

**STUDY SCHEME & SYLLABUS
FOR
MASTER OF COMPUTER
APPLICATIONS

BATCH-2026**

Master of Computer Applications (MCA)

Semester-I									
Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							MSE	External Exam	Total
26C2CAP-B1	Bridge Course*	Computer Programming using C	S/US	2	0	0	50	-	50
26C2CAP-B2	Bridge Course*	Computer Science Essentials	S/US	2	0	0	50	-	50
26C2CAP-B3	Bridge Course*	Mathematics	S/US	2	0	0	50		50
26C2CAP-101	Core Theory	Discrete Structures & Optimization	4	4	0	0	30	70	100
26C2CAP-102	Core Theory	Programming in Python	4	4	0	0	30	70	100
26C2CAP-103	Core Theory	Advanced Data Structures	4	4	0	0	30	70	100
26C2CAP-104	Core Theory	Advanced Database Management System	4	4	0	0	30	70	100
26C2CAP-105	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	3	0	0	30	70	100
26C2CAP-111	Core Practical/Laboratory	Data Structures using Python Laboratory	2	0	0	4	70	30	100
26C2CAP-112	Core Practical/Laboratory	Advanced Database Management System Laboratory	2	0	0	4	70	30	100
26C2CAP-113	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	1	0	0	2	30	20	50
26C2CAP-114	Skill Enhancement Course	Career and Placement Planning - 1	1	0	0	2	50	-	50
26C2CAP-115	Value Added Course (NCC)	**MOOC	0	0	0	2	-	-	S/US
	TOTAL		25	19	0	14	370	430	800

*Bridge courses are not applicable to all the students, please refer MCA eligibility given above in order to offer bridge courses to students

Note: ** MOOCs List is to be prepared by the department level committee.

S= Satisfactory, US=Un Satisfactory

Master of Computer Applications (MCA)

Semester-II									
Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							MSE	External Exam	Total
26C2CAP-201	Core Theory	Web Technologies	4	4	0	0	30	70	100
26C2CAP-202	Core Theory	Design & Analysis of Algorithms	4	4	0	0	30	70	100
26C2CAP-203	Core Theory	Advanced Java	4	4	0	0	30	70	100
26C2CAP-204	Core Theory	Linux Administration	4	4	0	0	30	70	100
26C2CAP-205	Core Theory	Information Security & Cyber Law	4	4	0	0	30	70	100
26C2CAP-211	Core Practical/Laboratory	Web Technologies Laboratory	2	0	0	4	70	30	100
26C2CAP-212	Core Practical/Laboratory	Advanced Java Laboratory	2	0	0	4	70	30	100
26C2CAP-213	Core Practical/Laboratory	Linux Administration Laboratory	2	0	0	4	70	30	100
25C2CAP-214	Skill Enhancement Course	Career and Placement Planning - 2	1	0	0	2	50	-	50
25C2CAP-215	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
TOTAL			27	20	0	16	410	440	850

*Students will undergo 4 weeks of Summer Training after 2nd semester. Examination will be conducted along with 3rd semester practicals.

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Master of Computer Applications (MCA)

Semester-III									
Course Co	Course Type	Course Title	Cd	L	T	P	Marks		
							MSE	External Exam	Total
26C2CAP-301	Core Theory	Advanced Computer Networking	4	4	0	0	30	70	100
26C2CAP-302	Core Theory	Artificial Intelligence & Machine Learning	4	4	0	0	30	70	100
26C2CAP-303	Core Theory	Theory of Computation	4	4	0	0	30	70	100
	Elective – I		3	3	0	0	30	70	100
	Elective – II		3	3	0	0	30	70	100
26C2CAP-311	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	2	0	0	4	70	30	100
26C2CAP-312	Core Practical/ Laboratory	Artificial Intelligence & Machine Learning Laboratory	2	0	0	4	70	30	100
	Elective – II Laboratory		2	0	0	4	70	30	100
26C2CAP-313		*Summer/Institutional Training	2	0	0	4	70	30	100
26C2CAP-314	Skill Enhancement Course	Career and Placement Planning - 3	1	0	0	2	50	-	50
26C2CAP-315	Value Added Course (NCC)	**MOOC	0	0	0	2	-	-	S/US
	TOTAL		27	18	0	20	480	470	950

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*Summer Internship Credits/marks are also added in this semester's marks sheet.

Elective – I	
Course Code	Course Title
26C2CAP-PE1-01	Software Project Management
26C2CAP-PE1-02	Optimization Techniques
26C2CAP-PE1-03	Data Mining and Business Intelligence
26C2CAP-PE1-04	Enterprise Resource Planning
26C2CAP-PE1-05	Principles of Operating System

Elective – II Laboratory	
Course Code	Course Title
26C2CAP-PE2-11	Mobile Applications Development Laboratory
26C2CAP-PE2-12	Simulation & Modelling Laboratory
26C2CAP-PE2-13	e-Commerce and Digital Marketing Laboratory
26C2CAP-PE2-14	Software Testing & Quality Assurance Laboratory

Elective – II	
Course Code	Course Title
26C2CAP-PE2-01	Mobile Applications Development
26C2CAP-PE2-02	Simulation & Modeling
26C2CAP-PE2-03	e-Commerce and Digital Marketing
26C2CAP-PE2-04	Software Testing & Quality Assurance

Master of Computer Applications (MCA)

Semester-4									
Course Code	Course name	Course Type	Cd	L	T	P	Marks		
							MSE	External Exam	Total
26C2CAP-401	Core Theory	Machine Learning & Data Analytics using Python	4	4	0	0	30	70	100
26C2CAP-411	Core Practical/ Laboratory	Machine Learning & Data Analytics using Python	2	0	0	4	70	30	100
	Elective – III		4	4	0	0	30	70	100
	Elective – III Laboratory		2	0	0	4	70	30	100
26C2CAP-410		Research/Technical Seminar	1	0	0	2	0	100	100
26C2CAP-412		Project	8	0	0	16	180	120	300
26C2CAP-413	Skill Enhancement Course	Career and Placement Planning - 4	1	0	0	2	50	-	50
26C2CAP-414	Value Added Course (NCC)	*MOOC	0	0	0	2	-	-	S/US
	TOTAL		22	8	0	30	430	420	850

Note: ** MOOCs List is to be prepared by the department level committee.

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Elective – III	
Course Code	Course Title
26C2CAP-PE3-01	Cloud Computing
26C2CAP-PE3-02	Digital Image Processing
26C2CAP-PE3-03	NLP and Speech Recognition
26C2CAP-PE3-04	IOT & Blockchain Technology
26C2CAP-PE3-05	Full Stack Development
26C2CAP-PE3-06	Advanced Web Technologies

Elective – III Laboratory	
Course Code	Course Title
26C2CAP-PE3-11	Cloud Computing Laboratory
26C2CAP-PE3-12	Digital Image Processing Laboratory
26C2CAP-PE3-13	NLP and Speech Recognition Laboratory
26C2CAP-PE3-14	IOT &Blockchain Technology Laboratory
26C2CAP-PE3-15	Full Stack Development Laboratory
26C2CAP-PE3-16	Advanced Web Technologies Laboratory

Semester-I

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-B1	Computer Programming using C	Core Theory	S/US	2	0	0	50		50

Prerequisite: - Basic computer knowledge, logical problem-solving skills, and fundamental mathematics.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the fundamentals of programming including data representation, algorithms, flowcharts, pseudo code, character sets, identifiers, variables, constants and expressions.
CO2	Apply arithmetic, relational, logical, assignment and conditional operators along with library functions to develop basic programs.
CO3	Make use of input–output operations and control statements such as loops and decision-making structures in program development.
CO4	Utilize arrays, strings and storage classes for efficient data handling and manipulation in programs.
CO5	Create programs using functions, recursion and basic object-oriented concepts including classes and objects.

Detailed Syllabus

Section-A

UNIT–I: Logic Development: Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants.

(8 Hrs)

UNIT–2: Operations and Expressions: Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.

(6 Hrs)

UNIT–3 Data Input and Output: formatted & unformatted input output.

Control Statements: While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements. .

(8 Hrs)

Section-B

UNIT–4: Arrays: Defining, processing arrays, passing arrays to a function, multi dimensional arrays.

Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition(Pub.Yr.)
1	Programming in ANSI C	E. Balagurusami	Tata McGraw Hill.	5th (2010/2011)
2	Programming in C	Stephen G Kochan	Pearson	6th (2020/2021)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Object Oriented Programming	Lafore R	Galgotia	1st (2006)
2	Let us C	Yashvant P Kanetkar	BPB	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-B2	Computer Science Essentials	Core Theory	S/US	2	0	0	50		50

Prerequisite: -Basic understanding of computers, mathematics (especially algebra), and problem-solving skills.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the basic concepts of computer systems including hardware, software, data, information, and various input-output devices.
CO2	Describe different types of memory and apply number systems, conversions, and binary arithmetic in data representation.
CO3	Make Use of word processing and spreadsheet software to create, edit, format documents, perform calculations, and generate charts.
CO4	Analyze the presentation using graphics software and explain the basic concepts and components of a Database Management System.
CO5	Interpret the fundamentals of operating systems, data communication methods and different types of computer networks and topologies.

Detailed Syllabus

Section-A

UNIT-I: Human Computer Interface Concepts of Hardware and Software; Data and Information. Devices: Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. (Brief introduction of all) .

(7 Hrs)

UNIT-2:Memory: Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. Data Representation: Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.

(7 Hrs)

UNIT-3 Word processing: Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.

Spreadsheet: Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.

(7 Hrs)

Section-B

UNIT-4: Presentation Graphics Software: Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows. DBMS: Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS.

(7 Hrs)

UNIT-5: Fundamentals of Operating system: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. Data communications concepts: Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex.

Types of Networks: LAN, MAN, WAN, Topologies.

(7 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Fundamentals of Computers	V Rajaraman	V Rajaraman,	5th (2010/2011)
2	Computer Fundamentals	A. Goel	Pearson	6th (2020/2021)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Computers"	Peter Norton	Norton	1st (2006)
2	Computer Course Windows 10 with MS Office 2012	Satish Jain	BPB	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-B3	Mathematics	Core Theory	S/US	2	0	0	50		50

Prerequisite:- Basic knowledge of mathematics, especially arithmetic and logical reasoning.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the basic concepts of sets including representation methods, types of sets and operations on sets.
CO2	Apply logical statements and connectives to perform basic logical operations and identify logical equivalence, tautologies, and contradictions.
CO3	Describe different types of matrices and perform matrix operations such as addition, subtraction, multiplication, and transpose.
CO4	Interpret the concepts of arithmetic progression to identify terms and compute the sum of finite series.

Detailed Syllabus

Section-A

UNIT-I: Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set.

(10 Hrs)

Unit-II: Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.

(10 Hrs)

Unit-III: Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix), Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.

(10 Hrs)

Unit-IV : Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities

(10 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete Mathematics and Its Applications	Kenneth H	Rosen, Mc Graw	5th Edition (2010/2011)
2	Discrete Mathematical Structures	Kolman B	Busby R.	6th Edition (2020/2021)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete and Combinatorial Mathematics	Grimaldi Ralph P	Ramana	1st Edition (2006)
2	Introduction to Graph Theory	West Douglas B	Pearson	4th Edition (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-101	Discrete Structures & Optimization	Core Theory	4	4	0	0	30	70	100

Prerequisite: - Basic knowledge of mathematics, especially logic, sets, relations, and algebra.

Course Outcomes

At the end of the course the student will be able to	
CO1	Apply the operations of sets, relations and functions including equivalence, compatibility, and partial order relations using Venn diagrams and set identities to solve applied problems.
CO2	Analyze properties of Rings, Boolean Algebra, logic gates and Karnaugh maps to simplify Boolean expressions and solve problems using symbolic logic.
CO3	Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle.
CO4	Explain algebraic structures including semigroups, monoids, groups, cosets and normal subgroups and apply morphisms and congruence relations to solve problems.
CO5	Evaluate the properties of directed and undirected graphs including Eulerian and Hamiltonian paths, graph coloring, connectivity, planarity and apply isomorphism and homomorphism concepts.

Detailed Syllabus

Section-A

UNIT-I: Sets, relations, and functions: Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations.

(10 Hrs)

UNIT-2: Rings and Boolean algebra: Rings, Subrings, Morphism of rings ideals and quotient rings. Euclidean domains, Integral domains and fields, Boolean Algebra, Direct product morphisms, Boolean sub-algebra, Boolean Rings, Application of Boolean algebra (Logic Implications, Logic Gates, Karnaughmap)

(10 Hrs)

UNIT-3: Combinatorial Mathematics: Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Applications of Combinatorics, Counting problems in probability and statistics, Combinatorial proofs of algebraic identities, Problem-solving strategies using combinatorial methods

(10 Hrs)

Section-B

UNIT-4: Monoids and Groups: Groups, Semigroups and monoids, Cyclic semigroups and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups, Symmetry in geometry and physics, Combinatorial and algebraic problem solving

(11 Hrs)

UNIT-5: Graph Theory: Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism, Applications in graph theory, coding theory and cryptography

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete Mathematics (Schaum series)	Lipschutz	McGraw Hill	5th (2010/2011)
2	Applied Discrete Structures for Computer Science	Alan Doerr and Kenneth Levarseur	Creative Commons	6th (2012)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete and Combinatorial Mathematics	Kenneth H Rosen	McGraw Hill	1st (2006)
2	Elements of discrete mathematics	C L Liu	McGraw Hill	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-102	Programming in Python	Core Theory	4	4	0	0	30	70	100

Prerequisite: - Basic computer knowledge, logical thinking, and familiarity with problem-solving.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the history, features, limitations and major applications of Python and outline the steps to set up and run Python programs.
CO2	Apply Python data types, variables, type conversions and input/output functions to write basic Python programs.
CO3	Analyze and use Python operators, expressions, decision-making statements, loops and control structures along with native data types.
CO4	Design Python programs using functions, recursion and modules, including standard modules and packages to solve complex programming problems.
CO5	Make use of Python programs using exception handling, file operations and object-oriented programming concepts including classes, objects, attributes and garbage collection.

Detailed Syllabus

Section-A

UNIT-I: Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.

(10 Hrs)

UNIT-2 Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.

(10 Hrs)

UNIT-3: Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. Control Structures: Decision making statements, Python loops, Python control statements.

Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).

(10 Hrs)

Section-B

UNIT-4: Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.

(11 Hrs)

UNIT-5: Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Programming in Python	Pooja Sharma	BPB Publications	4th (2017)
2	Core Python Programming	R. Nageswara Rao	Dreamtech	2nd (2012)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Python, The complete Reference	Martin C. Brown	McGraw Hill	1st (2006)
2	Python in a Nutshell	A. Martelli	McGraw Hill	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-103	Advanced Data Structures	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Strong understanding of basic data structures, programming concepts, and problem-solving skills.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the fundamental concepts of data structures, including their types, basic algorithms and different methods of analyzing algorithm efficiency.
CO2	Compare the different sorting algorithms along with hashing techniques to solve computational problems and evaluate their efficiency.
CO3	Analyze the structure and operational behavior of advanced data structures to determine their efficiency and suitability for different computational problems.
CO4	Investigate different graph representations and determine appropriate approaches to obtain efficient solutions in graph-based scenarios.
CO5	Formulate efficient solutions for string processing problems by utilizing string operations and advanced string matching algorithms .

Detailed Syllabus

Section-A

UNIT-I: Introduction to Data Structures: Data Structures and its Types, Algorithms, Time Complexity, Recurrence, Probabilistic Analysis, Amortized Analysis, Aggregate method, accounting method, potential method, Competitive Analysis, Comparing online vs offline algorithms.

(10 Hrs)

UNIT-2 Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort. **Hashing Techniques:** Direct Address Tables, Hash Tables, Hash Functions, Division method, multiplication method, universal hashing, Open Addressing, Perfect Hashing, Static hashing for known key sets and applications

(10 Hrs)

UNIT-3: Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets, Union-Find operations, Path compression and union by rank, Applications: Kruskal's algorithm, network connectivity.

(10 Hrs)

Section-B

UNIT-4: Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths: Dijkstra's algorithm, Bellman-Ford algorithm, All Pairs Shortest Paths: Floyd-Warshall algorithm, Johnson's algorithm, Maximum Flow, Ford-Fulkerson method, Edmonds-Karp algorithm.

(11 Hrs)

UNIT-5: String Matching: String, String Length, String Concatenation, String Copy, String-Matching, Brute Force algorithm, Rabin Karp algorithm, Hashing technique for pattern matching, Handling collisions, rolling hash, Knuth Morris-Pratt (KMP) algorithm, Boyer-Moore algorithm, Applications of String Matching, Text search in files, bioinformatics, data mining.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Algorithms	Thomas Cormen	Prentice Hall of India	3rd (2009)
2	Algorithm Design	Kleinberg J., Tardos E.	Pearson	1st (2012)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Structures and Algorithms	Aho Alfred V., Hopperoft John E.	Addison Wesley	1st (2001)
2	Data structure	Seymour Lipschutz	Tata McGraw Hill	4th (2014)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-104	Advanced Database Management System	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Basic knowledge of databases, SQL, and data modeling concepts.

Course Outcomes

At the end of the course the student will be able to

CO1	Describe the need of DBMS over traditional data storage systems and describe basic DBMS concepts including architecture, users, data models, and ER model components.
CO2	Apply normalization techniques along with functional, multivalued and join dependencies to design efficient relational database schemas while enforcing integrity constraints.
CO3	Analyze transaction management, concurrency control techniques and database recovery methods to ensure database consistency and reliability.
CO4	Explain distributed database concepts including data storage, transactions, commit protocols, concurrency control and distributed query processing.
CO5	Design Big Data and NoSQL database solutions, including XML databases for effective data management and usage.

Detailed Syllabus

Section-A

UNIT-I: Need of DBMS over traditional Data storage mechanisms, Basic DBMS terminologies; Architecture of a DBMS: Data Independence, DBMS Component Structure, DBMS USERS, various DBMS Data Models, Conceptual Model: Entity Relationship Model, Importance of ERD, Symbols (Entity:Types of Entities, weak Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality).

(10 Hrs)

UNIT-2 Normalization and its various forms, Functional Dependencies, Multi valued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints Relational Languages: Relational Algebra, Relational Calculus, Query Execution, optimization and evaluation Plans.

(10 Hrs)

UNIT-3:Transaction Management and Concurrency Control techniques, Database Recovery Management Concepts and methods. Introduction and Need of Database Administration and activities of Database administration.

Parallel Databases : Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems-Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism

(10 Hrs)

Section-B

UNIT-4:Distributed Database Concepts : Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing Multidimensional Databases and their uses in data analytics. Temporal Databases : Introduction to Temporality, Temporal relationships, temporal hierarchies.

(11 Hrs)

UNIT-5:String Matching: Spatial Databases: Spatial data types, spatial relationships, Topological Relationships, Spatial Data Structures and methods of storage. Big Data : introduction: introduction to NOSQL Databases (Open Source only). Need and usage of XML Databases: XML Data Model – DTD – XML Schema

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Database System Concept	Abraham Silberschatz, Henry F. Korth and S. Sudarshan	McGraw-Hill	6th (2013)
2	An Introduction to Database System	Bipin C. Desai	Galgotia Publications Pvt Ltd-New Delhi	6th Revised (2012)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	SQL, PL/SQL The Programming Language of Oracles	Ivan Bayross	BPB Publications	4th Revised (2009)
2	Database System	Peter Rob Carlos Coronel	Cengage Learning	8th (2015)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-105	Technical Communication	Core Theory	3	3	0	0	30	70	100

Prerequisite: -Proficiency in English, basic computer skills, and reading and writing abilities.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the principles of effective technical communication and describe the importance of clear communication in professional environments.
CO2	Explain various communication techniques to write and design technical documents such as reports, manuals, and proposals.
CO3	Make use of different communication channels and tools for delivering technical information to diverse audiences, including emails, presentations, and collaborative platforms.
CO4	Classify the effectiveness of technical communication by reviewing documents and presentations for clarity, coherence, and accuracy in conveying technical content.
CO5	Create well-structured technical documents and multimedia presentations that address specific technical problems and provide solutions for targeted audiences.

Detailed Syllabus

Section-A

UNIT-1: Basics of Technical Communication: Functions of Communication Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7C's and other principles), Non-verbal Communication.

(8 Hrs)

UNIT-2 Basic Technical Writing: Paragraph writing (descriptive, Imaginative etc.), Precise writing, Techniques for summarizing long passages without losing meaning, Practice exercises on passages from technical and non-technical contexts, Reading and comprehension, Letters- Format & various types.

(7 Hrs)

UNIT-3: Advanced Technical Writing: Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography.

(8 Hrs)

Section-B

UNIT-4: Verbal Communication: Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences, Types: formal, informal, virtual meetings, Agenda preparation and minutes of meeting (MOM), Communication etiquette in meetings and conferences, Role-playing exercises: chairperson, participant, presenter.

(8 Hrs)

UNIT-5: Technical Communication: MS-Word, Adobe Frame maker and ROBO Help * Lab Exercises based on Listening and Speaking skills, Listening comprehension exercises: note-taking, summarizing, Speaking practice: dialogues, role-plays, announcements, Peer review and instructor feedback for improve

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	The Written Word	Vandana R Singh,	Oxford University Press	7th(2023)
2	et al Business Communication	K Ramchandran	Macmillan	6th (2020)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Business Communication and Communicative English	Swati Samantaray	BPB Publications	5th(2015)
2	English and Communication Skills for Students of Science and Engineering	S.P. Dhanavel	Cengage Learning	8th (2020)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-111	Data Structures using Python Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: - Basic knowledge of Python programming and fundamental data structure.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the basic concepts of arrays and perform operations such as insertion, deletion, traversal, and searching.
CO2	Demonstrate the searching and sorting algorithms including linear search, binary search, bubble sort, selection sort, and quick sort.
CO3	Implement and manipulate linked lists including singly and circular linked lists.
CO4	Identify linear data structures such as stack and queue and perform their basic operations.
CO5	Apply tree and graph concepts by implementing binary search trees, tree traversals and graph traversal algorithms such as BFS and DFS.

Exp. No.	Experiment Title & Technical Task
1	Write a Python program to create an array of 5 elements and display the array items. Access each individual element through indexes.
2	Write a Python program to reverse the order of the items in the array.
3	Write a Python program to append a new item to the end of the array.
4	Write a Python program to remove a specified item using the index from an array.
5	Write a Python program to get the length of an array.
6	Write a Python program for binary search.
7	Write a Python program for sequential or linear search.
8	Write a Python program to sort a list of elements using the bubble sort algorithm.
9	Write a Python program to sort a list of elements using the selection sort algorithm.
10	Write a Python program to sort a list of elements using the selection sort algorithm.
11	Write a Python program to sort a list of elements using the quick sort algorithm.
12	Write a Python program to create a singly linked list, append some items and iterate through the list.
13	Write a Python program to find the size of a singly linked list.
14	Write a Python program to search a specific item in a singly linked list and return true if the item is found otherwise return false.
15	Write a Python program to delete the first item from a singly linked list.
16	Write a Python program to create circular single linked lists.

17	Write Python programs to implement stack and its operations using list.
18	Write Python programs to implement queue and its operations using list.
19	Write a Python program to create a Balanced Binary Search Tree (BST) using an array (given) elements where array elements are sorted in ascending order.
20	Write a Python program to find the kth smallest element in a given a binary search tree.
21	Write a Python program to traverse the binary tree using pre-order, post-order and in order traversals.
22	Write a Python program to count the number of nodes in binary search tree.
23	Write a Python program to traverse the graph using Depth First Search and Breadth First Search
24	Write a Python program to create Red Black Tree and perform operations of Insertion and Deletion in it.
25	Write a Python program to implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Python Data Structures and Algorithms	Benjamin Baka, David Julian,	Packt Publishers	5th (2017)
2	“Introduction to Programming using Python	Y Daniel Liang	Pearson.	4th (2016)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	“Problem Solving in Data Structures and Algorithms using Python: programming interview guide”	Hemant Jain	BPB Publications	6th (2016)
2	Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code”	S.P. Dhanavel	Addison-Wesley,	3rd (2014)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-112	Advanced Database Management System Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: - Basic knowledge of SQL, database concepts, and familiarity with DBMS tools.

Course Outcomes

At the end of the course the student will be able to	
CO1	Apply advanced SQL queries, joins, and subqueries to manipulate and retrieve data from complex database schemas.
CO2	Analyze the normalization techniques to design efficient and optimized database schemas.
CO3	Explain the performance of various database management systems by comparing their query optimization techniques and execution plans.
CO4	Identify transaction management and concurrency control techniques in multi-user database environments to ensure consistency and isolation.
CO5	Create distributed databases along with the replication and partitioning techniques to improve data availability and fault tolerance.

Exp. No.	Experiment Title & Technical Task
1	Database design using E-R model and Normalization (Any 3 systems).
2	Implementation of DDL Commands to perform creation of table, alter, modify and drop column operations.
3	Implementation of Constraint ▪ Check Constraint ▪ Entity Integrity Constraint ▪ Referential Integrity Constraint ▪ Unique Constraint ▪ Null Value Constraint
4	Implementation of DML and DCL Commands.
5	Implementation of Data and Built in Functions in SQL.
6	Implementation of Nested Queries and Join Queries.
7	Implementation of Cursors.
8	Implementation of Procedures and Functions.
9	Implementation of Triggers.
10	Implementation of Embedded SQL.
11	Consider a Database applications, Design and Develop Conceptual Data Model (E R Diagram) with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints.
12	Implementation of various DBA roles/techniques ▪ Creation of user ▪ Granting of privileges to the users ▪ Creation of roles ▪ Loading of privileges into user defined roles. ▪ Import/Export data between various databases and flat files

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	SQL, PL/SQL The Programming Language of Oracle	Ivan Bayross	BPB Publications.	4th Revised (2009)
2	Oracle PL/SQL Programming	Steven Feuerstein and Bill Pribyl	O'Reilly Media	5th (2009)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	SQL, PL/SQL The Programming Language of Oracle	Ivan Bayross	BPB Publications.	4th Revised (2009)
2	Oracle PL/SQL Programming	Steven Feuerstein and Bill Pribyl	O'Reilly Media	5th (2009)

Course Code	Course Name	Course Type	CD	L	T	P	Marks		
							Internal	External	Total
225C2CAP-113	Technical Communication Laboratory	Practical	1	0	0	2	30	20	50

Prerequisite: -Basic proficiency in English, reading and writing skills, and familiarity with computer typing.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe effective listening skills to understand spoken English in different communication contexts.
CO2	Apply listening and speaking skills to communicate effectively in everyday and professional situations.
CO3	Make Use of appropriate language for conversations and dialogues in common everyday situations.
CO4	Analyze conversational contexts and converse fluently in English with appropriate clarity and coherence.
CO5	Create clear and coherent written texts independently for academic and professional purposes.

Exp. No.	Experiment Title & Technical Task
1	Listening Comprehension
2	Self-Introduction, Group Discussion and Role Play
3	Common Everyday Situations: Conversations and Dialogues
4	Communication at Workplace
5	Interviews
6	Formal Presentations

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Practical English Usage	Michael Swan	OUP	1st (1995)
2	Communication Skills.	Sanjay Kumar and Pushp Lata	Oxford University Press	4th (2011)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Practical English Usage	Michael Swan	OUP	1st (1995)
2	Communication Skills.	Sanjay Kumar and Pushp Lata	Oxford University Press	4th (2011)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-114	Career and Placement Planning - 1	Skill Enhancement Course	1	0	0	2	50	0	50

Prerequisites: Basic knowledge of arithmetic operations, elementary mathematics and fundamental logical reasoning skills required for problem solving and analytical thinking.

Course Outcomes:

At the end of the course the student will be able to	
CO1	apply mental calculation techniques and mathematical shortcuts to simplify and solve numerical expressions efficiently.
CO2	analyze coded information and spatial relationships to interpret patterns and determine accurate logical conclusions.
CO3	implement numerical properties and mathematical relationships to solve problems involving numbers, factors, multiples, and divisibility.
CO4	analyze quantitative relationships to solve problems involving averages, proportional reasoning, and real-life numerical situations.
CO5	evaluate patterns and logical sequences to identify inconsistencies and determine the correct classification.

Detailed Syllabus

Unit 1: Vedic Mathematics & Simplifications: - Introduction to Vedic Mathematics, Simplification Techniques (Fractions, Decimals, Percentages, Ratios, Exponents), Squares, Cubes, Square Roots, Cube Roots, Multiplication Techniques, Divisibility Rules, Virnaculum, Simplification Techniques & Shortcuts.

(6 Hrs.)

Unit 2: Coding Decoding & Directions: - Introduction to Coding Decoding, Types of Coding Decoding (Letter, Number, Symbol, Mix), Coding Decoding Techniques (Pattern Recognition, Substitution, Logical Reasoning based), Advanced Coding & Decoding Patterns. Introduction to the concept of directions, Types of Directions, Cardinal Directions (N,S,E,W), Intermediate Directions (NE,NW,SE,SW), Movement- Clockwise, Anticlockwise, Concept of Shadow, Shortest Distance & Direction.

(5 Hrs.)

Unit 3: Number System, Problem on Numbers & HCF-LCM: - Types of Numbers, Factorials, Remainder Theorems, Number of Zeros, Highest Powers, Unit Digit Finding, Problems on Numbers. Introduction to the concept of HCF-LCM, Finding LCM-HCF (Prime Factorization, Division Method). HCF-LCM of Fractions, Relation between HCF-LCM and Problems, Co-Primes, Application & Problem Solving.

(6 Hrs.)

Unit 4: Averages, Ages & Ratio & Proportions: - Introduction to the concept of Averages, Finding Averages (Formula & Approximation Techniques), Problems on Averages. Introduction to the Ages Problems, Types of Problems (Simple, Age Ratio, Age Difference), Techniques for solving. Introduction to Ratio & Proportion, Combining of Ratios, Comparison of Ratio, Duplicate, Sub Duplicate, Triplicate, Sub Triplicate Ratio, Problems on Ratio & Proportions, Mean Proportional.

(7 Hrs.)

Unit 5: Odd Man Out: - Introduction to odd man out, Types of patterns & Techniques (Letter Series, Number Series), Identifying Patterns

(2 Hrs.)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal	R.S. Aggarwal	S Chand and Company Ltd	Revised Edition 2025
2	A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal	R.S. Aggarwal	(S. Chand)	2 nd (2018)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Quantitative Aptitude & Logical Reasoning	TPP Department	TPP	6 th Edition
2	Fast Track Objective Arithmetic by Rajesh Verma (Arihant)	Rajesh Verma	Arihant Publications (India) Ltd	Latest Edition-2025-2026

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-115	Value Added Course (NCC)	MOOC	0	0	0	2	-	-	S/US

Course Outcomes:

Defined by the online platform for the specific course chosen.

The Departmental committee shall select a MOOC available on any reputed platform. However, the selected MOOC should not be similar to the regular courses offered as a part of the department curriculum.
course

The overall monitoring of the MOOC course will be under the supervision of the teacher In-charge of the department. The Departmental Academic Committee shall assess the student work based on the relevant course completion certificate.

S= Satisfactory

US=Unsatisfactory

Semester-2

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-201	Web Technologies	Core Theory	4	4	0	0	30	70	100

Prerequisite: Students must have the basic knowledge of any text editor like Notepad, Notepad++ and Edit plus etc.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the basic concepts of the Internet, TCP/IP protocol, IP addressing, and web technologies.
CO2	Apply HTML tags, text formatting, lists and color coding for creating webpages.
CO3	Make use of images, tables and graphical elements using HTML attributes during web page development.
CO4	Develop interactive web pages using hyperlinks, frames, CSS and basic JavaScript.
CO5	Create dynamic web forms by applying JavaScript objects and user-defined objects for client-side.

Detailed Syllabus

Section-A

UNIT-I: Internet Basics: Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, How IP addressing came into existence? A brief overview of TCP/IP and its services, transmission control protocol. Contact hours Introduction To HTML: Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags), Commonly Used HTML Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines).

(10 Hrs)

UNIT-2: Basic Formatting Tags: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. **Lists Type of Lists** (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists

(10 Hrs)

UNIT-3: Adding Graphics To HTML Documents: Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. Tables: Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes Tag.

(10 Hrs)

Section-B

UNIT-4: Linking Documents: Links (External Document References, Internal Document References), Image As Hyperlinks. Frames: **Introduction to Frames:** The tag, The tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Introduction to JavaScript: **Introduction to JavaScript:** JavaScript in Web Pages (Netscape and JavaScript, Database Connectivity, Client side JavaScript, Capturing User Input); The Advantages of JavaScript (an Interpreted Language, Embedded within HTML, Minimal Syntax -Easy to Learn, Quick Development, Designed for Simple, Small Programs, Performance, Procedural Capabilities, Designed for Programming User Events, Easy Debugging and Testing, Platform Independence/Architecture Neutral); Writing JavaScript into HTML.

(11 Hrs)

UNIT-5: Forms Used by a Web Site: The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element) Other Built-In Objects in JavaScript

(The String Object, The Math Object, The Date Object), User Defined Objects (Creating a User Defined Object, Instances, Objects within Objects).

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Internet for EveryOne:	Lipschutz	McGraw Hill	5th (2010/2011)
2	“Fundamentals of Internet and WWW”	Greenlaw R; Hepe	Tata McGraw-Hill	4th (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Asp in 21 Days	Chris Payne	Sams Publishing	2nd (2003)
2	Internet& Web Technologies	RajKamal	Tata McGraw-Hill Education	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-202	Design & Analysis of Algorithms	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Student must have knowledge about Data Structures.

Course Outcomes

At the end of the course the student will be able to	
CO1	Classify algorithms based on order arithmetic, time and space complexity, asymptotic notation and orders of growth to compare the performance of recursive and non-recursive algorithms.
CO2	Apply the algorithm using an appropriate design technique for solving a given problem.
CO3	Design solutions for combinatorial problems using Backtracking and Branch-and-Bound techniques.
CO4	Analyze the sorting and searching algorithms and apply them to appropriate problems.
CO5	Classify problems as P, NP or NP Complete.

Detailed Syllabus

Section-A

UNIT-1: Algorithms: Analyzing algorithms, order arithmetic, Time and space complexity of an algorithm, comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time. Principles of Algorithm Design. Mathematical analysis of Recursive and Non-recursive algorithms.

(10 Hrs)

UNIT-2: Basic Algorithm Design Techniques: Divide-and-conquer, Greedy approach, Randomization and dynamic programming, Breaking a problem into overlapping subproblems and storing solutions to avoid recomputation, Analysis: Time and space complexity, Comparison with naive recursive approaches.

(10 Hrs)

UNIT-3: Example problems on Backtracking: n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.

(10 Hrs)

Section-B

UNIT-4: Sorting and searching: Insertion and selection sort, Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting. Exhaustive search and String Matching.

(11 Hrs)

UNIT-5: Graphs and NP-completeness: Graph traversal: Breadth-First Search(BFS) and Depth-First Search (DFS). Applications of BFS and DFS. Shortest paths in graphs: Dijkstra algorithm. Definition of class NP, P, NP hard and NP-complete problems.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S	McGraw Hill	5th (2010/2011)
2	The Design and Analysis of Computer Algorithms	A.V. Aho, J.E.Hopcroft, and J.D.Ullman	Pearson Education India	4th (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson Education	2 nd (2003)
2	Algorithm Design	Michael T Goodrich and Roberto Tamassia	Wiley India	4 th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-203	Advanced Java	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Student must have knowledge about Data Structures.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe Servlets for handling HTTP requests, responses, cookies and session tracking.
CO2	Apply JSP concepts including directives, scripting elements, implicit objects and session management.
CO3	Develop web applications using the Struts framework and MVC architecture with database connectivity.
CO4	Make use of the Hibernate framework and JavaBeans/EJB concepts for database interaction and enterprise applications.
CO5	Explain RMI and CORBA concepts for distributed computing.

Detailed Syllabus

Section-A

UNIT-I:Servlets: Overview of Java EE web applications, Role of Servlets in server-side programming, The life cycle of Servlet, Java Servlet Development kit, Servlet API, Reading the servlet parameters, Reading initialization parameters, Handling HTTP requests and responses, Using cookies, Session tracking and security issues.

(10 Hrs)

UNIT-2: Java Server Pages (JSP): JSP Architecture, Translation and compilation of JSP, Life cycle of JSP, JSP syntax basics-Directives, Declarations, Scripting, Standard actions, Custom tag libraries, Implicit objects, Object scope. Synchronization issues, Session management.

(10 Hrs)

UNIT-3: Struts: Introduction to struts framework, Need for MVC frameworks, Features and advantages of Struts, Understanding basic architecture of Model, view, controller. Deploying the application in struts with database connectivity, Struts plugins and interceptors, Exception handling and internationalization

(10 Hrs)

Section-B

UNIT-4: Hibernate: Introduction to hibernate framework, understanding basic architecture of Model, view, controller. Basic concepts of creating pojo files, reverse mapping, object creation in hibernate, database connectivity. Enterprise Java Bean: The bean developer kit (BDK), Use of JAR files, The java beans API, Creating a JavaBean, Types of beans, Stateful session bean, Stateless session bean, Entity bean.

(11 Hrs)

UNIT-5: Remote Method Invocation: Defining the remote interface, Implementing the remote interface, Compiling and executing the server and the client. Common Object Request Broker Architecture (CORBA): Overview of technical architecture, CORBA basics, CORBA services.

(11 Hrs)

Textbooks

S No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	The Complete Reference Java 2	Herbert Schildt	Tata McGraw -Hill.	5 th (2010/2011)
2	Advanced Java 2 Platform HOW TO PROGRAM	H.M. Deital, P.J. Dietal and S.E. Santry	Prentice Hall	4 th (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	“Core Java”	Grey Cornell and Horstmann Cay S	Sun Microsystems Press.	2 nd (2003)
2	“JSP: The Complete Reference	Philip Hannaa	Tata McGraw –Hill.	4 th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-204	Linux Administration	Core Theory	4	4	0	0	30	70	100

Prerequisite:-Basic understanding of computer systems, command-line operations, and file management.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the fundamentals of the Linux operating system including distributions, kernel structure, installation, booting and shutdown procedures and usage of the vi editor.
CO2	Apply Linux file system concepts to organize directories, manage file structures, assign appropriate file permissions and perform file management operations effectively.
CO3	Analyze the process of installing and removing software in Linux, including package retrieval, unpacking, configuration, compilation, installation and the management of users and groups.
CO4	Explain the configuration of DNS services, BIND database setup, DNS client configuration, and web server deployment using Apache HTTP Server.
CO5	Justify the configuration and administration of E-Mail servers and Samba server services for managing mail communication and file sharing in network environments.

Detailed Syllabus

Section-A

UNIT-1: Introduction: Linux: The Operating System: Linux Distributions, Difference Between Linux and Windows, Separation of the GUI and the Kernel, Understanding Linux Kernel, Installing Linux in a Server Configuration, Booting and Shutting Down Process, Concept of Root, Basic commands, working with vi Editor.

(10 Hrs)

UNIT-2: Understanding files and File System: Understanding Files and Directories in Linux, Types of Files, File naming conventions and case sensitivity, Absolute vs Relative path, File Structure and hierarchy, File Permissions, File Management and Manipulation.

(10 Hrs)

UNIT-3: Managing Packages & Users: Installing and removing Software in Linux, Getting and Unpacking the Package, Configuring the Package, Compiling the Package, Installing the Package, Managing Users and Groups, Understanding user accounts and groups in Linux, Creating directories and files with proper permissions.

(10 Hrs)

Section-B

UNIT-4DNS: Installing a DNS Server, configuring a DNS Server, DNS Records Types, Setting Up BIND Database Files, The DNS Toolbox, Configuring DNS Clients. Web Server: Understanding the HTTP Protocol, Installing the Apache HTTP Server, Starting Up and Shutting Down Apache, Configuring Apache.

(11 Hrs)

UNIT-5: E-Mail Server: Understanding SMTP, Installing the Postfix Server, Configuring the Postfix Server, Running the Server, POP and IMAP Basics, Installing the UW-IMAP and POP3 Server Samba Server: The Mechanics of SMB, Samba Administration, Using SWAT, Creating a Share, Mounting Remote Samba Shares, Creating Samba Users, Using Samba to Authenticate Against a Windows Server.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Linux Administration: A Beginner's Guide	Wale Soyinka	Tata McGraw -Hill.	5th (2010/2011)
2	UNIX and Linux system administration Handbook Evi Nemeth	Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin,	Pearson Education	4th (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Linux: The Complete Reference	Richard Petersen	McGrawHill	6th (2015)
2	Linux All-In-One for Dummies	Emmett Dulaney	Wiley India	4th (2009)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-205	Information Security and Cyber Law	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Basic knowledge of computer networks, operating systems, and an understanding of legal concepts.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the basic concepts of information technology law and cyber law.
CO2	Describe the legal framework of the Information Technology Act 2000 and its amendments.
CO3	Identify various cyber-crimes and analyze their legal implications and penalties.
CO4	Interpret legal issues related to digital signatures, electronic records, and cyber security.
CO5	Make use of cyber laws in protecting privacy, data and intellectual property in cyberspace.

Detailed Syllabus

Section-A

UNIT-I: Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability), Security Functional Requirements. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication.

(10 Hrs)

UNIT-2: Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, File Access Control, Role-Based Access Control. Database Security: The Need for Database Security, Database Access Control, Database Encryption.

(10 Hrs)

UNIT-3: Managing Packages & Users: Installing and removing Software in Linux, Getting and Unpacking the Package, Configuring the Package, Compiling the Package, Installing the Package, Managing Users and Groups

(10 Hrs)

Section-B

UNIT-4: Intrusion Detection: Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots. Firewalls & Intrusion Prevention Systems: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. Cryptographic Algorithms: Symmetric Encryption Principles, Data Encryption Standards (DES)

(11 Hrs)

UNIT-5: Introduction to Internet Security Protocols & Standards: SSL, TLS, HTTPS, IPv4 and IPv6 Security protocols. Security Policies and Cyber Laws: Concept of Information Security Policy, ISO Standards, various Indian Cyber Laws, Information Technology Act 2000, Electronic Record and E-Governance, Classification and Provisions of Cyber Crimes, Regulation of Certifying Authorities, Patent, Copyright, Digital signature, Introduction to Cyberspace.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	“Computer Security: Principles & Practice”	William Stallings, Lawrie Brown	Pearson	3rd (2015)
2	“Introduction to Information Security and Cyber Laws	Surya Prakash Tripathi, RitendraGoel, Praveen Kumar Shukla	Wiley India	2nd (2014).

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	“Cryptography and Network Security Principles and Practices”	William Stallings	Prentice Hall	4th (2006)
2	“Information Security Handbook”	Darren Death	Packt Publishing	5th (2017)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-211	Web Technologies Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.

Course Outcomes

At the end of the course the student will be able to	
CO1	Develop basic web pages using HTML tags, text formatting, hyperlinks and lists.
CO2	Design structured web pages using tables, frames, multimedia elements and layouts.
CO3	Create interactive web forms such as login, registration and data entry forms using HTML.
CO4	Apply JavaScript to perform basic computations and decision-making operations such as arithmetic calculations, prime number checking and factorial.
CO5	Build dynamic web pages using JavaScript for user interaction, validation and event handling.

Exp. No.	Experiment Title & Technical Task
1	Design index page of a book Titled Web Designing.
2	Create a simple HTML page to demonstrate the use of different tags.
3	Display Letter Head of your college on a web page & it must be scrolling Right to Left.
4	Create a link to move within a single page rather than to load another page.
5	Display “Name of University” using different Text formatting Tags.
6	Design Time Table of your department and highlight the most important periods.
7	Use Tables to provide layout to your web page.
8	Embed Audio and Video into your web page.
9	Divide a web page vertically and display the logo of your college in the left pane and the logo of the university in the right pane.
10	Create Bio- Data of an employee.
11	Design the front page of a hospital with different styles.
12	Design a web page and display horizontally two different web pages at a time.
13	Write a program to create a login form. On clicking the submit button, the user should get navigated to a profile page.
14	Write a HTML code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials.
15	Write a HTML code to create a website in your college or department and create a link for a Tutorial of a specific subject.
16	Write a program to perform following operations on two numbers input by the user: Addition 2) Subtraction 3) Multiplication 4) Division.

17	Design a program to solve quadratic equations.
18	Write a program to determine the greatest number of three numbers.
19	Write a script to compute the Average and Grade of student's marks.
20	Design a scientific calculator and make events for each button using scripting language.
21	Write a script to check whether a number is even or odd?
22	Write a program to show whether a number is prime or not?
23	Write a program to show a multiplication table of any number.
24	Write a program to find the factorial of any number.
25	Write a program to show Fibonacci Series between 0 to 74.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Web Technologies: A Computer Science Perspective	Jeffrey C. Jackson	Prentice Hall	1 st (2008)
2	HTML and CSS: Design and Build Websites**	Jon Duckett	Wiley	1 st (2011)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	JavaScript and JQuery: Interactive Front-End Web Development**	Jon Duckett	Wiley	1 st (2014)
2	Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5	Robin Nixon	O'Reilly Media	5 th (2018)

Course Code	Course Name	Course Type	CD	L	T	P	Marks		
							Internal	External	Total
26C2CAP-212	Advanced Java Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: - Proficiency in core Java programming, object-oriented principles, and familiarity with software development tools

Course Outcomes

At the end of the course the student will be able to	
CO1	Develop web applications using Servlets to handle HTTP requests, responses, cookies and session tracking.
CO2	Create dynamic web pages using JavaServer Pages (JSP) and reusable components using JavaBeans (BDK).
CO3	Implement Enterprise Java Beans (EJB) concepts including Session Beans and Entity Beans used in enterprise applications.
CO4	Design web applications using the Struts framework with MVC architecture and database connectivity.
CO5	Apply Hibernate framework and SEO techniques including keyword analysis, image optimization and creation of robots.txt and sitemap files.

Exp. No.	Experiment Title & Technical Task
1	Create a Servlet to handle HTTP Requests and Responses.
2	Implementation of the concept of Cookies and Session Tracking.
3	Illustrate the concept of JavaServer Pages (JSP).
4	Create a JavaBean by using Bean Developer Kit (BDK).
5	Implementation of various types of beans like Session Bean and Entity Bean.
6	Introduction to Struts platform with basic connectivity.
7	Deploying first sample program using MVC architecture in struts.
8	Implementing database connectivity in struts.
9	Creating one sample application in struts.
10	Introduction to Hibernate framework.
11	Creating simple Hibernate application.
12	Take a web site and prepare the SEO report of the website including status of following factors: Title tag, meta-description tag, header tags, keyword consistency, number of back links, robots.txt and xml sitemaps then after going through the steps of SEO prepare the report.
13	Discuss any five tools to prepare the list of ten organic key words for SEO purpose.
14	Optimize the images in the website using suitable methods and compare the reports before and after the SEO steps.
15	Write the robot and sitemap file of a website under consideration.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"The Complete Reference Java 2"	Herbert Schildt	Tata McGraw -Hill	2nd (2007)
2	"Advanced Java 2 Platform How To Program"	H.M. Deital, P.J. Dietal and S.E. Santry	Prentice Hall.	2nd (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"Core Java"	Grey Cornell and Hortsman Cay S	Sun Microsystems Press.	2nd (2007)
2	"JSP: The Complete Reference"	Philip Hanna	Tata McGraw -Hill.	2nd (2007)

Course Code	Course Name	Course Type	CD	L	T	P	Marks		
							Internal	External	Total
26C2CAP-213	Linux System Administration Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: - Basic knowledge of Linux commands, file systems, and terminal usage.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the installation process and features of Linux desktop and server operating systems.
CO2	Apply Linux commands to perform file, process and user management operations.
CO3	Make use of Linux administration commands for system configuration and monitoring.
CO4	Explain server requirements and configuration strategies for Linux servers.
CO5	Implement Linux administration tasks to ensure security, efficiency and reliability in system operations.

Exp.No.	Experiment Title & Technical Task
1	Installation of Linux operating system. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Network configuration d. Setting time zones e. Creating password and user accounts f. Installing and removing packages g. Shutting down
2	Working with basic commands
3	Linux system administration a. Becoming super user b. Temporarily changing user identity with su command c. Using graphical administrative tools d. administrative commands e. administrative configuration files
4	Configuring NICs with Network Device Configuration Utilities (ip and ifconfig)
5	Install and configure a DNS Server with a domain name of your choice.
6	Install and configure DHCP server and client
7	Install and configure Mail Server
8	Install and configure Apache Web Server for hosting websites
9	Securing a simple network with Linux firewall (Netfilter/iptables)
10	Setting up Samba Server to share files and printers with Windows-based and other operating systems

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Linux Administration: A Beginner's Guide	Wale Soyinka	Tata McGraw -Hill	2nd (2007)
2	UNIX and Linux system administration Handbook Evi Nemeth	Dan Mackin	Pearson Education	2nd (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Linux: The Complete Reference	Richard Petersen	McGrawHill	6th (2015)
2	Linux All-In-One for Dummies	Emmett Dulaney	Wiley India.	2nd (2007)

Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-214	Career and Placement Planning - 2	Skill Enhancement Course	1	0	0	2	50	0	50

Prerequisites: Foundational grammar, vocabulary, and speaking skills.

Course Outcomes:

At the end of the course the student will be able to: -	
CO1	Demonstrate improved group communication and workplace interaction skills.
CO2	Apply verbal ability concepts in grammar, vocabulary, and reading tasks relevant to employability.
CO3	Participate effectively in group discussions, case-based conversations, and structured speaking tasks.
CO4	Develop foundational professional documents and workplace communication habits.
CO5	Analyse communication situations and respond with clarity, logic, and confidence.

Detailed Syllabus

Unit 1: Professional Communication in Group Contexts

Transition from academic to professional communication, speaking with purpose, body language in professional settings, listening in teams, collaboration skills, discussion etiquette, communication in formal vs informal contexts. **Activity:** Icebreaker with role-based speaking, body language observation task. **(5 Hours)**

Unit 2: Verbal Ability for Employability

Advanced sentence correction, error detection, commonly confused words, sentence completion, para jumbles basics, contextual vocabulary, reading comprehension with inference and tone-based questions. **Activity:** Timed verbal drills, RC strategy practice, sentence completion tasks.

(5 Hours)

Unit 3: Group Discussion & Analytical Communication

Introduction to group discussion, types of GDs, initiating and concluding a GD, agreeing and disagreeing politely, idea structuring, speaking with relevance, handling interruptions, current-affairs-based discussion approach. **Activity:** Mock GDs, topic analysis sheet, role rotation in GD.

(6 Hours)

Unit 4: Case Study & Problem-Solving Communication

Introduction to case study approach, identifying problem statement, brainstorming techniques, solution framing, presenting practical recommendations, collaborative problem solving, structured speaking under pressure. **Activity:** Short case analysis, group solution presentation, business scenario discussion.

(5 Hours)

Unit 5: Resume Basics, Digital Communication & Professional Presence

Introduction to resume writing, components of an effective resume, academic achievements and projects presentation, introduction to LinkedIn awareness, email etiquette basics, digital professionalism, online communication manners. **Activity:** Drafting first resume, email writing practice, profile headline exercise.

(5 Hours)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Verbal Ability book	TPP Dept.	TPP	6th Edition
2	Interviews and Group Discussions	T. S. Jain & Gupta	Upkar Publications	2nd(2008)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Word Power Made Easy	Norman Lewis	Goyal Publishers	4th (2012)
2	Communication Skills for Engineers	Sunita Mishra & C.Muralikrishna	Pearson Education	1st(2011)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	Externa	Total
26C2CAP-215	Value Added Course (NCC)	MOOC	0	0	0	2	-	-	S/US

Course Outcomes:

Defined by the online platform for the specific course chosen.

The Departmental committee shall select a MOOC available on any reputed platform. However, the selected MOOC should not be similar to the regular courses offered as a part of the department curriculum.
course

The overall monitoring of the MOOC course will be under the supervision of the teacher In-charge of the department. The Departmental Academic Committee shall assess the student work based on the relevant course completion certificate.

S= Satisfactory

US=Unsatisfactory