT					
			MCAE205F	Automata Theory & Computational Complexity					
B. PRACTICAL									
1	ENGG	Core	MCA291	Python Programming Lab	0	0	4	4	2
2	ENGG	Core	MCA292	Data Structure Lab	0	0	4	4	2
3	ENGG	Core	MCA293	Operating System Lab (Unix)	0	0	4	4	2
Total of Theory, Practical								**31**	**25**

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: learn basic of operating system

O2: Understand the different types of Operating System, Memory management and process management,

Course Outcome:

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

CO1 Apply various concepts of CPU scheduling, memory management, synchronization and file management.

CO2 Analyze different algorithms of process scheduling, disk scheduling, OS structures and services.

CO3 Evaluate different operating system approaches.

CO4 Design solutions for complex problems related to Process and Memory Management.

CO-PO Mapping:

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

Course Content:

Module-I: [6L]

Introduction: Operating System structure, Operating System operations, Process management,
Memory management, Storage management, Protection and security, Kernel data structures, computing environments. Operating System Services, User Operating System interface.

Module II: [15L]

Process: Processes: Process Concept, Process Scheduling, Interprocess communication.
Process Synchronization: The critical section problem, Peterson's solution, Mutex locks, Semaphores,
Classical problems of synchronization.Multithreaded Programming: Multithreading models.
CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks,
Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.

Module III: [10]

Memory: Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.
Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing.

Module IV: [3L]

Disk Performance: Introduction, Why disk scheduling is necessary, Disk scheduling strategies, rotational optimization.

Module V: [2L]

File and Database Systems: Free space management, File access control.

Textbook:

1. Operating System Concepts, by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, Wiley India, 2012.

Reference Book:

1. Operating Systems, A Concept-Based Approach, by DM Dhamdhere, 3rd Edition, Tata Mcgraw-Hill, 2012.
2. Modern Operating Systems, by Andrew S. Tanenbaum and Herbert Bos, 4th Edition, Pearson, 2014.
3. UNIX complete reference by Herbert Schildt, 2nd edition McgrawHill2.
4. Sumitabha Das: UNIX Concepts and Applications, 4th Edition, Tata McGraw Hill, 2006.

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: MCAE205A

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: MCAE205B

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: MCAE205C

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: MCAE205D

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: MCAE205E

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: MCAE205F

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 Objective: The objectives of the course are to make the students able to

O1: understand and appreciate the principles in the design and implementation of operating systems software.

Course Outcome:

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

CO1 Experiment with Unix commands and shell programming

CO2 Analyze the best CPU scheduling algorithm, memory management algorithm, synchronization techniques for a given problem instance

CO3 Develop algorithm for deadlock avoidance, detection and file allocation strategies

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 Content:

Module I: Basic Commands of UNIX:
File and Directory Related commands, Process and status information commands, Text related commands, File Permission commands, Pipes and filters, Managing Local Users and Groups

Module II: Shell programming
Variables, Control Structure, Loop, Array, Function

Module III: System Calls
I/O and Unix System Calls

Module IV: Process Synchronization
Implementation of Classical Synchronization problems using Semaphore

Module V: CPU Scheduling Algorithm

Module VI: Memory Management Schemes

Module VII:.Page Replacement Algorithm

Textbooks:

1. Russ Cox, Frans Kaashoek, Robert Morris, xv6: a simple, Unix-like teaching operating system", Revision8.
2. Sumitabha Das , UNIX Concepts and Applications, Tata McGraw-Hill

2nd Year 3rd Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA301	Software Engineering	3	1	0	4	4
2	ENGG	Core	MCA302	Artificial Intelligence	3	1	0	4	4
3	ENGG	Core	MCA303	Object Oriented Programming with JAVA	3	1	0	4	4
4	VAC(PE)	Minor	MCAE304A	Basic Data Science	3	0	0	3	3
			MCAE304B	Image Processing					
			MCAE304C	Cloud Computing					
			MCAE304D	Web Technology					
			MCAE304E	Android Application Development					
			MCAE304F	Web Enabled JAVA Programming					
			MCAE304G	Generative AI					
5	VAC(PE)	Minor	MCAE305A	Machine Learning	3	0	0	3	3
			MCAE305B	Data Warehousing and Data Mining					
			MCAE305C	Introduction to Big Data Analytics					
			MCAE305D	Cryptography					
			MCAE305E	Operation Research and Optimization Techniques					
			MCAE305F	Pattern Recognition					
			MCAE305G	Information Retrieval					

B. PRACTICAL									
1	ENGG	Core	MCA393	Object Oriented Programming with JAVA Lab	0	0	4	4	2
2	ENGG	Core	MCAE394	Elective III Lab	0	0	4	4	2
3	PRJ	PROJECT	MCA381	Minor Project and Viva-voce	0	0	8	8	3
C. MANDATORY ACTIVITIES / COURSES									
Total of Theory, Practical								**32**	**25**

Course Name: Software Engineering

Course Code: MCA301

Contact: (3:1:0)

Total Contact Hours: 40

Credit: 4

Prerequisites:

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

O1: To develop a broad understanding of Software Engineering by learning the software development life cycle for object-oriented solutions to real-world problems and gaining knowledge of testing concepts.

Course Outcome:

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

CO1 Analyze the problem scenario and identify classes/objects and their properties, relationships in- class model.

CO2 Learn software development life cycle for Object-Oriented solutions for Real-World Problems.

CO3 Apply the concepts of object-oriented methodologies to analyze requirements and design to the point where it is ready for implementation..

CO4 Demonstrate the concept of Testing to measure the quality of software.

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: Introduction to Software Engineering(4L)

What is Software Engineering? Software Engineering Concepts, Software Engineering Development Activities, Managing Software Development, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

Module 2: Object-Oriented Concept, Modeling (5L)

Object-Oriented Principals and Concepts: Classes and object, Modularity, Abstraction and Encapsulation; Object Relationship like Association, Aggregation and Composition; Inheritance, Polymorphism and Dynamic Binding Interfaces Model: Importance of Modeling, Object Oriented Modeling Identifying the Elements of an Object Model: Identifying classes and objects, Specifying the attributes Defining operations, Finalizing the object definition.

Module 3: Introduction to UML, Basic and Advanced Structural Modeling (8L)

Overview of UML, Conceptual Model of UML, Architecture, S/W Development Life Cycle. Classes Relationship, Common mechanism, Diagrams, Class Diagram, Advanced classes, Advanced Relationship, Interface, Types and Roles, Packages, Object Diagram.

Module 4: Basic and Advanced Behavioral Modeling and Architectural Modeling (8L)

Interactions, Use cases, Use Case Diagram, Sequence Diagram, Collaboration Diagram, Interaction Diagram, Activity Diagram, State Chart Diagram. Artifacts, Artifact Diagram, Implementation Diagram, Deployment Diagram.

Module 5: Object-Oriented Design and Analysis (9L)

Generic components of Object-Oriented Design model, System Design process, Partitioning the Analysis Model, Concurrency and subsystem Allocation, Task Management component, Data Management Component, Resource Management Component, Inter Sub-system Communication. Iterative Development, Unified process & its Phases: Inception, Elaboration, Construction, Transition, Understanding requirements.

Module 6: Software Testing (6L)

Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection; Unit Testing, Integration Testing, System Testing and Acceptance Testing.

Text Books:

1. The Unified Modelling Language User Guide, Grady Booch, James Raumbaugh, Ivar Jacobson, Second Edition, The (Addison-Wesley Object Technology Series).

2. Object Oriented Software Engineering, Ivar Jacobson, ACM Press, Third Edition.

3. Applying UML and Patterns, Craig Larman Motilal Uk Books of India, Third Edition.

Reference Books

1. Object-Oriented Software Engineering: Using UML, Patterns, and Java, Bernd Bruegge, Allen Dutoit, Pearson, Third Edition.

2. Software Engineering – A Practitioner's Approach, Roger. S. Pressman and Bruce R. Maxim, McGraw Hill, Eighth Edition.

Course Name: Artificial Intelligence

Course Code: MCA302

Contact: (3:1:0)

Total Contact Hours: 40

Credit: 4

Prerequisite:

Data Structure, Design and Analysis of Algorithms, Statistics

Course Objective:

Comprehend the fundamental concepts of Knowledge Representation and Inference in Artificial Intelligence and its utilitarian importance in current technological context, Formulate a problem as State-Space Exploration Framework or an Inference Framework of Artificial Intelligence, Use the strategies of AI-Heuristics to find acceptable solutions avoiding brute-force techniques.

Course Outcome

After completion of this course students will be able to

CO1	Understand various AI search algorithms for instance uninformed, informed, heuristic, constraint satisfaction.
CO2	Apply facts, rules, and concepts of knowledge representation for instance logic-based, frame-based, semantic nets, inference and theorem proving.
CO3	Analyze working knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO4	Evaluate and create knowledge representation, reasoning, and machine learning techniques for the solution of real-world problems.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	3	--	--	--	--	--	--	1	1
CO2	2	1	3	3	--	--	--	--	--	--	1	1
CO3	2	3	1	3	--	--	--	--	--	--	3	2
CO4	2	3	1	3	--	1	2	2	--	--	3	2

Course Contents:

Module 1: Introduction to Artificial Intelligence [3L]

Basic Concepts, History of Artificial Intelligence, Architecture of an Artificial Intelligent Agent, Applications of Artificial Intelligence

Module 2: Artificial Intelligence Problem Formulation as State-Space Exploration Problem for Goal Searching [4L]

Basic Concepts, State-Space Exploration Formulation for Water Jug Problem, Missionaries and Cannibals Problems, Farmer-Wolf-Goat-Cabbage Problem, 8-Puzzle Problem, Constraint Satisfaction Problem and Production System for Goal Searching. Blind Search Techniques for Goal Searching: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, Uniform Cost Search, Bi-directional Search.

Module 3: Heuristic Techniques for Goal Searching [8L]

Basic Concepts of Heuristic Techniques and Properties of Heuristic Functions, Hill Climbing Search. Best First Search, A* Search, Memory-bounded heuristic search: Iterative-deepening A* Search, Recursive Best First Search, Simplified Memory Bounded A* Search. Simulated Annealing Based Stochastic Search, Genetic Algorithm Based Evolutionary Search, Ant Colony Optimization, Particle Swarm Optimization

Module 4: Adversarial Search for Game Playing: [2L]

Basic Concepts, Minimax Search, Alpha-Beta Pruning.

Module 5: Knowledge Representation and Inference using Propositional Logic and Predicate Logic: [5L]

Propositional Logic: Knowledge Representation and Inference using Propositional Logic Predicate Logic: Knowledge Representation, Inference and Answer Extraction using First Order Predicate Logic

Module 6: Slot-and-Filler Structure for Knowledge Representation [3L]

Weak Slot-and-Filler Structure for Knowledge Representation: Semantic Nets and Frames. Strong Slot-and-Filler Structure for Knowledge Representation: Conceptual Dependency and Script.

Module 7: Reasoning under Uncertainty [11L]

Bayesian Inferencing and Bayesian Belief Network, Dempster-Shafer Theory, Overview of Fuzzy Logic and Inferencing, Overview of Hidden Markov Model. Planning: Basic Concepts, Problem of Blocks World, Components of a Planning System, Algorithms for Planning: Goal Stack, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Algorithms for Planning as State-Space Search, Heuristics for planning, Planning Graphs and GRAPHPLAN Algorithm. Introduction to Natural Language Processing: Basic Concepts, Steps of Natural Language Processing, Morphological, Syntactic and Semantic Analysis, Discourse Integration and Pragmatic Analysis, Applications of Natural Language Processing.

Module 8: Introduction to Machine Learning [4L]

Basic concepts of Machine Learning Model, Supervised Learning, Unsupervised Learning, and Reinforced Learning, Overview of Artificial Neural Network

Text books:

1. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.
2. Rich, E., Knight, K and Shankar, B. 2009. Artificial Intelligence, 3rd edition, Tata McGrawHill.

Reference books:

1. Padhy, N.P. 2009. Artificial Intelligence and Intelligent Systems, Oxford University Press.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill.

Course Name: Object Oriented Programming with JAVA

Course Code: MCA303

Contact: (3:1:0)

Total Contact Hours: 40

Credit: 4

Prerequisites: Logic of programming language, Basic concepts of object-oriented concepts

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

Understand the fundamentals of the Java language and its object-oriented programming paradigm. Use Java syntax and features (classes, objects, inheritance, interfaces, generics, collections) to design and implement software. Apply exception handling, multithreading, and Java I/O streams to develop robust applications. Develop GUI-based and networked applications using Java APIs (AWT/Swing, sockets). Debug, document, and test Java programs, following good programming practices

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

CO1 Demonstrate and apply basic Java syntax, control structures, and object-oriented programming concepts -classes, objects, methods, inheritance, interfaces.

CO2 Design and implement Java programs using encapsulation, inheritance, interfaces, packages, and generics.

CO3 Use exception handling, Java I/O streams, and utility classes to write robust, file-oriented Java applications.

CO4 Develop multithreaded and network-based Java applications, applying synchronization and inter-thread communication.

CO5 Build simple GUI-based Java applications using AWT or Swing and integrate the use of Java APIs for practical software development.

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 [9L]

OOP Concepts - Data Abstraction, Encapsulation, Inheritance, Benefits of Inheritance, Polymorphism, Classes and Objects, Procedural and OOP Paradigms. Introduction. To Java, Data Types, Variables & Constants, Scope & Life Time of Variables, Precedence Of Operator, Expressions, Type Casting, Enumerated Types, Block Scope, Control Flow, Conditional Statements, Loops, Break & Continue Statements, Arrays, Console Input/Output, Formatting Output, Constructors Methods, Parameter Passing, Static Fields & Methods, Access Control, "this" Reference, Method Overloading, Recursion, Garbage Collection, Building Strings, String Class.

Module II: Inheritance and Polymorphism [10L]

Inheritance - Hierarchical Inheritance: Super and Sub Classes, Member Accessing Rules, Super Keyword, And Preventing Inheritance: Final Classes and Methods, Object Class and its Methods.

Polymorphism - Dynamic Binding, Method Overriding, Abstract Classes and Methods

Interfaces - Interfaces and Abstract Classes, Definition, Implementation, Accessing Implementations by Interface References, Extending Interfaces.

Inner Classes - Usage, Local, Anonymous and Static Inner Classes, Examples.

Packages - Definition, Creation and Accessing a Package, Understanding CLASSPATH, Importing Packages.

Module III: Exception Handling & Multithreading [8L]

Exception Handling - Dealing with Errors, Advantages of Exception Handling, The Classification - Exception Hierarchy, Checked and Unchecked Exceptions, Try, Catch, Throw, Throws and Finally, Exceptions-Throwing, Exception Specification, Built-in Exceptions, Creating Exception Sub Classes.

Multithreading - Difference Between Multiple Processes and Multiple Threads, Thread States, Creating and Interrupting Threads, Thread Priorities, Synchronizing Threads, Inter-Thread Communication, Procedure Consumer Pattern.

Module IV: Database & File Handling [6L]

Collection Framework - Introduction, Generics and Common Use of Collection Classes, Array List, Vector, Hash Table, Stack, Enumeration, Iterator, String Tokenizer, Random, Scanner, Calendars and Properties.

Files - Streams - Byte Streams, Character Streams, Text Input/Output, Binary Input/Output, Random Access of File Operations, File Management.

Module V: GUI Programming (Case study) [7L]

GUI Programming - The AWT Class Hierarchy, Introduction to Swing, Swing Vs, AWT, Hierarchy of Swing Components, Containers - Jframe, Japplet, Jdialog, Jpanel, Overview of Swing Components: Jbutton, Jlabel, Jtextfield, Jtextarea, Swing Applications, Layout Management - Types - Border, Grid and Flow

Event Handling - Events, Sources, Classes, Listeners, Event Sources and Listeners, Delegation Event Model, Examples. Handling Mouse Events, Adapter Classes.

Text Books:

5. The Complete Reference JAVA, Herbert Schildt, TMH Publication.
6. Java Programming, Joyce Farrell, Cengage Publication.
7. Programming with Java, E Balagurusamy, McGraw Hill Publication.

Reference Books

1. JAVA and Object-Oriented Programming Paradigm, Debasish Jana, Prentice Hall of India
2. Beginning JAVA, Ivor Horton, WROX Publication
3. JAVA 2 UNLEASHED, Tech Media Publications.JAVA 2(1.3) API Documentations.

Course Name: Basic Data Science

Course Code: MCAE304A

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisite:

Basic knowledge in data storage and retrieval, Knowledge in Quantitative Aptitude and Statistics, Proficiency in Algorithms and Computer Programming Skills.

Course Objective:

Demonstrate knowledge of statistical data analysis techniques utilized in business decision making, Use data mining software to solve real-world problems.

Course Outcome

After completion of this course students will be able to

CO1 Demonstrate proficiencies with statistical and probabilistic data analysis.

CO2 Evaluate different statistical analysis mechanisms over various datasets utilizing modern software tools.

CO3 Apply the statistical knowledge to build and assess different data-driven models.

CO4 Demonstrate skill in data engineering like storage, extraction, transformation, loading, pre-processing, feature identification, and data mining.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction [4L]

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in Data Science Project – Applications of Data Science in various fields – Data Security Issues.

Module 2: Data Collection and Data Pre-Processing [8L]

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

Module 3: Exploratory Data Analytics [8L]

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA

Module 4: Model Development [8L]

Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot –Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample, Evaluation – Prediction and Decision Making.

Module 5: Model Evaluation [8L]

Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting , Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing, Multiple Parameters by using Grid Search.

Textbooks:

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

Reference books:

1. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.

Course Name: Image Processing

Course Code: MCAE304B

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Knowledge on Computer Programming.

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

O1: To understand the fundamental concept of the digital image processing system.

O2: To learn different feature extraction techniques for image analysis and recognition.

O3: To learn various compression techniques.

O4: To learn the evaluation of the techniques for image enhancement and restoration.

Course Outcome:

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

CO1 Understand the fundamental concepts of a digital image processing system

CO2 Apply various transformation techniques for improving the image quality

CO3 Analyze various image compression techniques.

CO4 Evaluate image segmentation and representation techniques

CO-PO Mapping:

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

Course Contents:

Module I: Introduction: [4L]

Background, Digital Image Representation (Grey & Colour), Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display, Basics of image compression.

Module II: Digital Image Formation [4L]

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non-uniform.

Module III: Image Preliminaries [7L]

Neighbor of pixels, Connectivity, Relations, Equivalence & Transitive Closure, Distance Measures, Arithmetic/Logic Operations, Fourier and Wavelet Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform.

Module IV: Image Enhancement [5L]

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement, Linear & Nonlinear Stretching, Histogram Processing, Smoothing - Image Averaging, Mean Filter, Low-pass Filtering, Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering, Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Module V: Image Restoration [4L]

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration- Unconstrained & Constrained, Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation, Spatial Transformation, Gray Level Interpolation.

Module VI: Image Segmentation [6L]

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Text Books:

1. Digital Image Processing by Woods, Gonzalves, Pearson.
2. Digital Image Processing & Analysis by Chanda & Majumder, PHI.

Reference Books

3. Digital Image Processing by Jahne by Springer India.
4. Image Processing, Analysis & Machine Vision by Sonka, VIKAS.
5. Fundamentals of Digital Image Processing by Jain, PHI.

Course Name: Cloud Computing

Course Code: MCAE304C

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Basic knowledge of programming, data structures, algorithms, operating systems, and computer networks.

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

O1: To develop conceptual understanding of cloud computing fundamentals, service and deployment models, and modern cloud-native trends.

Course Outcome:

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

CO1 Demonstrate an understanding of fundamental cloud computing concepts, service models (IaaS, PaaS, SaaS), deployment models, and cloud-native trends such as multi-cloud and distributed cloud.

CO2 Apply concepts of abstraction and virtualization, including CPU, memory, I/O virtualization, containerization, and serverless computing, for efficient resource utilization in cloud environments.

CO3 Analyze various cloud services and applications (IaaS, PaaS, SaaS, IDaaS, CaaS, FaaS, BaaS, AIaaS, DBaaS) and evaluate their role in modern computing solutions.

CO4 Explain and compare Service-Oriented Architecture (SOA), Web Services, and Microservices in the context of cloud environments, highlighting benefits, challenges, and applications.

CO5 Evaluate cloud-based storage systems and security mechanisms, including data protection, identity management, compliance frameworks, risk management, and emerging security trends such as Zero Trust and CSPM.

CO-PO Mapping:

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

CO3	1	3	2	3	-	-	2	-	-	-	2	3	-	-	2
CO4	1	3	2	3	-	-	-	-	-	-	-	3	-	-	2
CO5	3	3	3	-	-	2	3	-	-	-	-	-	3	-	3

Course Contents:

Module I: Basics of Cloud Computing [4L]

Defining a Cloud, Cloud Types - NIST Cloud Reference Model, Cloud Cube Model, Deployment Models (Public, Private, Hybrid and Community Clouds), Service Models - IaaS, PaaS, SaaS, Benefits and Advantages of Cloud Computing, Cloud trends – Multi-Cloud and Distributed Cloud, Cloud-native architecture basics.

Module II: Concepts of Abstraction and Virtualization[4L]

Taxonomy of Virtualization, Reference model for Virtualization, Virtualization of CPU, Memory, I/O devices, Containerization (Docker, Kubernetes basics) vs Virtual Machines, Serverless computing introduction.

Module III: Services and Application by Type [5L]

IaaS - Basic Concept, Workload, Partitioning of Virtual Private Server Instances, Pods, Aggregations, Silos, PaaS – Basic Concept, Tools and Development Environment with examples, SaaS - Basic Concept and Characteristics, Open SaaS, Examples of SaaS Platform, Identity as a Service (IDaaS), Compliance as a Service (CaaS), Function as a Service (FaaS), Backend as a Service (BaaS), AI as a Service (AIaaS), Database as a Service (DBaaS).

Module IV: Concepts of Service Oriented Architecture (SOA) and Web Service (WS) [2L]

Service-Oriented Architecture - Basics, Terminologies, Components, Standards and Technologies, Benefits and Challenges, Web Services - Basics, Characteristics, Terminologies, Scope, Business Models, Micro services vs SOA in Cloud Environments.

Module V: Cloud-based Storage and Security [7L]

Cloud File Systems including GFS and HDFS, Cloud security concerns, Security boundary, Security service boundary, Overview of security mapping, Security of data - cloud storage access, storage location, tenancy, encryption, auditing, compliance, Identity management (awareness of identity protocol standards), Risk Management and Compliance, Research Trends in Cloud Computing, Zero Trust Security Model in Cloud, Cloud Security Posture Management (CSPM), Privacy and regulatory frameworks (GDPR, HIPAA in Cloud context).

Module VI: Introduction to Various Web Services and Cloud Federation [5L]

FAmazon Web Services, Google Web Services, Microsoft Cloud Services, Definition, Different scenario description, Replace ability and negotiation mechanism, Edge Computing and its relation with Cloud, Cloud Federation and Interoperability Challenges, Trends in Cloud Cost Optimization and FinOps.

Text Books:

8. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, McGrawHill Education.
9. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd.

Reference Books

1. Cloud Computing: A Practical Approach by Anthony T. Velte, Tata McGraw-Hill, First Edition.
2. Building Applications in Cloud: Concept, Patterns and Projects by Moyer, Pearson.
3. Cloud Security by Ronald Krutz and Russell DeanVines, Wiley-India, First Edition.

Course Name: Web Technology

Course Code: MCAE304D

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites: Students should have a basic understanding of computers, operating systems, networking concepts, and at least one programming language. They should also possess logical problem-solving skills and familiarity with using text editors, web browsers, and file management.

Course Objectives: After successful completion of this course, students will be able to:
Understand the basic working methodology of HTML, CSS, javascript
Apply In-Built and Create User defined functions of java script for form validation.
Students are able to develop a dynamic web page by the use of java script and DHTML..
Debug the Programs by applying concepts and error handling techniques.

Course Outcome:

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

CO1 Describe the fundamental concepts of Internet, client-server architecture, DNS, IP, HTTP, URL, browser working principles, web hosting, and W3C standards.

CO2 Apply HTML tags, attributes, forms, tables, lists, multimedia elements, and CSS properties to design structured and styled web pages.

CO3 Develop responsive and interactive web designs using advanced CSS techniques, Bootstrap components, and media queries.

CO4 Implement client-side interactivity through JavaScript, including DOM manipulation, events, form validation, arrays, functions, and introduction to AngularJS.

CO5 Analyze principles of web publishing, hosting, document interchange, search engines, and AI techniques for real-world applications in modern web development.

CO-PO Mapping:

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

Course Contents:

Module 1: Understanding of Internet [3]

www, client-server, DNS, IP Protocol, HTTP, URL, Browser working principal, Web Hosting, W3C standard, Cloud Development.

Module 2: Fundamental of Web Design HTML [6]

HTML: Introduction, Editor (VS Code/ Sublime), Element, Attribute, Head, Heading, Paragraph, Style, Formatting, Quotation, Comment, Color, CSS, Link, Image, Table, List, Block & Inline, Class, ID, Iframe , Script, File path, Layout, Code, Entity, Symbol, Emoji , Charset, Forms, Form Attributes, Elements, Input types, Input Attributes.

Module 3: Fundamental of Web Design CSS [7]

Introduction, Selector, External-Internal-Inline CSS, Comments, Color, Background, Border, Margin, Padding, Height, Width, Box model, Outline, Text, Font, Icon, Link, List, Table,Display,Maxwidth,Position,Overflow,Float,Inline-bock,Align,Pseudo-class,Pseudo- element, Opacity, Navigation Bar, Dropdowns, Image gallery, Image sprites, Attributes Selector, Form, Counter, Units, Rounded corner, Border image, Gradient, Shadow, Text Effect, Web Fonts,Transition,Animation,Tooltip,StyleImage,Button,Pagination,Multiplecolumn,Media Query, Flexbox.

Module 4: Advance Web Design [3]

CSS Responsive Design: Introduction,Viewport, Gridview, Mediaqueries, Responsive image, Responsive video. Bootstrap: Introduction, Container, Grid, Typography, Color, tables, Images, jumbotron,Alerts, Button, Button group, Badges, Progress bar, Spinner, Pagination, List group, Card, Dropdown, Collapse, Navs, Navbar , Forms, Input, Input group, Carousel, Modal, Tooltip, Popover, Toast, Scroll spy, Flex, Media object.

Module 5: Java Script [6]

Introduction, output, variables, operator, Datatype, Function, Object, Event, String, String method, Number method, Array, Array method, Array iteration, Date & Date format, Date method, Math, Random, Comparison, Condition, For, While, break, This keyword, Function, Arrow function, Form validation, HTML DOM – Documents, Elements, HTML,CSS, Animation, Event, Even listener, Navigation, Nodes, Collection, Node list. Form Validations in JavaScript, JS Popup Boxes. Introduction to Angular JS: Expressions, Modules and Directives.

Module 6: Advanced AI Techniques and Real-world Applications [6]

Web hosting Basics, Documents Interchange Standards, Components of Web Publishing, Document management, Web Page Design Considerations and Principles , Search and Meta Search Engines, WWW, Browser ,HTTP, Publishing Tools

Text Books:

1. "Learning Web Designing "by Ramesh Bangia, Khanna Book Publishing Co.
2. "HTML, CSS, and Java Script All in One:Covering HTML5, CSS3,and ES6" by Julie C. Meloni and Jennifer Kyrnin Publisher: BPB Publications
3. "Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics" by Jennifer Niederst Robbins

Publisher: O'Reilly Media

Reference Books

1. "HTML and CSS: Design and Build Websites "by Jon Duckett Publisher: Wiley India Pvt. Ltd.
2. "JavaScript and JQuery: Interactive Front-End Web Development "by Jon Duckett Publisher: Wiley India Pvt. Ltd.

Course Name: Android Application Development

Course Code: MCAE304E

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites: Basic understanding of programming logic, data structures, and algorithms.

Course Objectives: The objectives of this lab are to enable students to design, develop, and deploy Android applications by applying programming logic, data structures, and mobile app development concepts.

O1: To develop a clear conceptual understanding of mobile database management (SQLite, Firebase, etc.) and apply it for solving real-world industry problems through Android applications.

Course Outcome: On successful completion of the course, students will be able to design, develop, and deploy functional Android applications by applying programming, database, and mobile development concepts:

CO1	Understand the fundamentals of Android architecture, application components, and development environment.
CO2	Design user interfaces using XML layouts, Views, and apply event-driven programming concepts.
CO3	Develop Android applications with effective use of activities, intents, fragments, and services.
CO4	Integrate mobile databases (SQLite, Firebase, etc.) for efficient data storage, retrieval, and management.

CO5	Build and deploy Android applications that incorporate UI design, database handling, and essential mobile features to solve real-world problems.

CO-PO Mapping:

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

Course Contents:

Module I: Writing First Application [6L]

Creating Android Project, Android Virtual Device Creation, Setup debugging environment, Workspace setup for development, Launching emulator, debugging on mobile devices.

Module II: Basic UI design [4L]

Basics about Views, Layouts, Resources, input controls, Input Events, Toasts.

Module III: More UI Design[7L]

Layouts design Grid View and List View, Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.

Module IV: Activity and Fragment[4L]

Activity, Fragment, Activity Life cycle and Fragment Lifecycle.

Module V: Intents [4L]

Implicit Intents, Explicit intents, communicating data among Activities.

Module VI: Navigation Drawer[5L]

Panel that displays the app's main navigation screens on the left edge of the screen

Module VII: Android Notifications [5L]

Toast, Dialogs (TimePicker,DatePicker, Progress, Alert),Notification Manager and Push Notification

Module VIII: Introducing SQLite [5L]

SQLite Open Helper and creating a database-Opening and closing a database,Working with cursors Inserts, updates,and deletes

lab-manual / textbook:

1. *Android App Development For Dummies* by Michael Burton
2. *The Busy Coder's Guide to Android Development* by Mark L. Murphy

References :

3. *Kotlin for Android Developers* by Antonio Leiva

4. *Android Programming: The Big Nerd Ranch Guide"* by Bill Phillips, Chris Stewart, and Kristin Marsicno

Course Name: Web Enabled JAVA Programming

Course Code: MCAE304F

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites:

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

O1: To provide an understanding of JSP, Servlet, and JSF frameworks, and to enable learners to design and develop dynamic, database-driven web applications and interactive websites using technologies such as JSP, Servlet, and AJAX.

Course Outcome:

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

CO1	Understand the basic working methodology of JSP, servlet and JSF Frameworks.
CO2	Create dynamic web applications using JSP and servlet and database**.**
CO3	Design and develop a Web site using AJAX.
CO4	Apply concepts to Debug the Programs and error handling techniques.

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: Core Java Overview (6L)

Object-oriented concepts, Exception Handling, Multi-Threading Introduction to JDBC: Overview of JDBC API, The Java.sql package, JDBC Drivers, Executing SQL commands using JDBC Drivers, static and dynamic Execution of SQL statements, Execution of Stored Procedures using JDBC. Introduction to Transactions and Transaction Methods, Introduction to JNDI, Introduction to Data Source and Connection pooling, Introduction to Web Applications, Web Servers Overview of J2EE Technologies.

Module 2: Introduction to Java Servlets (6L)

Static and Dynamic contents, Servlet life Cycle and Life cycle methods, Servlet Request and Response Model, Deploying a Servlet, Servlet State Transitions, Servlet Config and Servlet Context, Servlet Redirection and Request Dispatch, Servlet Synchronization and Thread Model. Maintaining Client State: Cookies, URL rewriting, Hidden form fields, Session Tracking.

Module 3: Introduction to JSP (8L)

JSP & Servlet as Web Components, Servlets vs. JSP, JSP Lifecycle, JSP Page Lifecycle Phases, General Rules of Syntax, JSP syntactic elements, JSP element syntax, Template content. JSP elements-directives, declarations, expressions, scriptlets, actions. JSP Standard Actions: jsp:useBean, jsp:getPreoperty, jsp:setProperty, jsp:include, jsp:forward, jsp:plugin, jsp:param, Java Server Pages Standard Tag Library (JSTL).

Module 4: Introduction to JSF Frameworks (12L)

A Simple Example, Sample Application Analysis, Development Environments for JSF, A Sample Application, Bean Scopes Configuring Beans, Navigation, Static Navigation, Dynamic Navigation, Standard JSF tags, Data tables, conversion and validation Overview of the Conversion and Validation Process, Using Standard Converters. Life Cycle Events, Value Change Events, Action Events, Event Listener Tags, Immediate Components, Passing Data from the UI to the Server, Custom Components, Classes for Implementing Custom components, Tags and Components, The Custom Component Developer's Toolbox, Generating Markup, Processing Request Values, Using Converters, Implementing Custom Component Tags, The TLD File, The Tag Handler Class, Defining Tag Handlers in JSF 1.1.

Module 5: Hibernate Framework (4L)

Overview of Hibernate Framework; Advantages of ORM over JDBC; Hibernate Architecture and Core Components; Setting Up Hibernate in a Java Application; Mapping Java Classes to Database Tables; Hibernate Configuration (XML and Annotations); Basic CRUD Operations: Save, Update, Delete, Retrieve Hibernate Query Language (HQL) Basics

Module 6: AJAX (6L)

Ajax Fundamentals, JavaScript Libraries, The Prototype Library, The Fade Anything Technique Library, Form Completion. Realtime Validation, Propagating Client-Side View State Direct Web Remoting, Ajax Components, Hybrid Components, Keeping JavaScript Out of Renderers, Transmitting JSP Tag Attributes to JavaScript Code, Ajax4jsf, Implementing Form Completion with Ajax4jsf, Implementing Real-time Validation with Ajax4jsf, Introduction to Java Web Services.

Text Books:

1. Professional Java Server Programming- J2EE 1.3 Edition- Subrahmanyam Allamaraju and Cedric Buest- Apress publication, 2007.

2. Core JavaServer Faces-Second Edition-David Geary, Cay Horstmann-Prentice Hall-2007.

3. S. G. T. Raghavan, Java and JDBC, Oxford University Press, 2nd Edition

Reference Books

1. S. R. S. Sharma, Servlet & JSP Programming, PHI Learning, 2nd Edition

2. Ramesh F. Gujjula, Mastering Hibernate, BPB Publications, 1st Edition

Course Name: Generative AI

Course Code: MCAE304G

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Basics of Machine Learning, Programming in Python

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

O1: To develop conceptual understanding of the theoretical foundations of generative models.

O2: Learn various architectures of generative AI including GANs, VAEs, Transformers, and Diffusion Models.

O3: Implement generative models using modern deep learning frameworks.

O4: Explore applications of generative AI across domains such as NLP, computer vision, and healthcare.

O5: Critically analyze ethical, social, and security challenges in generative AI deployment.

Course Outcome:

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

CO1	Explain the fundamentals of generative models and their mathematical foundations.
CO2	Compare and analyze architectures such as VAE, GAN, Transformer, and Diffusion models.
CO3	Apply generative models for tasks such as text generation, image synthesis, and data augmentation.
CO4	Evaluate generative models using metrics like FID, BLEU, and perplexity.

CO5 Assess ethical issues, biases, and responsible AI practices in generative systems.

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	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	-	3
CO5	2	3	2	1	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Module I: Introduction to Generative AI: [4L]

Overview of Generative AI vs. Discriminative AI, Applications of Generative AI (text, image, video, healthcare, finance) , Ethical considerations and risks

Module II: Variational Autoencoders (VAEs) [6L]

Autoencoder basics, Bottleneck representation, Probabilistic generative modelling, Variational Inference, Latent Space representation, Applications in anomaly detection and data synthesis

Module III: Generative Adversarial Networks (GANs) [8L]

GAN architecture: Generator & Discriminator, Variants: DCGAN, CycleGAN, StyleGAN, BigGAN

Challenges: mode collapse, instability, Evaluation metrics: FID, IS score ,

Module IV: Transformers and Large Language Models (LLMs) [8L]

Attention mechanism & Transformer architecture, GPT, BERT, LLaMA, and other foundation models, Fine-tuning, prompt engineering, zero/few-shot learning, Case studies: Chatbots, Code generation, Content creation

Module V: Diffusion Models [7L]

De noising Diffusion Probabilistic Models (DDPMs), Stable Diffusion, Imagen, DALL•E, Text-to-Image and Text-to-Video synthesis, Comparisons with GANs and VAEs.

Module VI: Applications and Future Directions [8L]

Applications: Healthcare, Finance, Entertainment, Smart Agriculture, Generative AI in multimodal systems, Hybrid Quantum-Classical Generative Models (overview), Security, Privacy, and Responsible AI

Text Books:

1. Goodfellow I., Bengio Y., Courville A. – Deep Learning, MIT Press.
2. Goodfellow I., Pouget-Abadie J. – Generative Adversarial Networks (GANs), NIPS Tutorial.
3. Vaswani A. et al. – Attention is All You Need, NeurIPS.

Reference Books

4. David Foster – Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, O'Reilly.
5. Palash Goyal, Sumit Pandey, Karan Jain – Deep Learning for Natural Language Processing, Apress.
6. Philipp Singer – Diffusion Models in AI, Springer.

Course Name: Machine Learning

Course Code: MCAE305A

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites: Foundational knowledge in Mathematics -Linear Algebra, Probability, and Statistics

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

O1: To apply the algorithms to a real-world problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Course Outcome:

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

CO1	Understand the basic concepts of machine learning, supervised, unsupervised, regression analysis, and machine learning algorithms.
CO2	Apply the learned concepts of machine learning to interpret various problems
CO3	Analyze the different mathematical machine learning models for various systems
CO4	Evaluate the machine learning models with respect to the performance parameters
CO5	Design and implement various machine learning algorithms in the range of real world problems

CO-POMapping:

	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 to Machine Learning [2L]

Types of human learning, What is machine learning?, Types of machine learning– supervised, unsupervised, semi-supervised and reinforcement learning, machine learning activities, applications of machine learning.

Module II: Linear Algebra [3L]

Scalar, Vector, Matrix, Matrix Operation, Norms, Probability, Joint Distribution, Bayes Theorem, Expectation, Covariance.

Module III: Supervised Learning - Regression & Classification [14L]

Introduction of regression, Regression algorithms: Simple linear regression, multiple linear regressions, Polynomial regression model, gradient decent algorithm, Logistic regression, Maximum likelihood estimation. Introduction of supervised learning, Classification model and learning steps, Classification algorithms: Naïve Bayes classifier, k-Nearest Neighbour (kNN), Decision tree, picking the best splitting attribute: entropy and information gain. Support vector machines, Random forest.

Module IV: Unsupervised Learning: **[7L]**

Introduction of unsupervised learning, unsupervised vs supervised learning, Application of unsupervised learning, Clustering and its types, Partitioning method: k-Means and K-Medoids, Hierarchical Agglomerative Clustering, Density-based methods – DBSCAN.

Module V: Artificial Neural Network: **[6L]**

Biological neuron, artificial neuron, Activation functions, Architectures of neural network, Perceptron, Learning process in ANN, Back propagation.

Module VI: Dimensionality Reduction [4L]

Principal component Analysis (PCA), Linear Discriminant Analysis (LDA), Feature selection, Feature manipulation and normalization.

Text Books:

1. Machine Learning, Rajiv Chopra, Khanna Publishing
2. Introduction to Machine Learning, Jeeva Jose, AICTE Recommended

Reference Books

3. Tom M. Mitchell, “Machine Learning”, McGraw-Hill,

4. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press,

Course Name: Data Warehousing and Data Mining

Course Code: MCAE305B

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites:

Course Objectives The objectives of this course are to:

Introduce the concepts of data warehousing and OLAP. Provide an understanding of data mining methods and algorithms. Apply data mining techniques to classification, clustering, and prediction problems. Analyze time-series patterns and web data for real-world applications. Familiarize students with frameworks for big data and distributed data mining.

Course Outcomes (COs)

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

CO1: Explain the concepts, architecture, and tools of data warehousing.

CO2: Apply OLAP models and tools for multidimensional data analysis.

CO3: Implement classification, clustering, and prediction techniques for real datasets.

CO4: Analyze sequential and temporal patterns including time-series data.

CO5: Extend mining algorithms for web data and big data environments.

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

CO5	2	3	2	2	-	-	-	-	-	-	2	1	2	3	1

Course Contents

Module 1: Introduction to Data Warehousing (6L)

Need for data warehousing, Operational vs. informational data stores, Architecture, characteristics, and database design, ETL process (sourcing, acquisition, cleanup, transformation), Metadata, access tools, and data marts, Data warehousing administration and management.

Module 2: Online Analytical Processing (OLAP) (4L)

Importance of OLAP in business decision making, Multidimensional data model and OLAP guidelines, Multidimensional vs. multi-relational OLAP, Types and categorization of OLAP tools, Web-based OLAP applications.

Module 3: Introduction to Data Mining (6L)

Motivation and scope of data mining, Data mining effectiveness and integration with business processes, Decision trees: concepts, algorithms, and applications, Role of decision trees in business scorecards.

Module 4: Classification and Prediction (5L)

Cluster analysis: types of data, partitioning and hierarchical methods, Frequent pattern mining (transactional and temporal-based), Prediction models for business and scientific data.

Module 5: Time-Series Analysis (4L)

Characteristics of time-series data, Periodicity and trend analysis, Similarity search in time-series data.

Module 6: Web Mining (5L)

Web content, structure, and usage mining, Mining multimedia and web documents, Automatic classification of web pages, Distributed and big data mining approaches.

Text Books

1. Berson, A., & Smith, S. J. (2003). *Data Warehousing, Data Mining and OLAP*. Tata McGraw Hill.
2. Ponniah, P. (2009). *Data Warehousing Fundamentals for IT Professionals* (2nd ed.). Wiley India.

Reference Books

3. Parida, R. (2006). *Principles and Implementation of Data Warehousing.* Lakshmi Publications

Course Name: Introduction to Big Data Analytics

Course Code: MCAE305C

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Basic knowledge in data storage and retrieval, Knowledge in Quantitative Aptitude and Statistics, Proficiency in Algorithms and Computer Programming Skills.

Course Objectives: Know the fundamental concepts of big data and analytics, explore tools and practices for working with big data, learn about stream computing.

Course Outcome:

After completion of this course student will be able to

CO1 Understand basic concepts and requirements of big data analytics

CO2 Apply the concept of big data analytics to handle huge dataset

CO3 Analyze big data with different available algorithm and theorem

CO4 Design and develop different analytical solution organizing huge dataset

CO-PO Mapping:

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

Course Contents:

Module I: Introduction to Big Data [10L]

Evolution of Big data - Best Practices for Big data Analytics - Big data characteristics -Validating - The Promotion of the Value of Big Data - Big Data Use Cases- Characteristics of Big Data Applications - Perception and Quantification of Value -Understanding Big Data Storage - A General Overview of High-Performance Architecture - HDFS - MapReduce and YARN - Map Reduce Programming Model

Module II: Clustering and Classification [10L]

Advanced Analytical Theory and Methods: Overview of Clustering - K-means - Use Cases - Overview of the Method - Determining the Number of Clusters - Diagnostics - Reasons to Choose and Cautions .- Classification: Decision Trees - Overview of a Decision Tree - The General Algorithm - Decision Tree Algorithms - Evaluating a Decision Tree - Decision Trees in R - Naïve Bayes - Bayes‘ Theorem - Naïve Bayes Classifier.

Module III: Association and Recommendation System [6L]

Advanced Analytical Theory and Methods: Association Rules - Overview - Apriori Algorithm - Evaluation of Candidate Rules - Applications of Association Rules - Finding Association & finding similarity - Recommendation System: Collaborative Recommendation- Content Based Recommendation - Knowledge Based Recommendation- Hybrid Recommendation Approaches.

Module IV: Stream Memory [7L]

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing, Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating moments – Counting oneness in a Window – Decaying Window – Real time Analytics Platform(RTAP) applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions. Using Graph Analytics for Big Data: Graph Analytics

Module V: Nosql Data Management for Big Data and Visualization [7L]

NoSQL Databases: Schema-less Models‖: Increasing Flexibility for Data Manipulation-Key Value Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases Hive - Sharding – Hbase – Analyzing big data with twitter - Big data for E-Commerce Big data for blogs - Review of Basic Data Analytic Methods using R.

Text Books:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge

University Press.

2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with

Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/Elsevier Publishers.

Reference Books

3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing,

Visualizing and Presenting Data", Wiley publishers.

4. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its

Applications", Wiley Publishers.

Course Name: Cryptography

Course Code: MCAE305D

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisite:

Discrete Mathematics, Computer Networking,

Course Objective:

The objective of the course is to study the about how to maintain the Confidentiality, Integrity and Availability and Authenticity of the data over insecure channel by various means and to understand various protocols for network security to protect against the threats in the networks.

Course Outcome

After completion of this course students will be able to

CO1: Identify computer and network security threats, classify the threats, and understand different technique of cryptography and security.

CO2: Analyze existing cryptographic algorithm, authentication, and key agreement protocols, identify the strength and weaknesses of existing algorithm

CO3: Apply different algorithm and technique of encryption and decryption method over information and security techniques to the existing computer and network platforms.

CO4: Design and develop cryptography algorithm and network technique security product or code, investigate the strong and weak points of the product or code.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction [4L]

Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.

Module 2: Cryptography [7L]

Cryptography: Concepts & Techniques Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, and Symmetric & Asymmetric key Cryptography, Key Range & Key Size.

Module 3: Symmetric Key Algorithm [8L]

Symmetric Key Algorithm: Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES (Data Encryption Standard) algorithm, IDEA (International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm

Module 4: Asymmetric Key Algorithm [5L]

Asymmetric Key Algorithm, Digital Signature and RSA Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).

Module 5: Internet Security Protocols [5L]

Internet Security Protocols, User Authentication Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.

Module 6: Electronic Mail Security [4L]

Electronic Mail Security Basics of mail security, Pretty Good Privacy, S/MIME

Module 7: Firewall Introduction [3L]

Firewall Introduction, Types of firewalls, Firewall Configurations.

Text books:

1. Cryptography and Network Security, William Stallings, 2nd Edition, Pearson Education Asia
2. Network Security private communication in a public world, C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.

Reference books:

4. Network Security Essentials: Applications and Standards by William Stallings, Pearson
5. Designing Network Security, Merike Kaeo, 2nd Edition, Pearson Books
6. Building Internet Firewalls, Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition
7. Practical Unix & Internet Security, Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly .

Course Name: Operation Research and Optimization Techniques

Course Code: MCAE305E

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Basic knowledge of Linear Algebra, Calculus, and Fundamentals of Probability & Statistics.

Course Objectives:

To provide fundamental knowledge of optimization techniques for solving linear and nonlinear programming problems. To develop analytical and problem-solving skills in modeling and solving real-life decision-making problems using LPP, TP, AP, and Game Theory. To equip students with mathematical tools and techniques to analyze, design, and optimize systems for effective resource utilization.

Course Outcome:

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

CO1: **Formulate and solve Linear Programming Problems using graphical and simplex methods, including duality concepts.**
CO2: **Analyze and solve Transportation and Assignment Problems using appropriate algorithms for optimal solutions.**
CO3: **Apply principles of Game Theory to solve two-person zero-sum games using pure and mixed strategies.**
CO4: **Solve Nonlinear Programming Problems using Lagrange multipliers, Kuhn–Tucker conditions, and optimization techniques.**

CO-PO Mapping:

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

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

Course Contents:

Module 1: Linear Programming Problem (LPP)-I[8L]

Formulation of an LPP, Graphical Method of solution of an LPP, Convex Combination and Convex Set, Convex Hull and Convex Polyhedron, Canonical and Standard form of an LPP, Basic Solution of a system of linear equations, Simplex Method, Big-M Method, Concept of Duality, Mathematical formulation of duals.

Module 2: Linear Programming Problem (LPP) – II [8L]

Transportation Problems (TP), Representation of Transportation Problems as LPP, Methods of finding initial basic feasible solution of TP: North-West Corner Rule, Matrix Minima Method, Vogel's Approximation Method, Optimality test of the basic feasible solution, Assignment Problems, Hungarian Method.

Module 3: Game Theory [7L]

Introduction, Strategies, The Minimax and Maximin Criterion, Existence of Saddle Point, Two person zero-sum Games, Games with Saddle Point – Pure Strategies, Games without a Saddle Point – Mixed Strategies, Symmetric Games, Dominance Principle, Graphical Method of Solution, Algebraic Method of Solution.

Module 4: Non-Linear Programming Problem (NLPP) [7L]

Single-variable Optimization, Multivariate Optimization with no constraints: Semidefinite Case, Saddle Point, Multivariate Optimization with Equality Constraints: Method of Lagrange Multipliers, Multivariable Optimization with inequality constraints: Kuhn-Tucker Conditions.

Text Books:

1. Linear Programming and Game Theory by J. G. Chakraborty and P. R. Ghosh, Moulik Library.
2. Operations Research by KantiSwarup, P. K. Gupta and Man Mohan, S. Chand and Sons

Reference Books

3. Engineering Optimization by S. S. Rao, New Age Techno Press.

4. Operations Research by J K Sharma, Macmillan India Ltd

Course Name: Pattern Recognition

Course Code: MCAE305F

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Pre requisites: Fundamentals of probability and linear algebra

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

O1: To learn the fundamentals of pattern recognition and its relevance to classical and modern problems.

O2: To identify where, when and how pattern recognition can be applied.

Course Outcome:

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

CO1 Understand the basic concepts of pattern recognition theories, such as Bayes classifier, linear discriminant analysis.

CO2 Recall about state-of-the-art algorithms used in pattern recognition research.

CO3 Analyze images and make automatic decisions based on extracted feature information.

CO4 Formulate various applications in pattern recognition.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1		-	-	-	-	-	-	-	-	-	1	1	2	3	1

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

Course Contents:

Module I: Introduction to Pattern Recognition [6L]

Importance of Pattern Recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi-Supervised Learning.

Module II: Classifiers Based on Bayes Decision Theory [12L]

Introduction, Bayes Decision Theory: Minimizing the Classification Error Probability, Minimizing the Average Risk, Discriminant Functions and Decision Surfaces, Bayesian Classification for Normal Distributions: The Gaussian Probability Density Function, The Bayesian Classifier for Normally Distributed Classes, Decision Hyper planes, Minimum Distance Classifiers, Estimation of Unknown Probability Density Functions: Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability Estimation, Bayesian Inference, Maximum Entropy Estimation, Mixture Models, Expectation Maximization (EM) Algorithm, Application to the Mixture Modeling Problem, Nonparametric Estimation, The Naive-Bayes Classifier, The Nearest Neighbor Rule, Bayesian Networks, Problems.

Module III: Linear Classifiers [11L]

Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm: Proof of the Perceptron Algorithm Convergence, Variants of the Perceptron Algorithm, The Perceptron, The Pocket Algorithm, Kesler's Construction, Least Squares Methods: Mean Square Error Estimation, Multiclass Generalization, Stochastic Approximation and the LMS Algorithm, Sum of Error Squares Estimation, Mean Square Estimation Revisited: Mean Square Error Regression, MSE Estimates Posterior Class Probabilities, The Bias–Variance Dilemma, Logistic Discrimination, Support Vector Machines: Separable Classes, Nonseparable Classes, The Multiclass Case, v-SVM, Support Vector Machines: A Geometric Viewpoint, Reduced Convex Hulls, Problems.

Module IV: Feature Selection [11L]

Introduction, Preprocessing: Outlier Removal, Data Normalization, Missing Data, The Peaking Phenomenon, Feature Selection Based on Statistical Hypothesis Testing: Hypothesis Testing

Basics- The Known Variance Case, The Unknown Variance Case, Application of the t-Test in Feature Selection. The Receiver Operating Characteristics (ROC) Curve, Class Separability Measures, Divergence, Chernoff Bound and Bhattacharyya Distance, Scatter Matrices, Feature Subset Selection: Scalar Feature Selection, Feature Vector Selection, Suboptimal Searching Techniques, Optimal Feature Generation, Neural Networks and Feature Generation/Selection, Support Vector Machines: A Last Touch, The Bayesian Information Criterion.

Text Books:

1. Pattern Recognition, S.Theodoridis and K.Koutroumbas, 4th Ed., Academic Press, 2009.

Reference Books

2. Pattern Recognition and Machine Learning, C.M.Bishop, Springer, 2006.
3. Pattern Classification, R.O.Duda, P.E.Hart and D.G.Stork, John Wiley, 2001.

Course Name: Information Retrieval

Course Code: MCAE305G

Contact: (3:0:0)

Total Contact Hours: 40

Credit: 3

Prerequisites:

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

O1: Learn how to write code that can index and retrieve text, and how to evaluate systems that can do this. Learn how to look at text and semi-structured data sets. Learn how to judge information retrieval systems and how to use a text similarity measure. Knowing about search engines, Classifying Text.

Course Outcome:

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

CO1 Interpret open-source search engine framework and explore its capabilities

CO2 Apply appropriate method of classification or clustering.

CO3 Design and implement innovative features in a search engine.

CO4 Design and implement a recommender system.

CO5 Demonstrate an open-source search engine framework and explore its capabilities

CO6 Demonstrate the entire process flow of a search engine

CO-POMapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	--	2	2	2	2	2	2	1	1	1	1
CO2	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
CO3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
CO5	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
CO6	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2

Course Contents:

Module 1: Overview of text retrieval systems (5L)

Boolean retrieval. The term vocabulary and postings list. Dictionaries and tolerant retrieval. Index construction and compression.

Module 2: Retrieval models and implementation: Vector Space Models (4L)

Vector Space Model. TF-IDF Weight. Evaluation in information retrieval.

Module 3: Query expansion and feedback (5L)

Relevance feedback, pseudo relevance feedback, Query Reformulation.

Module 4: Probabilistic models; statistical language models (8L)

Okapi/BM25, Language models, KL-divergence, Smoothing.

Module 5: Text classification & Text clustering (9L)

The text classification problem, Naive Bayes text classification, k- nearest neighbors, Support vector Machine, Feature Selection, Vector-space clustering, K-means algorithm, Hierarchical clustering, DBSCAN algorithm, PAM and PAMK, EM algorithm.

Module 6: Web search basics, crawling, indexes, Link analysis (5L)

Web Characteristic, Crawling, Web As a graph, Page Rank, Hubs and Authorities.

Module 7: IR applications (4L)

Information extraction, Question answering, Opinion summarization, Social Network.

Text Books:

1.Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. http://nlp.stanford.edu/IR-book/information-retrieval-book.html

2.ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008.

Reference Books

1. http://www.morganclaypool.com/doi/abs/10.2200/S00158ED1V01Y200811HLT 001

Course Name: Object Oriented Programming with JAVA Lab

Course Code: MCAE393

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Prerequisites: Logic of programming language, Basic concepts of object-oriented concepts

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

To understand how to design, implement, test, debug, and document programs that use basic data types and computation, simple I/O, conditional and control structures, string handling, functions and object oriented approaches.

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

CO1	Define classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.
CO2	Illustrate object oriented modelling techniques like classes and Instances modelling techniques
CO3	Interpret fundamentals of object-oriented programming in Java, including defining Classes, invoking methods, using class libraries, etc.
CO4	Construct programming solutions with exception handling and multi-threading concept
CO5	Solve GUI program with proper event handling techniques.

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: Java Basics: [10L]

Simple Java programming using operators, control statements & loops, array.
Programming on class, object, and method, access specifier.
Programming on constructor, method/constructor overloading.
Programming on this keyword, call by value & call by reference, static variables & methods, inner classes.

Module II: Basic String handling & I/O: [10L]

Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(),toUpperCase(), trim(), valueOf() methods. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(),delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(),setLength(), substring(), toString() methods. Programming on Command line arguments. Programming using keyboard input by implementing BufferedReader& Scanner classes.

Module III: Inheritance, Interface and Java Packages: [10L]

Programming on Simple Inheritance, super and final keywords, super() method.
Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface.
Programming on importing system package, creating user-defined package, importing userdefinedpackage, using protected access specifier, subclassing an imported class of a package,using same names for classes of different packages, adding multiple public classes to a package.

Module IV: Exception handling, Multithreading [10L]

Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception.
Programming on creating child threads i) by extending thread class ii) by implementing runnableinterface, creating child threads by assigning thread priorities.
Programming on creating simple applet to display some message, creating applet two add 2integers, creating applet to do GUI based programming.

Text Books:

1. Java Fundamentals - A Comprehensive Introduction, Daleskrien, Herbert Schildt, Mcgraw-Hill Education.

Reference Books

4. Java For Programmers, Paul Deitel And Harvey Deitel, Pearson Education.
5. Thinking In Java, Bruce Eckel, Pearson Education

Course Name: Basic Data Science Lab

Course Code: MCAE394A

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Pre requisites: Fundamental concept of Statistics. Python programming language

Course Objectives:

The objectives of the course are to make the students able to:

Understand fundamental knowledge of Data Science. Utilize fundamental concepts of statistics in data science problems. Determine the equation of the trend line to forecast outcomes for time periods in future. Utilize machine learning models for scientific applications.

Course Outcome:

After completion of this course successfully the students will be able to:

CO1 Learn the key difference between various areas of data science.

CO2 Understand the fundamental concepts of tools and techniques available in data science. Realize the basic trends in two variable plots of numerical data.

CO3 Build the fundamental algorithms available in Artificial Intelligence. Perform the quantitative and qualitative analysis of the data.

CO4 Use a computer to develop a regression analysis, and interpret the output that is associated with it.

CO5 Implement the key algorithms available in data mining and machine learning.

CO-PO Mapping:

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

Course Contents:

Module I: Introduction to Python [4L]

Introduction to Python Libraries - Numpy, Pandas, Matplotlib, Scikit. Perform Data exploration and preprocessing in Python.

Module II: Implementation of Descriptive Statistics [8L]

Read the datasets(.txt, .xlsx, .csv) from the local system. Make numerical summery(descriptive statistics) of data. Apply various measures- range, interquartile range, mean absolute deviation, variance, and standard deviation.

Module III: Data Visualization [12L]

Make graphical summery (bar chart, histogram, scatter plot, pie plot, box plot) of data. Group multiple charts through subplot. Detect the outliers (if exists), impute the outliers using suitable methods.

Module IV: Implementation of Regression [4L]

Implement simple linear regression with suitable datasets, Implement the multivariate regression with suitable datasets and present the outputs. Implement the logistic regression using suitable datasets.

Module V: Building Models using different techniques [4L]

Build models using different Assembling techniques, Build models using Decision trees.

Module VI: Building model to perform Classification [4L]

Implement K-NN algorithm and weighted kNN to classify a dataset.

Module VII: Building model to perform Clustering [4L]

Build model to perform Clustering using K-means and determining the value of K.

Text Books

1. Rachel Schutt, Cathy O' Neil, "Doing Data Science : Straight Talk from the Frontline " by Schroff / O ' Reilly,2013.
2. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight " by John Wiley & Sons, 2013.

Reference Books

3. Ian Ayres, "Super Crunchers: Why Thinking-by-Numbers Is the New Way to Be Smart" Ist Edition by Bantam,2007.
4. Eric Seigel, "Predictive Analytics: The Power to Predict who Will Click, Buy, Lie, or Die", 1 st Edition, by Wiley, 2013.

Course Name: Image Processing Lab

Course Code: MCAE394B

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Prerequisite:

Knowledge on Computer Programming.

Course Objective:

The aim of this course is to familiarize the students in the regular Image Processing Software with respect to basic processing required to generate thematic maps from different sources of images..

Course Outcome

After completion of this course students will be able to

CO1: Apply enhancing operations on the image using spatial filters and frequency domain filters

CO2: Analyse the characteristics of the image using different transformation techniques.

CO3: Estimate the efficiency of the compression techniques on the images.

CO4: Implement different segmentation operations of images.

CO-PO Mapping:

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

Course Contents:

Simulation using MATLAB/ Python

1. Image sampling and quantization
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Different types of Transforms
6. Histogram Processing
7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection.
10. Region based Segmentation
11. Analysis of images with different color models.
12. Image compression techniques
13. Image restoration
14. A mini project based on medical image processing

Text books:

1. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2004.

Reference books:

2. Sandipan Dey. Python Image Processing Cookbook, Packt Publishing

Course Name: Cloud Computing Lab

Course Code: MCAE394C

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Prerequisite:

Networking, Operating System, Web Technology.

Course Objective:

The objective of the course is to learn and apply the concept of cloud computing in real world application

Course Outcome

After completion of this course students will be able to

CO1: Apply the concept to solve practical application

CO2: Analyzing different service in cloud computing

CO3: Evaluate different available service with Amazon and Azure

CO4: Design Cloud based application

CO-PO Mapping:

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

CO1	2	3	-		-	-	-	-	-	-	2	1	2	1	1
CO2	3	3	3	2	2	-	-	-	-	-	3	2	3	1	1
CO3	3	3	3	2	3	-	-	-	-	-	3	2	2	1	1
CO4	3	3	3	4	2	-	-	-	-	-	3	2	3	1	1
CO5	2	3	-		-	-	-	-	-	-	2	2	2	1	1

Course Contents:

Module 1: Virtual Machine

Creation of vpc, vnet, virtual machine, Private and Public IP configuration

Module 2: Application Development

Implementation of SOAP Web services in JAVA Applications.

Use Azure to launch the web applications. Test Simple Application

Module 3: Security

Identity and access management, Multifactor Authentication.

Module 4: Bot and AI service

Test AWS and AZURE Bot and AI services

Text books:

1. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, LeeGillam, Springer, 2012

Reference books:

2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg,Andrzej M. Goscinski, Wile, 2011
3. https://aws.amazon.com/
4. https://azure.microsoft.com/en-us/

Course Name: Web Technology Lab

Course Code: MCAE394D

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Pre requisites: Logic of programming language, basics of HTML and CSS

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

O1: Know how to write programs in HTML forms using JavaScript.

O2: Know HTML forms are created with CSS, Bootstrap.

O3: Know strategy to connect with MYSQL Server and use PHP Server.

Course Outcome:

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

CO1 Understand the underlying assumption of defining variables, constants, operators, expressions, HTML Form creation and submissions. POST & GET Method & Implementation of Decision, Loops, Functions, Array and Exception Handling concepts.

CO2 How HTML forms are created with CSS, Bootstrap.

CO3 Strategy to connect with MYSQL Server.

CO4 Ability to check validation using JavaScript & JQuery.

CO5 Connecting forms with MYSQL Server and use PHP Server.

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 to Web Technologies: [4L]

- Overview of Internet, WWW, Client-Server architecture. Basic structure of HTML document. Defining variables, constants, operators, expressions in JavaScript. HTML Forms: input types, attributes, form controls (text, password, radio, checkbox, select, textarea, button, file upload). Form submission using GET & POST methods.

Module II: HTML Forms with CSS and Bootstrap [10L]

Introduction to CSS: selectors, properties, positioning, box model. Styling forms using internal, external and inline CSS. Introduction to Bootstrap framework. Bootstrap Grid System and Components for form design. Creating responsive web forms with Bootstrap.

Module III: JavaScript for Client-Side Scripting [6L]

Decision-making and looping constructs in JavaScript. Functions, arrays, objects, and exception handling. DOM manipulation and event handling. Client-side form validation using JavaScript. Introduction to jQuery for form validation and effects.

Module IV: PHP for Server-Side Programming [8L]

Introduction to PHP: syntax, variables, data types, operators. Control structures: decision-making and looping. Functions, arrays, string handling, and file handling. Working with forms in PHP: capturing and processing form data.

Module V: Database Connectivity with MySQL [7L]

Introduction to MySQL: database, tables, primary key, foreign key. Basic SQL operations: SELECT, INSERT, UPDATE, DELETE. Connecting PHP with MySQL using mysqli and PDO. Executing queries and fetching results. Building web applications with PHP and MySQL integration.

Module VI: Mini Project [5L]

End-to-End mini project: Student Registration / Feedback System / Login-Authentication System

Text Books:

5. Jon Duckett, *"HTML & CSS: Design and Build Websites"*, Wiley.

6. Robin Nixon, *"Learning PHP, MySQL & JavaScript"*, O'Reilly.

Reference Books

7. Uttam K. Roy, *"Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML and AJAX"*, Oxford University Press.
8. Luke Welling and Laura Thomson, *"PHP and MySQL Web Development"*, Addison-Wesley.
9. Paul Deitel, Harvey Deitel, Abbey Deitel, *"Internet & World Wide Web: How to Program"*, Pearson.

Course Name: Android Application Development Lab

Course Code: MCAE394E

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Prerequisites: Basic understanding of programming logic, data structures, and algorithms.

CourseObjectives: The objectives of this lab are to enable students to design, develop, and deploy Android applications by applying programming logic, data structures, and mobile app development concepts.

O1: To develop a clear conceptual understanding of mobile database management (SQLite, Firebase, etc.) and apply it for solving real-world industry problems through Android applications.

Course Outcome: On successful completion of the course, students will be able to design, develop, and deploy functional Android applications by applying programming, database, and mobile development concepts :

CO1	Understand the fundamentals of Android architecture, application components, and development environment.
CO2	Design user interfaces using XML layouts, Views, and apply event-driven programming concepts.
CO3	Develop Android applications with effective use of activities, intents, fragments, and services.
CO4	Integrate mobile databases (SQLite, Firebase, etc.) for efficient data storage, retrieval, and management.

CO5	Build and deploy Android applications that incorporate UI design, database handling, and essential mobile features to solve real-world problems.

CO-PO Mapping:

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

Course Contents:

Module 1: Writing First Application [6L]

Creating Android Project, Android Virtual Device Creation, Setup debugging environment,Workspace setup for development, Launching emulator,debugging on mobile devices.

Module 2: Basic UI design [4L]

Basics about Views, Layouts, Resources,Input controls,Input Events,Toasts.

Module 3: More UI Design[7L]

Layouts design Grid View and List View ,Action bar, Adapters, Menus: Option menu, context menu, sub menu, Pickers - Date and Time, Spinners.

Module 4: Activity and Fragment[4L]

Activity, Fragment, Activity Life cycle and Fragment Lifecycle.

Module 5: Intents [4L]

Implicit Intents, Explicit intents, communicating data among Activities.

Module 6: Navigation Drawer[5L]

Panel that displays the app's main navigation screens on the left edge of the screen

Module 7: Android Notifications [5L]

Toast, Dialogs(TimePicker,DatePicker, Progress, Alert),Notification Manager and Push Notification

Module 8: Introducing SQLite [5L]

SQLite Open Helper and creating a database-Opening and closing a database,Working with cursors Inserts, updates,and deletes

Text Book

1. Android App Development For Dummies by Michael Burton

2. The Busy Coder's Guide to Android Development by Mark L. Murphy

References Book

3. Kotlin for Android Developers by Antonio Leiva

4. Android Programming: The Big Nerd Ranch Guide" by Bill Phillips, Chris Stewart, and Kristin Marsicno

Course Name: Web Enabled JAVA Programming Lab

Course Code: MCAE394F

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Pre requisites: Basic knowledge on Java and computer networking and database.

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

O1: Describe the web application architecture and protocols; Illustrating different technologies those are used to develop web applications;

O2: Describe different frameworks those used to develop web applications.

Course Outcome:

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

CO1	Apply the concept of web technology in designing solution
CO2	Analyze different features of web technology for best sutiable solution providing
CO3	Evaluate different web application solution applying the concept of different front end and back end technologies
CO4	Create web application solution for different problems

CO-PO Mapping:

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

Course Contents:

HTML Developing application using different HTML elements, designing forms using HTML, Apply DOM CSS Using different CSS Styles for designing interactive forms and interfaces. Java Script Using Java script variables, operators, control structure, functions and event handling, Form validation using java script, Node js server implementation, express js for implementing web application handling get, put, post, etc.

JDBC Connecting to databases using jdbc:odbc bridge and Type-4 drivers, Batch execution, Stored Procedure Servlet Developing web application using servlet: get/post, Developing filter application, Session handling. JSP Developing web application using JSP as view, Session handling using JSP, Using JSP components, Custom tag development.

AJAX Developing web application using AJAX: accessing XML, text files. Web Service Development web service as reusable components Innovative Experiments. Develop some innovative experiments.

Text books:

1. Professional Java Server Programming Allamaraju.

Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. A kilandeswari, PHI Learning, Delhi, 2013.
2. Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Kogent Learning Solutions INC.

Course Name: Generative AI Lab

Course Code: MCAE394G

Contact: (0:0:4)

Total Contact Hours: 40

Credit: 2

Pre requisites: Basics of Machine Learning, Programming in Python

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

O1: To develop conceptual understanding of the theoretical foundations of generative models.

O2: Learn various architectures of generative AI including GANs, VAEs, Transformers, and Diffusion Models.

O3: Implement generative models using modern deep learning frameworks.

O4: Explore applications of generative AI across domains such as NLP, computer vision, and healthcare.

O5: Critically analyze ethical, social, and security challenges in generative AI deployment.

Course Outcome:

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

CO1 Explain the fundamentals of generative models and their mathematical foundations.

CO2 Compare and analyze architectures such as VAE, GAN, Transformer, and Diffusion models.

CO3 Apply generative models for tasks such as text generation, image synthesis, and data augmentation.

CO4 Evaluate generative models using metrics like FID, BLEU, and perplexity.

CO5 Assess ethical issues, biases, and responsible AI practices in generative systems.

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	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	-	2
CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	-	3
CO5	2	3	2	1	-	-	-	-	-	-	-	3	2	-	2

Course Contents:

Module 1: Introduction and Statistics I (Statistical Distribution Concepts and Requirements for Generative AI)

Module 2: Statistics II (Statistical Distribution Comparison Methods and Challenges

Module 3: Characteristics of Linear versus Non-linear Models.

Module 4: Mathematical Concepts for Optimization (Gradient, Jacobian, Hessian, and Taylor Series).

Module 5: Review the basics of Neural Networks (MLP, Activation Functions, Backpropagation, Cost Functions)

Module 6: Review of Convolutional Neural Networks and Recurrent Neural Networks

Module 7: Review of Seq2Seq, Attention Mechanisms, Positional Encoding, Transformer Architecture.

Module 8: Representation Learning Concepts, Self-Organized Maps, Boltzmann Machine, Restricted Boltzmann Machine

Module 9: Autoencoders, Generative Adversarial Networks, GAN challenges, GAN Models

Module 10: Large Language Models I (BERT models, GPT models, Post ChatGPT models)

Module 11: Large Language Models II (Prompt engineering methods, NLP evaluations, LLM, RAG)

Module 12: Text-to-Image Models

Module 13: Neural Radiance Field, 3D Gaussian Splatting

Module 14: Neural Network Regularization and Compression Approaches (Quantization, Compression, Pruning, Low- Rank Adaptation)

Text Books:

1. Goodfellow I., Bengio Y., Courville A. – Deep Learning, MIT Press.
2. Goodfellow I., Pouget-Abadie J. – Generative Adversarial Networks (GANs), NIPS Tutorial.
3. Vaswani A. et al. – Attention is All You Need, NeurIPS.

Reference Books

4. An Introduction to Statistical Learning: with Applications in R (James et al.)
5. Dive into Deep Learning (Zhang et al.)
6. Some chapters of the instructor's ongoing book: https://github.com/Rezar/MLBook

2nd Year 4th Semester									
Sl. No.	Broad Category	Category	Paper Code	Subject	Contact Hours/ Week				Credit Points
					L	T	P	Total	
A. THEORY									
1	ENGG	Core	MCA401	Design and Analysis of Algorithm	3	1	0	4	4
2	VAC(OE)	Minor	MCAO401A	Deep Learning	3	0	0	3	3
			MCAO401B	Bioinformatics					
			MCAO401C	Information Theory & Coding					
			MCAO401D	Blockchain Technology					
			MCAO401E	Intelligent Control					
			MCAO401F	Design of Embedded Systems					
			MCAO401G	Business Analytics					
			MCAO401H	Robotics					
			MCAO401I	Multimedia					
			MCAO401J	Distributed System					
			MCAO401K	Big Data Analytics					
			MCAO401L	Social Networks					
B. PRACTICAL									
1	PRJ	PROJECT	MCA481	Major Project Dissertation	0	0	12	12	12
2	PRJ	PROJECT	MCA482	Major Project Viva-voce	0	0	4	4	4
3	PRJ	Skill Enhancement Course (SEC)	MCA483	Grand Viva	0	0	2	2	2
C. MANDATORY ACTIVITIES / COURSES									
Total of Theory, Practical								**25**	**25**

Course Name: Design and Analysis of Algorithm
Course Code: MCA401
Contact: (3:1:0)
Total Contact Hours: 40
Credit: 4

Pre requisites: A solid understanding of basic programming concepts (preferably in C/C++/Java/Python). Knowledge of data structures, including arrays, linked lists, stacks, queues, trees, and graphs. Familiarity with mathematical foundations such as discrete mathematics, logic, and basic combinatorics. Understanding of complexity concepts like time and space efficiency at an elementary level. Problem-solving skills and the ability to analyze programs for correctness.

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

To understand the running times of algorithms based on asymptotic analysis and justify the correctness of algorithms. To understand and implement the greedy paradigm for a given problem. To learn the implementation of Back Tracking and Branch-&-Bound problem.

Course Outcome:

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

CO1	Understand and analyze the running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
CO2	Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it.
CO3	Understand and implement the greedy paradigm for a given problem.
CO4	Design the dynamic programming paradigm and implement it.
CO5	Understand and implement the Back Tracking and Branch-&-Bound problem.
CO6	Explain the ways to analyze randomized algorithms (expected running time, probability of error).

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
CO6	3	3	2	2	–	–	–	–	–	–	–	3	3	–	3

Course Contents:

Module I: Introduction: [8L]

Characteristics of the algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module II: Divide-&-Conquer and Greedy Method [8L]

Divide & Conquer: General Method, Finding maximum and minimum, Merge sort, Quicksort, Selection, Strassen's matrix multiplication.

Greedy Method: General Method, knapsack problem, Tree vertex splitting, Job sequencing with deadlines, optimal storage on tapes.

Module III: Dynamic Programming [8L]

Multistage graphs, all-pairs shortest paths, single-source shortest paths.

String Editing: 0/1 knapsack. Search techniques for graphs: DFS-BFS-connected components, biconnected components.

Module IV: Back Tracking and Branch-&-Bound [8L]

Back Tracking: 8-queens, Sum of subsets, Graph Coloring, Hamiltonian cycles. Branch and Bound: Traveling Salesperson problem.

Module V: Lower Bound Theory [8L]

Comparison trees, Oracles and advisory arguments, Lower bounds through reduction, Basic Concepts of P-NP, NP-Hard and NP-Complete problems.

Text Books:

1. E. Horowitz, S. Sahni and S. Rajasekaran, 2008, Computer Algorithms, Second Edition, Universities Press, India.
2. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 4th Edition, MIT Press/McGraw-Hill.

Reference Books

1. A.V. Aho, J.E. Hopcroft, J.D. Ullmann, 1974, The Design and Analysis of Computer Algorithms, Addison Wesley, Boston.

The Art of Computer Programming: Fundamental Algorithms v. 1: Volume 3 by Donald E. Knuth.

Course Name: Deep Learning
Course Code: MCAO402A
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisite:

Linear Algebra, Machine Learning

Course Objective:

The objective of the course is to present an introduction to deep learning systems, with an emphasis on introducing major deep learning algorithms, the problem settings, and their applications to solve real world problems.

Course Outcome:

After completion of this course student will be able to

CO1	Understand the basics of Machine Learning & Deep Learning techniques that make it useful to real-world problems.
CO2	Apply Deep learning algorithms such as supervised, semi-supervised, and unsupervised.
CO3	Analyze various Deep learning techniques to investigate real world applications.
CO4	Evaluate and create model for finding the solution of real world industry issues and problems.

CO-POMapping:

	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 Content:

Module I: Introduction [8L]:

Introduction to Deep Learning, Bayesian Learning, Decision Surfaces, Linear and Logistic Regression. Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, different activation functions, Optimization Techniques, Gradient Descent, Batch Optimization

Module II: Convolution Neural Networks [5L]:

Convolutional Neural Network, Building blocks of CNN, Transfer Learning, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc. ConvNets: Basic concepts of Convolutional Neural Networks starting from filtering. Convolution and pooling operation and arithmetics of these. ConvNet Architectures: Discussions on famous convnet

Module III: Recurrent Neural Networks [4L]:

LSTM, GRU, Encoder Decoder architectures, Discussion on Recurrent Neural Networks (RNNs), Long-Short Term Memory (LSTM) architectures, Attention.

Module IV: Deep Unsupervised Learning [6L]:

Unsupervised Learning with Deep Network, Autoencoders, Variational Autoencoders, Adversarial Generative Networks, Autoencoder and DBM, Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

Module V: Computer Vision [6L]:

Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection etc. LSTM Networks, Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, Attention models for computer vision tasks.

Module VI: Applications of Deep Learning[7L] :

Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Introduction to NLP and Vector Space Model of Semantics

Text Books:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep learning." An MIT Press book in preparation. (2015).
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education,

Reference Books:

3. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Course Name: Bioinformatics
Course Code: MCAO402B
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisite:
Concepts of Computer Networking, Network Security, Database Management Systems

Course Objective:
The basic objective is to learn about different bio molecules, their structures and functions, various data sets in bioinformatics, computational techniques useful in bioinformatics.

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

CO1: Understand the knowledge of Bioinformatics technologies with the related concept of DNA, RNA and their implications.

CO2: Analyze the techniques of different types of Data Organization and Sequence Databases types of Tools for Sequence Data Banks.

CO3: Apply the knowledge of the DNA Sequence Analysis.

CO4: Evaluate the performance of different types of Probabilistic models used in Computational Biology.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction to Molecular Biology [10L]

Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA: Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Translation Introduction to Metabolic Pathways.

Module 2: Sequence Databases [4L]

Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank, OMIM, Taxonomy browser, PubMed

Module 3: DNA Sequence Analysis [10L]

DNA Mapping and Assembly: Size of Human DNA, Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.

Module 4: Introduction Probabilistic models used in Computational Biology [7L]

Probabilistic Models; Hidden Markov Model: Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics: Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model: Architecture, Principle, Application in Bioinformatics.

Module 5: Biological Data Classification and Clustering [4L]

Assigning protein function and predicting splice sites: Decision Tree

Textbooks:

1. Bio Informatics and Molecular Evolution by Paul G. Higgs and Teresa K. Attwood
2. Bio Informatics Computing by Bryan Bergeron

Reference books:

3. Bio Informatics and Functional Geneomics, by Jonathan Pevsner
4. Gene Cloning DNA Analysis, by T.A. Brown

Course Name: Blockchain Technology
Course Code: MCAO402D
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre-requisites: Basics of Cryptography, Computer Networks, Database Systems

Course Objectives

O1: Understand the fundamental principles of blockchain technology and distributed ledger systems.
O2: Learn the architecture, components, and working of blockchain systems.
O3: Explore consensus mechanisms and cryptographic techniques in blockchain.
O4: Apply blockchain concepts to design and implement smart contracts and decentralized applications (DApps).
O5: Analyze applications of blockchain in finance, supply chain, healthcare, and other domains, along with associated challenges.

Course Outcomes (CO)

- CO1: Explain the fundamental concepts of blockchain, distributed ledgers, and cryptographic primitives.
- CO2: Compare different blockchain architectures and consensus protocols.
- CO3: Develop smart contracts and decentralized applications using blockchain frameworks.
- CO4: Evaluate blockchain performance, scalability, and security issues.
- CO5: Analyze case studies of blockchain applications across industries.

CO–PO Mapping

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	-	2
CO2	3	3	2	2	-	-	-	-	-	-	-	3	3	-	2

CO3	3	3	3	3	-	-	-	-	-	-	-	3	2	-	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	-	3

Course Contents

Module 1: Introduction to Blockchain : [4L]

Overview of blockchain, distributed ledger systems, history and evolution, key characteristics (immutability, transparency, decentralization), comparison with traditional databases.

Module 2: Cryptographic Foundations: [5L]

Public key cryptography, hash functions, Merkle trees, digital signatures, zero-knowledge proofs.

Module 3: Blockchain Architecture and Consensus : [7L]

Blockchain structure: blocks, transactions, nodes; Consensus mechanisms: Proof of Work (PoW), Proof of Stake (PoS), Delegated PoS, Practical Byzantine Fault Tolerance (PBFT), mining and validation processes.

Module 4: Smart Contracts and DApps : [6L]

Introduction to Ethereum and Solidity, writing and deploying smart contracts, gas and transactions, decentralized applications, interoperability and cross-chain communication.

Module 5: **Applications of Blockchain : [5L]**

Blockchain in finance (cryptocurrency, CBDCs), supply chain, healthcare, IoT, digital identity, e-governance; Case studies and industry adoption.

Module 6: Challenges and Future Directions : [3L]

Scalability, security, privacy, regulatory and ethical issues, blockchain 3.0 and beyond, integration with emerging technologies (AI, IoT, quantum computing).

Text Books

1. Narayanan A., Bonneau J., Felten E., Miller A., Goldfeder S. – Bitcoin and Cryptocurrency Technologies, Princeton University Press.
2. Bashir I. – Mastering Blockchain, Packt Publishing.
3. D. Tapscott & A. Tapscott – Blockchain Revolution, Penguin.

Reference Books

4. Mougayar W. – The Business Blockchain, Wiley.
5. Swan M. – Blockchain: Blueprint for a New Economy, O'Reilly.
6. Crosby M. et al. – Blockchain Technology: Beyond Bitcoin, Applied Innovation Review.

Course Name: Intelligent Control
Course Code: MCAO402E
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisites: Neural Networks- Linear Algebra, Graph theory, calculus, probability

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

To expose the students to the concepts of feed forward neural networks. To provide adequate knowledge about feedback neural networks. To provide adequate knowledge about fuzzy and neuro-fuzzy systems. To provide comprehensive knowledge of fuzzy logic control to real time systems. To provide adequate knowledge of genetic algorithms and its application.

Course Outcome:

At the end of this course, students will be able to-

CO1	Describe fundamentals of neural network and how to use various learning algorithm for machine learning
CO2	To analyze and design control system using Neural model
CO3	How to apply fuzzy system to design decision making logic.
CO4	To solve optimization problem using various searching techniques
CO5	To design the control system for autonomous robotic system.
CO6	To learn the application of Programming model to implement various machine learning concepts in the application of robotics and automation.

CO-PO Mapping:

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

CO4	3		2								2		2		3
CO5	3	3	2			1					2				3
CO6	3	2	2	1	1	1					2				

Course Contents:

Module I: ARCHITECTURES – ANN**[6L]**

Covers the fundamentals of Artificial Neural Networks (ANN), including biological and artificial neuron models, supervised and unsupervised learning, single and multi-layer feed-forward networks, learning algorithms, and the back-propagation network.

Module II NEURAL NETWORKS FOR CONTROL**[7L]**

Focuses on the application of neural networks in control systems, including feedback networks, discrete-time Hopfield networks, transient response of continuous-time systems, process identification, and neuro-controllers for systems like the inverted pendulum.

Module III FUZZY SYSTEMS**[9L]**

Introduces Fuzzy Systems, covering classical and fuzzy sets, fuzzy relations, fuzzification, defuzzification, fuzzy rules, membership functions, knowledge base, decision-making logic, and an introduction to neuro-fuzzy and adaptive fuzzy systems.

Module IV APPLICATION OF FUZZY LOGIC SYSTEMS**[10L]**

Explores practical applications of fuzzy logic control in various systems such as home heating, liquid level control, aircraft landing, inverted pendulum, fuzzy PID control, and fuzzy-based motor control.

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 V Genetic Algorithms **[8L]**

Basic concept of Genetic algorithm, detail algorithmic steps, adjustment of free Parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like tabu search and ant colony search techniques for solving optimization problems.

Text Books:

1. Laurance Fausett, "Fundamentals of Neural Networks", Pearson Education, 1992.
2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Tata McGraw Hill, 3rd Edition, 2010.
3. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Edition, 2nd Edition, 2013.

Reference Books

1. Simon Haykin, "Neural Networks", Pearson Education, 2003.
2. John Yen & Reza Langari, "Fuzzy Logic Intelligence Control & Information", Pearson Education, New Delhi, 2003.
3. M.Gen and R,Cheng, "Genetic algorithms and optimization", Wiley Series in Engineering Design and Automation, 2000.

Course Name: Design of Embedded Systems
Course Code: MCAO402F
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisite:
Knowledge of basic microprocessor and microcontroller.

Course Objective:
An ability to design a system, component, or process to meet desired needs within realistic constraints. Ability to understand microcontroller, microcomputer, embedded system. Understand different components of a micro-controller and their interactions. To become familiar with the programming environment used to develop embedded systems. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral device. Learn debugging techniques for an embedded system

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

CO1: Understand the architecture and classifications of different embedded systems and the related programming knowledge.
CO2: Understand the concepts of embedded systems like I/O, timers, interrupts, interaction devices.
CO3: Choose case-specific debugging technique for an embedded system.
CO4: Design various real time systems using embedded systems.

CO-PO Mapping:

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

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

Course Contents:

Module I: Introduction to the Embedded System [6L]

Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC.

Module II: Serial and parallel communication: devices and protocols, wireless communication: [8L]

The devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth.

Module III: Program Modelling [8L]

Program Modeling Concepts; Fundamental issues in Hardware software co-design, Unified Modeling Language (UML), Hardware Software trade-offs DFG model, state machine programming model, model for multiprocessor system.

Module IV: Real Time Operating Systems [8L]

Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

Module V: PIC microcontroller [10L]

Introduction, architecture, comparison of PIC with other CISC and RISC based systems and microprocessors, assembly language programming, addressing modes, instruction set, Interfacing with various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming.

Textbooks:

1. Introduction to Embedded Systems: Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)

Reference books:

3. Embedded Systems: Rajkamal (TMH)

4. Embedded Systems: L. B. Das (Pearson)
5. Embedded System design: S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)

Course Name: Business Analytics
Course Code: MCAO402G
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisite:
Basic knowledge of Statistical Inference, Multiple Linear Regression and Probability Distributions. Algorithms and Computer Programming Skills.

Course Objective:
The objective of this course is to cover fundamental algorithms and techniques used in Business Analytics its applications along with the statistical foundations.

Course Outcome
After completion of this course students will be able to
CO1: Find a meaningful pattern in data
CO2: Graphically interpret data
CO3: Implement the analytic techniques
CO4: Handle large scale analytics projects from various domains

CO-PO Mapping:

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

Course Contents:

Module 1: Foundations of Business Analytics: [6L]

Introduction to Business Analytics, Analytics on Spreadsheets. Data Definitions and Analysis Techniques. Elements, Variables, and Data categorization, Levels of Measurement, Data management and indexing, Introduction to statistical learning and R-Programming

Module 2: Product-Market Fit [5L]

Gap Analysis, Carrying Out Gap Analysis, steps in Gap Analysis, conducting a Representative Survey for Gap Analysis, Predicting Consumer Behaviour and Gap Analysis in Smartphone Market.

Module 3: Analytical Modelling [6L]

Analytical Modelling by Factor and Cluster Analysis, Factor Analysis Concepts, Application of Factor Analysis Concepts of Cluster Analysis, Similarity Measures, Application of Cluster Analysis.

Module 4: Analytical Modelling by Logistics Regression and Discriminant Analysis [7L]

Linear Discriminant Analysis Model, Predictive Modelling using Discriminant Analysis, Application of Linear Discriminant Analysis for Credit Scoring of Loan Applicants. Theoretical Formulation of Logistics Regression, Mathematical Interpretation of Logistics Regression, Indicator for Model Fit, Applying Logistics Regression, Application of Logistics Regression in Predicting Risk in Portfolio Management Testing the Reliability/Consistency of the Different Factors Measured.

Module 5: Segmentation of primary target market by Heuristic Modelling: [5L]

Introduction to RFM Analysis, Enhancing Response Rates with RFM Analysis.

Module 6: Segmentation of target market and Case Studies and Projects: [11L]

Segmentation of target market based on large databases using Decision Tree approach. Introduction to Chi-square Automatic Interaction Detection (CHAID), Predictive Modelling by CHAID. Case Studies and Projects: Understanding business scenarios, Feature engineering and visualization. Scalable and parallel computing with Hadoop and Map-Reduce, Sensitivity Analysis, Practice and analysis with R.

Textbooks:

1. Business Analytics: An Application Focus, Purba Halady Rao, Prentice Hall.
2. Business Analytics, James R. Evans, Pearson.

Reference books:

1. Modeling Techniques in Predictive Analytics, Thomas W. Miller, Pearson
2. Enterprise Analytics: Optimize Performance, Process, and Decisions Through Big Data, Thomas H. Davenport, Pearson.
3. Fundamentals of Business Analytics, Seema Acharya, Wiley India.

Course Name: Robotics
Course Code: MCAO402H
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: Basic knowledge of programming languages such as C, C++ or Python. Familiarity with mathematics concepts including linear algebra, probability, and differential equations. Understanding of data structures, algorithms, and control systems at a fundamental level.

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

O1: To introduce the fundamental concepts of robotics, including kinematics, dynamics, and control of robotic systems.
O2: To develop the ability to design, simulate, and analyse robotic systems for industrial and real-world applications.
O3: To provide practical exposure to robotics programming, sensors, actuators, and artificial intelligence integration.

Course Outcome:

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

CO1	Explain the fundamental principles of robotics, including structure, components, and classifications of robots.
CO2	Apply the concepts of kinematics and dynamics to model and analyse robotic motion.
CO3	Demonstrate the use of sensors, actuators, and controllers in robotic systems.
CO4	Design and implement basic robotic algorithms for navigation, path planning, and control.
CO5	Integrate programming and simulation tools (e.g., Python, ROS, MATLAB) for robotic applications.
CO6	Evaluate the applications of robotics in manufacturing, healthcare, defence, and service industries, considering ethical and societal implications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	2	2	1	1	–	–	–	–	–	–	–	3	2	–	2
CO2	3	3	2	2	–	–	–	–	–	–	–	3	3	–	2
CO3	3	3	2	2	–	–	–	–	–	–	–	3	2	–	2
CO4	3	3	3	3	–	–	–	–	–	–	–	3	3	–	3
CO5	2	3	3	3	–	–	–	–	–	–	–	3	3	–	3
CO6	2	3	2	2	–	–	–	–	–	–	–	3	2	–	2

Course Contents:

Module I: Introduction: [6L]

Definition, history, and scope of robotics, Types and classification of robots (industrial, service, mobile, humanoid), Components of a robotic system: sensors, actuators, controllers. Overview of robot kinematics, dynamics, and control, Applications and societal impact of robotics.

Module II: Kinematics and Dynamics of Robots [8L]

Mathematical foundations: coordinate frames, transformations, Forward kinematics and inverse kinematics, Jacobians and velocity analysis, Dynamics of robotic manipulators, Trajectory planning and motion control.

Module III: Sensors, Actuators, and Control Systems [7L]

Types of sensors: position, velocity, force, vision, and proximity, Actuators: electric, hydraulic, pneumatic, Control architectures: open-loop and closed-loop control, PID controllers in robotics, Introduction to advanced control strategies.

Module IV: Robot Programming and Simulation [7L]

Robot Operating System (ROS) overview, Programming robots using Python/C++, Introduction to robotic simulation tools (Gazebo, V-REP, MATLAB), Path planning algorithms: Dijkstra, A*, RRT, Introduction to machine learning in robotics.

Module V: Applications and Emerging Trends [8L]

Industrial applications: manufacturing, assembly, logistics, Healthcare applications: surgical robots, assistive robots, Defense and space robotics, Agricultural and service robotics, Emerging trends: swarm robotics, collaborative robots (cobots), AI-integrated robotics, Ethical, legal, and societal implications of robotics

Text Books:

5. John J. Craig, *Introduction to Robotics: Mechanics and Control*, 3rd Edition, Pearson Education, 2014.
6. Bruno Siciliano and Lorenzo Sciavicco, *Robotics: Modelling, Planning and Control*, Springer, 2010.

Reference Books

1. Richard D. Klafter, Thomas A. Chmielewski, and Michael Negin, *Robotics: Engineering and Applications*, Prentice Hall, 1993.
2. Mikell P. Groover, *Industrial Robotics: Technology, Programming, and Applications*, McGraw Hill, 2nd Edition, 2012.

Course Name: Multimedia
Course Code: MCAO402I
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisites: Basic knowledge of Computer Graphics. Fundamentals of Digital Image Processing. Basic programming skills (preferably C/C++, Java)

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

O1: To provide an in-depth understanding of multimedia systems, focusing on multimedia elements such as text, graphics, audio, video, and animation. The course emphasizes multimedia applications, multimedia data compression techniques, and multimedia authoring tools.

Course Outcome:

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

CO1 Understand multimedia components, applications, and architecture.

CO2 Design and develop multimedia applications using different tools.

CO3 Apply various compression techniques for audio, video, and images.

CO4 Work with multimedia databases and authoring tools.

CO5 Evaluate multimedia systems for practical implementation.

CO-PO Mapping:

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

CO3	2	3	2	1	1	2	-	-	-	-	-	3	2	3	-
CO4	3	3	2	3	1	1	-	-	-	-	-	3	3	2	-
CO5	3	2	2	2	2	1	-	-	-	-	-	2	2	3	-

Course Contents:

Module 1: Introduction: [4L]

Introduction to Multimedia • Definition and Concepts of Multimedia • Components of Multimedia • Multimedia Applications in Education, Entertainment, Business, Web, etc. Multimedia System Architecture • Types of Multimedia Data: Text, Graphics, Audio, Video, Animation.

Module 2: Text and Graphics[4L]

• Text in Multimedia: Fonts, Unicode, Hypertext • Image Processing Basics • Graphic File Formats (BMP, JPEG, PNG, GIF, TIFF) • Vector Graphics vs Raster Graphics • Image Editing Tools (Adobe Photoshop, GIMP, CorelDRAW)

Module 3: Audio in Multimedia [4L]

• Audio Formats: WAV, MP3, MIDI, OGG • Digital Audio Basics: Sampling, Bit Depth, Channels • Audio Compression Techniques (Lossy vs Lossless) • Audio Editing Tools (Audacity, Adobe Audition) • Sound Effects and Background Music

Module 4: . Video and Animation[4L]

• Digital Video Basics: Frame Rate, Resolution, Compression • Video Formats: AVI, MP4, MOV, MPEG • Principles of Animation: Frame by Frame, Tweening, Keyframing • 2D vs 3D Animation • Animation Tools (Adobe Animate, Blender, Maya)

Module 5: Multimedia Authoring Tools [4L]

• Concepts of Multimedia Authoring • Popular Tools: Adobe Director, Adobe Animate, Flash, Unity3D • Interactive Multimedia Design • Timeline-based Authoring • Object-oriented Authoring

Module 6: Multimedia Data Compression [4L]

• Need for Compression • Lossy vs Lossless Compression • Image Compression (JPEG, PNG) • Audio Compression (MP3, AAC) • Video Compression (MPEG, H.264, WebM)

Module 7: Multimedia Networking [4L]

• Streaming Concepts (Audio/Video Streaming) • Protocols: RTP, RTSP, HTTP, HLS • Multimedia over IP Networks • Content Delivery Networks (CDNs) • Bandwidth Considerations and Quality of Service (QoS)

Module 8: Multimedia Storage and Retrieval [4L]

• Storage Media: Optical Discs, Hard Disks, SSDs • Database for Multimedia (Multimedia DBMS) • Metadata in Multimedia • Indexing & Retrieval Techniques • Content-Based Image Retrieval (CBIR)

Module 9: Virtual Reality (VR) and Augmented Reality (AR) Basics[4L]

• Introduction to VR and AR • Hardware Requirements (Headsets, Sensors) • Application Areas • Simple VR/AR Development Concepts

Module 10: Multimedia Project Work / Case Studies[4L]

• Multimedia Project Design • Case Studies in E-learning, Virtual Tours, Interactive Presentations • Final Project Implementation (Often includes practical applications)

Text Books:

1. Multimedia Systems Design – Prabhat K. Andleigh, Kiran Thakrar
2. Fundamentals of Multimedia – Ze-Nian Li, Mark S. Drew
3. Multimedia: Making It Work – Tay Vaughan

Reference Book:

4. Multimedia Systems Ralf Steinmetz, Klara Nahrstedt
5. Multimedia: Making It Work Tay Vaughan
6. Principles of MultimediaAuthor: Ranjan Parekh

Course Name: Distributed System
Course Code: MCAO402J
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites: Operating System, Computer Networking

Course Objectives: This course introduces the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.

Course Outcome:

After completion of this course student will be able to

CO1	Understand the knowledge of the basic elements and concepts related to distributed system technologies for identify core architectural aspects of distributed systems
CO2	Use and apply important methods in distributed systems to support scalability and fault tolerance
CO3	Analyse the utility of main underlying components of distributed systems
CO4	Build a distributed system by using the required components

CO-PO Mapping:

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

Course Contents:

Module I: Introduction: [4L]

Definition and goals, Hardware and Software concepts, Design issues

Module II: Communication in Distributed System: [4L]

Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

Module III: Synchronization in Distributed Systems: [4L]
Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Module IV: Processes and Processors in Distributed Systems: [3L]

Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, Real time distributed systems, Process migration and related issues.

Module V: Distributed Shared Memory: [5L]

Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing.

Module VI: Naming: [4L]

Overview, Features, Basic concepts, System oriented names, Object locating mechanisms, Issues in designing human oriented names, Name caches, Naming and security, DNS.

Module VII: Distributed Web-based Systems: [5L]

Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications

Module VIII: Distributed Web-based Systems: [5L]

Architecture, Processes, Communication, Naming, Synchronization, Consistency and Replication: Web Proxy Caching, Replication for Web Hosting Systems, Replication of Web Applications

Module IX: Security: [3L]

Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Module X: Case Study: [3L]

Oracle Network File System, Google case study

Text Books:

1. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
2. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore,Tim Kindberg, Pearson

Reference Books

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson

Course Name: Big Data Analytics
Course Code: MCAO402K
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Prerequisite:
Data Structure, Design and Analysis of Algorithms, Database Management Systems, Statis Intelligence, Programming skills of Python

Course Objective:

Comprehend the fundamental concepts of the Big Data Analytics exploring machine learning strategies such as Supervised and Unsupervised Learning etc. for analyzing various types of large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework). Formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions. Apply the concepts of Big Data Analytics to solve problems of making automated decisions dealing with large scale structured as well as unstructured data distributed across multiple locations. Excogitate and Implement ideas to address the challenging issues of Big Data Analytics. Analyze the effectiveness of various Big Data Analytics Frameworks.

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

CO1: Understand and explain the fundamental concepts of the Big Data Analytics which are primarily explored for making automated decisions using machine learning strategies on analyzing large scale structured as well as unstructured data distributed across multiple locations (Map Reduce, Hadoop and NoSQL Framework) underscoring the utilitarian importance in current technological context for further exploration leading towards lifelong learning.

CO2: Identify and formulate an engineering problem of analyzing large scale data distributed across multiple locations to make automated meaningful decisions within the scope of Big Data Analytics Frameworks.

CO3: Explore relevant literature and apply the concepts of Big Data Analytics to solve problems

of making automated decisions dealing with large scale structured as well as unstructured data using Map Reduce, Hadoop and advanced SQL Frameworks

CO4: Excogitate ideas for proposing solutions to the challenging problems of Big Data Analytics.

CO5: Implement ideas of Big Data Analytics through developing feasible algorithms or frameworks and investigate their effectiveness in solving the relevant problems by analyzing the performances using proper techniques.

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction to Basic Analytics [10L]

Introduction: Big data overview, Analyst's perspective on data repositories, Current analytical architecture, Drivers of big data, Examples of big data analytics. Life Cycle of Data Analytics: Phase 1: Discovery, Phase 2: Data preparation, Phase 3: Model planning, Phase 4: Model building, Phase 5: Communication of results, Phase 6: Making operational. Basic Analytic Methods: Visualization, Dirty data, Data exploration versus presentation, Statistical methods for evaluation – hypothesis testing, difference of means, rank sum test, type I and type II errors, ANOVA.

Module 2: Advanced Analytic Methods I [8L]

Clustering: Overview, K-means, Determining the number of clusters, Diagnostics. Association Rules: Overview, Apriori algorithm, Evaluation of candidate rules, Application of association rules, Validation and testing, Diagnostics. Regression: Linear regression - model description, Logistic regression – model description, Other regression models. Classification: Decision trees – overview, General algorithm, Decision tree algorithms, Evaluating a decision tree, Naïve Bayes – Bayes theorem, Naïve Bayes classifier, Diagnostics of classifiers.

Module 3: Advanced Analytic Methods II [8L]

Time Series Analysis: Overview, Box-Jenkins methodology, Autocorrelation function (ACF), Autoregressive model, Moving average model, ARMA and ARIMA model, Building and evaluating an ARIMA model. Text Analysis: Steps in text analysis, Collecting raw text, Representing text, Term Frequency-Inverse Document Frequency (TFIDF), Categorizing documents by types, Determining sentiments. Map Reduce and Hadoop:Analytics for unstructured data – map reduce, Apache Hadoop, Hadoop Ecosystem – Pig, Hive, Hbase, Mahout.

Module 4: Advanced Analytic Methods III [10L]

Technology and Tools: SQL essentials - Join, Set, Grouping extensions, Advanced SQL – Window functions, User-defined functions, Ordered aggregates, MADlib, NoSQL. Integration of Techniques: Communicating and operationalizing an analytic project. Creating final deliverables – Developing core materials, project goals, Main findings, Approach, Model description and model details,

Recommendations, Providing technical specifications and code. Data visualization basics - Key points, evolution of a graph, common representation methods, how to clean up a graphic.

Textbooks:

1. EMC Education Services (Editor), Data Science and Big Data Analytics. John Wiley & Sons, 2015.
2. Mike Barlow, Real-Time Big Data Analytics: Emerging Architecture. O'Reilly, 2013.

Reference books:

3. Nathan Marz and James Warren, Big Data: Principles and Best Practices for Scalable Real-time Data Systems. Manning Publications, 2015.
4. Venkat Ankam, Big Data Analytics. Packt Publishing Ltd., UK, 2016.

Course Name: Social Networks
Course Code: MCAO402L
Contact: (3:0:0)
Total Contact Hours: 40
Credit: 3

Pre requisites:

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

O1: Learn history and evolution of Social networks. Develop an internal social media policy, including management, timing, and frequency. Create a defined process-map in which to create social media updates and understand the benefits associated with third-party social media management tools. Define the functionality of LinkedIn, Facebook, and Twitter and identify the target demographics associated with each platform. Understand the benefits of developing and maintaining profile in social network platforms.

Course Outcome:

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

CO1	Understand what social media is, the various channels through which it operates, and its role in marketing strategy
CO2	Describe S. M. A. R. T. social media goals to achieve successful online campaigns
CO3	Use principles of consumer and social psychology to develop social media content and campaigns that engage common people
CO4	Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks
CO5	Measure the impact of a social media campaign in terms of a specific objective

CO-PO Mapping:

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

Course Contents:

Module 1: Introduction to Social Media and Networks [6]

Concept of social media and social networking. Types of social media platforms (Facebook, X/Twitter, LinkedIn, Instagram, YouTube, Reddit, etc.). Evolution of social media in the digital era. Role of social networks in business, society, and governance. Integration of social media in marketing strategies.

Module 2: Social Media Goals and Strategy Formulation [5]

Setting objectives for social media campaigns. Introduction to S.M.A.R.T. (Specific, Measurable, Achievable, Relevant, Time-bound) goals. Planning social media strategies aligned with organizational objectives. Case studies of successful online campaigns.

Module 3: Psychology of Social Media and Content Development [7]

Basics of consumer psychology and online behavior. Influence of social identity and group dynamics on social networks. Content creation principles for engagement (text, images, videos, memes, hashtags). Emotional triggers and storytelling techniques in campaigns. Designing campaigns that appeal to common people

Module 4: Word-of-Mouth (WOM) and Viral Marketing [6]

Concept and importance of word-of-mouth in digital marketing. Techniques for creating shareable content. Viral marketing principles and case studies. Role of influencers and opinion leaders in message propagation. Network effects and diffusion of innovations theory.

Module 5: Measuring and Evaluating Social Media Campaigns [6]

Key Performance Indicators (KPIs) in social media (reach, engagement, impressions, conversions). Tools for campaign monitoring and analytics (Google Analytics, Facebook Insights, Twitter Analytics, etc.). ROI measurement in social media campaigns. Sentiment analysis and social listening tools. Ethical and privacy concerns in social media analytics

Text Books:

6. Kaplan, Andreas M., and Haenlein, Michael. Social Media: Back to the Roots and Back to the Future. Business Horizons, Elsevier, 2010.
7. Qualman, Erik. Socialnomics: How Social Media Transforms the Way We Live and Do Business. Wiley, 2nd Edition, 2013. Zarrella, Dan. The Social Media Marketing Book. O'Reilly Media, 2009.

8. Reference Books

9. Tuten, Tracy L., and Solomon, Michael R. Social Media Marketing. Sage Publications, 3rd Edition, 2020.
10. Safko, Lon. The Social Media Bible: Tactics, Tools, and Strategies for Business Success. Wiley, 4th Edition, 2017.
11. Li, Charlene, and Bernoff, Josh. Groundswell: Winning in a World Transformed by Social Technologies. Harvard Business Review Press, 2011.