STUDY SCHEME & SYLLABUS
FOR
MASTER OF COMPUTER APPLICATIONS

BATCH-2025

Semester-I									
Course Code	**Course Type**	**Course Title**	**Cd**	**L**	**T**	**P**	**Marks Distribution**		
							Internal	**External**	**Total**
25C2CAP-B1	Bridge Course*	Computer Programming using C	S/US	2	0	0	50	-	50
25C2CAP-B2	Bridge Course*	Computer Science Essentials	S/US	2	0	0	50	-	50
25C2CAP-101	Core Theory	Discrete Structures & Optimization	4	4	0	0	30	70	100
25C2CAP-102	Core Theory	Programming in Python	4	4	0	0	30	70	100
25C2CAP-103	Core Theory	Advanced Data Structures	4	4	0	0	30	70	100
25C2CAP-104	Core Theory	Advanced Database Management System	4	4	0	0	30	70	100
25C2CAP-105	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	3	0	0	30	70	100
25C2CAP-111	Core Practical/Laboratory	Data Structures using Python Laboratory	2	0	0	4	70	30	100
25C2CAP-112	Core Practical/Laboratory	Advanced Database Management System Laboratory	2	0	0	4	70	30	100
25C2CAP-113	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	1	0	0	2	30	20	50
TOTAL			**24**	**19**	**0**	**10**	**320**	**430**	**750**

Master of Computer Applications (MCA)

Semester-II									
Course Code	**Course Type**	**Course Title**	**Cd**	**L**	**T**	**P**	**Marks**		
							Internal	**External**	**Total**
25C2CAP-201	Core Theory	Web Technologies	4	4	0	0	30	70	100
25C2CAP-202	Core Theory	Design & Analysis of Algorithms	4	4	0	0	30	70	100
25C2CAP-203	Core Theory	Advanced Java	4	4	0	0	30	70	100
25C2CAP-204	Core Theory	Linux Administration	4	4	0	0	30	70	100
25C2CAP-205	Core Theory	Information Security & Cyber Law	4	4	0	0	30	70	100
25C2CAP-211	Core Practical/Laboratory	Web Technologies Laboratory	2	0	0	4	70	30	100
25C2CAP-212	Core Practical/Laboratory	Advanced Java Laboratory	2	0	0	4	70	30	100
25C2CAP-213	Core Practical/Laboratory	Linux Administration Laboratory	2	0	0	4	70	30	100
	TOTAL		**26**	**20**	**0**	**12**	**360**	**440**	**800**

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

Master of Computer Applications (MCA)

Semester-III									
							Marks		
Course Code	Course Type	Course Title	Cd	L	T	P	MSE	Final Exam	Total
25C2CAP-301	Core Theory	Advanced Computer Networking	4	4	0	0	30	70	100
25C2CAP-302	Core Theory	Artificial Intelligence & Machine Learning	4	4	0	0	30	70	100
25C2CAP-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
25C2CAP-311	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	2	0	0	4	70	30	100
25C2CAP-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
25C2CAP-313		*Summer/Institutional Training	2	0	0	4	70	30	100
25C2CAP-314	Skill Enhancement Course	Career and Placement Planning - 1	1	0	0	2	50	-	50
25C2CAP-315	Value Added Course (NCC)	**MOOC	0	0	0	2	-	-	S/US
	TOTAL		**27**	**18**	**0**	**20**	**480**	**470**	**950**

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

S= Satisfactory

*Summer Internship Credits/marks, US=Un Satisfactory are also added in this semester's marks sheet

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Elective – I	
Course Code	**Course Title**
25C2CAP-PE1-01	Software Project Management
25C2CAP-PE1-02	Optimization Techniques
25C2CAP-PE1-03	Data Mining and Business Intelligence
25C2CAP-PE1-04	Enterprise Resource Planning

Elective – II	
Course Code	**Course Title**
25C2CAP-PE2-01	Mobile Applications Development
25C2CAP-PE2-02	Simulation & Modeling
25C2CAP-PE2-03	e-Commerce and Digital Marketing
25C2CAP-PE2-04	Software Testing & Quality Assuranc

Elective – II Laboratory	
Course Code	**Course Title**
25C2CAP-PE2-11	Mobile Applications Development Laboratory
25C2CAP-PE2-12	Simulation & Modeling Laboratory
25C2CAP-PE2-13	e-Commerce and Digital Marketing Laboratory
25C2CAP-PE2-14	Software Testing & Quality Assurance Laboratory

Master of Computer Applications (MCA)

Semester-IV									
Course Code	**Course Type**	**Course Title**	**Cd**	**L**	**T**	**P**	**Marks**		
							Internal	**External**	**Total**
25C2CAP-401	Core Theory	Machine Learning & Data Analytics using Python	4	4	0	0	30	70	100
25C2CAP-411	Core Practical/ aboratory	Machine Learning & Data Analytics using Python	2	0	0	4	70	30	100
	Elective – III		4	4	0	0	30	70	100
	Elective – III aboratory		2	0	0	4	70	30	100
25C2CAP-410		Research/Technical Seminar	1	0	0	2	0	100	100
25C2CAP-412		Project	8	0	0	16	180	120	300
25C2CAP-413	Skill nhancement ourse	Career and Placement Planning - 2	1	0	0	2	50	-	50
25C2CAP-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.
S= Satisfactory, US=Un Satisfactory
*Summer Internship Credits/Marks are also added in this semester's marks sheet.

Elective – III	
Course Code	**Course Title**
25C2CAP-PE3-01	Cloud Computing
25C2CAP-PE3-02	Digital Image Processing
25C2CAP-PE3-03	NLP and Speech Recognition
25C2CAP-PE3-04	IOT & Block chain Technology
25C2CAP-PE3-05	Full Stack Development
25C2CAP-PE3-06	Advanced Web Technologies

Elective – III Laboratory	
Course Code	**Course Title**
25C2CAP-PE3-11	Cloud Computing Laboratory
25C2CAP-PE3-12	Digital Image Processing Laboratory
25C2CAP-PE3-13	NLP and Speech Recognition aboratory
25C2CAP-PE3-14	IOT &Block chain Technology aboratory
25C2CAP-PE3-15	Full Stack Development Laboratory
25C2CAP-PE3-16	Advanced Web Technologies aboratory

SEMESTER 1ST

25C2CA P-B1
Computer Programming Using C

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE): -**
Total marks: 50	**Elective status:** No

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes:

CO#	Course outcomes
CO1	student should be able to understand the logic building used in Programming.
CO2	students should be able to write algorithms for solving various real life problems.
CO3	to convert algorithms into programs using C.

Detailed Contents	Contact hours
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. **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.	6
Unit-II **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
Unit-III **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. **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion.	8

Objects and Classes: Introduction to Object Oriented Concepts, Features of OOP, Basic of classes and Objects.	

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

25C2CAP-B2
Computer Science Essentials

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE):** -
Total marks: 50	**Elective status:** No

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes:

CO#	Course outcomes
CO1	understanding the concept of input and output devices of Computers
CO2	learn the basic concepts of Operating Systems and Database Systems
CO4	learn basic word processing, Spreadsheet and Presentation Graphics Software skills.

Detailed Contents	Contact hours
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) **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
Unit-II **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. **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	**7**

Unit-III **DBMS:** Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. **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.	**8**

Text Books:

1. Fundamentals of Computers, V Rajaraman,NAdabala, PHI.
2. Computer Fundamentals and Programming in C, Reema Thareja, Oxford University Press, 2016.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
4. Computer Fundamentals, A. Goel, 2010, Pearson Education.
5. Computer Course Windows 10 with MS Office 2016, Satish Jain (Author), BPB Publications.

Reference Books:

1. “Introduction to Computers”, Peter Norton

25C2CAP-101
Discrete Structures &Optimization

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic Mathematical Knowledge
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	solve problems using the principle of inclusion-exclusion.
CO2	rules on inference, symbolic logic and Boolean Algebra.
CO3	apply elementary counting techniques using the product and sum rules.
CO4	determine the simple or a multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

Detailed contents	Contact hours
Part A **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. **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) **Combinatorial Mathematics:** Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application	24 Hours

Part B **Monoids and Groups:** Groups, Semigroups and monoids, Cyclic semi graphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups. **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.	20 Hours

Text Books:

1. Discrete Mathematics (Schaum series), Lipschutz (McGraw Hill).
2. Applied Discrete Structures for Computer Science, Alan Doerr and Kenneth Levarseur (Creative Commons) 2012.

Reference Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen.(McGraw Hill)
2. Discrete Mathematics and Graph Theory, Sartha, (Cengage Learning)
3. Elements of discrete mathematics. C L Liu (McGraw Hill)

25C2CAP-102
Programming in Python

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 30	**Duration of end semester exam (ESE):**3hrs
External max. marks:70	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: **-NA-**
Additional material required in ESE:-NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	demonstrate the Python environment, data types, operators used in Python.
CO2	compare and contrast Python with other programming languages.
CO3	explain the use of control structures and numerous native data types with their methods.
CO4	design user defined functions, modules, and packages and exception handling methods.
CO5	construct and handle files in Python and learn Object Oriented Programming Concepts.

Detailed Contents	Contact hours
Part- A **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. **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. **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).	22 hours

Part- B **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. **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.	22 hours

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

25C2CAP-103
Advanced Data Structures

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	choose appropriate data structures and algorithms and design solution for a specific problem.
CO2	analyze the operations of hashing to retrieve data from data structure.
CO3	design and analyze programming problem statements.
CO4	explain with analysis of efficiency and proofs of correctness.
CO5	select algorithm design approaches in a problem specific manner.

Detailed contents	Contact hours
Part A Introduction to Data Structures: Data Structures and its Types, Algorithms, Time Complexity, Recurrence, Probabilistic Analysis, Amortized Analysis, Competitive Analysis. Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort. Hashing Techniques: Direct Address Tables, Hash Tables, Hash Functions, Open Addressing, Perfect Hashing. Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets.	22 Hours
Part B Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths, All Pairs Shortest Paths, Maximum Flow. String Matching: String, String Length, String Concatenation, String Copy, String-Matching, Brute Force algorithm, Rabin Karp algorithm, Knuth-Morris-Pratt (KMP) algorithm, Boyer–Moore algorithm.	22 Hours

Text Books:

1. Thomas Coremen, "Introduction to Algorithms", Third edition, Prentice Hall of India, 2009.

Reference Books:

1. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Addison Wesley, 2001.
3. Seymour Lipschutz, "Data structure", Indian Adapted Edition, Tata McGraw Hill, 200

25C2CAP-104
Advanced Database Management System

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	explain the basic concepts of DBMS and RDBMS.
CO2	apply normalization theory to the normalization of a database.
CO3	analyze the concept of Transaction Management & Recovery techniques in RDBMS.
CO4	summarize the concept of Transaction Management & Recovery techniques in RDBMS.
CO5	develop and implement No SQL databases (Open Source).

Detailed contents	Contact hours
Part A 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, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality). **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. **Transaction Management and Concurrency Control** techniques, Database Recovery Management Concepts and methods. Introduction and Need of **Database Administration** and activities of Database administration.	22 Hours

Part B **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 **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. **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	22 Hours

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concept", Sixth Edition, 2013, McGraw-Hill
2. Bipin C. Desai, "An Introduction to Database System" , Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi

Reference Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications
2. Peter Rob Carlos Coronel, "Database Systems", Cengage Learning, 8th ed.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, 2006, Pearson Education.

25C2CAP-105
Technical Communication

Program: MCA	**L:**3 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes:

CO#	Course outcomes
CO1	demonstrate the Basics of Technical Communication.
CO2	Develop the basic proficiency in reading & listening.
CO3	Select various techniques to enhance verbal communication.
CO4	Make use of various software's for Technical communication.

Detailed contents	Contact hours
Part A **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. **Basic Technical Writing:** Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters– Format &various types.	16 Hours
Part B **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. **Verbal Communication:** Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. **Technical Communication:** MS-Word, Adobe Frame maker and ROBO Help * Lab Exercises based on Listening and Speaking skills	17 Hours

Text Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi.
2. K KRamchandran, et al Business Communication, Macmillan, New Delhi.
3. Swati Samantaray, Business Commnication and Commnicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD).

25C2CAP-111
Data Structures using Python Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Structures
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	demonstrate the concept of data structures, python and apply algorithm for solving problems
CO2	make use of linear and non-linear data structures for processing of ordered or unordered data..
CO3	analyze various algorithms based on their time and space complexity.
CO4	construct the trees with linear and non linear

LIST OF EXPERIMENTS	
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 insertion 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.

Text Books:

1. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.
2. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.

Reference Books:

1. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.
2. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.

25C2CAP-112
Advanced Database Management System Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	construct query a database using SQL DML/DDL commands
CO2	analyze integrity constraints on a database.
CO3	develop PL/SQL programs including stored procedures, stored functions, cursors
CO4	design new database and modify existing ones for new applications
CO5	inspect various DBA roles/techniques

S.No.	Practical Assignments
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

Text Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications.
2. Steven Feuerstein and Bill Pribyl, "Oracle PL/SQL Programming", 5th Edition, 2009, O'Reilly Media.

25C2CAP-113
Technical Communication Laboratory

Program: MCA	**L**:0 **T**:0 **P**:2
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 2 hours per week
Internal max. marks: 30	**Theory/Practical:**Practical
External max. marks: 20	**Duration of end semester exam (ESE): -**
Total marks: 50	**Elective status:**Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	demonstrate the Basics of Technical Communication
CO2	develop the basic proficiency in reading & listening, comprehension, writing and speaking skills among students
CO3	formulate in order to comprehend spoken and written English language, particularly the language of their chosen technical field
CO4	select various techniques to enhance verbal communication
CO5	make use of various software for Technical communication

Assignments:

Interactive practice sessions in Language Lab on Oral Communication	
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

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

SEMESTER 2ND

25C2CAP-201
Web Technologies

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks:100	

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

Co requisite: Student must know the background of Markup Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	demonstrate the basics of Internet and Web Services.
CO2	explain and Distinguish Programming Language and Markup Language.
CO3	construct various web pages and web sites together.
CO4	show user input from the remote users.
CO5	discuss connectivity concepts of Front End and Back End.

Detailed Contents	Contact hours

Part-A **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 TCP/IP and its services, transmission control protocol. **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). **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 **Type of Lists** (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists.	24 hours

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.	
Part-B **Linking Documents:** Links (External Document References, Internal Document References), Image As Hyperlinks. **Frames:** Introduction to Frames: The<FRAMESET> tag, The <FRAME> 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. **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).	20 hours

Text Books:

1. Internet for Every One: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.
3. RajKamal, "Internet& Web Technologies", edition Tata McGraw-Hill Education 2009.
4. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
5. A Beginner's Guide to Html Http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/html/html_tutorial.pdf
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/html/
4. https://www.cs.uct.ac.za/mit_notes/web_programming.html

5. http://www.pagetutor.com/table_tutor/index.html

25C2CAP-202
Design & Analysis of Algorithms

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Student must have knowledge about Data Structures**.**
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	choose problems based on their characteristics and practical importance.
CO2	develop Algorithms using iterative/recursive approach.
CO3	design algorithm using an appropriate design paradigm for solving a given problem.
CO4	classify P, NP or NP Complete problems.

Detailed contents	Contact hours
Part A **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. **Basic Algorithm Design Techniques:** Divide-and-conquer, Greedy approach, Randomization and dynamic programming. **Example problems on Backtracking:** n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and- Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.	24 Hours
Part B **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. **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.	20 Hours

Text Books:

1. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publication
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. J.Kleinberg and E.Tardos, Algorithm Design by, Pearson Education India
4. Coremen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI

Reference Books:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2nd Edition.
2. Michael T Goodrich and Roberto Tamassia : Algorithm Design, Wiley India
3. R C T Lee, S S Tseng, R C Chang, Y T Tsai : Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill

25C2CAP-203
Advanced Java

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	explain the features of advanced Java and write various programs.
CO2	construct API and implement Serialization concept of Java.
CO3	analyze Java Generics and develop Projects.
CO4	develop effective digital and social media strategies.

Detailed contents	Contact hours
Part A **Servlets:** The life cycle of Servlet, Java Servlet Development kit, Servlet API, Reading the servletparameters, Reading initialization parameters, Handling HTTP requests and responses, Using cookies, Session tracking and security issues. **Java Server Pages (JSP):** JSP Architecture, Life cycle of JSP, JSP syntax basics–Directives,Declarations, Scripting, Standard actions, Custom tag libraries, Implicit objects, Object scope. Synchronization issues, Session management. **Struts :** Introduction to struts framework, understanding basic architecture of Model, view, controller. Deploying the application in struts with database connectivity.	22 Hours
Part B **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. **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.	22 Hours

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, "Advanced Java 2 Platform HOW TO PROGRAM", Prentice Hall.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.
2. Philip Hanna, "JSP: The Complete Reference", Tata McGraw –Hill.

25C2CAP-204
Linux Administration

Program: MCA	**L**:4 **T**:0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite:
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	demonstrate the technical details of Linux operating system.
CO2	experiment with various Linux command and Implement file hierarchical structuring.
CO3	create user, manage and configure packages in Linux.
CO4	classify and configure the various internet services.

Detailed contents	Contact hours
Part A **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, **Understanding files and File System:** Understanding Files and Directories in Linux, File Structure and hierarchy, File Permissions, File Management and Manipulation, Managing File System **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	22 Hours
Part B **DNS:** 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	22 Hours

Apache **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	

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India

25C2CAP-205
Information Security and Cyber Law

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	identify issues involved in the field of information security.
CO2	explain the key security requirements of Confidentiality, Integrity & Availability.
CO3	demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO4	define the concept of Security policies and Cyber Laws.

Detailed contents	Contact hours
Part A 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. **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. **Malicious Software:** Types of Malicious Software (Malware)-Viruses, Worms,SPAM E-mail, Trojans, Zombie, Bots, Keyloggers, Phishing, Spyware, Backdoors, Rootkits, Preventive Measures.Denial-of-Service Attacks: Types of DoS attacks, Defenses Against Denial-of-Service Attacks.	22 Hours

Part B	22 Hours
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) **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.	

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.
2. Surya Prakash Tripathi, RitendraGoel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India,2014.

Reference Books:

1. Christof Paar , Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010
2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.
3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

25C2CAP-211
Web Technologies Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:**4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 70	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Core
Total marks: 100	

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

Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	explain Static and Dynamic concepts of web designing.
CO2	develop ability to retrieve data from a database and present it online.
CO3	construct web pages that apply various dynamic effects on the web site.
CO4	clasify complex and large problems using Scripting Language & Markup Language.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

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 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 logo of your college in left pane and logo of university in right pane.
10.	Create Bio- Data of an employee.
11.	Design 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 website in your college or department and create link for Tutorial of 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 greatest number of three numbers.
19.	Write a script to compute, the Average and Grade of students marks.
20.	Design a scientific calculator and make event 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 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.

Reference Books:

1. Greenlaw R; Hepp E, “Fundamentals of Internet and www”, 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner’s Guide to HTML Http://www.Ncsa.Nine.Edit/General/Internet/www/ html.prmter.

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

25C2CAP-212
Advanced Java Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	classify problems as P, NP or NP Complete
CO2	explain the advanced features of Java and write the programs.
CO3	construct API and implement Serialization concept of Java.
CO4	analyze Java Generics and develop Projects.

S.No.	Practical Assignments (Java)
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.
	Practical Assignments (SEO)
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.

Text Books:

1. Herbert Schildt , “The Complete Reference Java 2” , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, “Advanced Java 2 Platform How To Program”, Prentice Hall.
3. Laudon and Traver, “E-Commerce: Business, Technology & Society”, Pearson Education
4. Shivani Karwal, “Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing”, CreateSpace

Independent Publishing Platform, 1st edition.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., “Core Java”, Sun Microsystems Press.
2. Philip Hanna, “JSP: The Complete Reference”, Tata McGraw –Hill..

25C2CAP-213
Linux System Administration Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks:70	**Duration of end semester exam (ESE):** -
External max. marks:30	**Elective status:** Core
Total marks: 100	

Prerequisite:
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	make use of digital marketing for developing effective digital and social media strategies
CO2	experiment with various commands for performing different operation
CO3	apply various Linux administration commands
CO4	build and configure various servers in Linux environment

Lab Practicals

S.No	Practical Assignments
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 configuring a DNS Server with a domain name of your choice.
6.	Install and configuring DHCP server and client
7.	Install and configuring Mail Server
8.	Install and configuring 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

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education
3. Linux Command Line and Shell Scripting Bible, 3rd Edition Richard Blum, Christine Bresnahan, Wiley

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India

Semester-III

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-301	Advanced Computer Networking	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Computer Networks / Data Communication and basic knowledge of TCP/IP protocols.

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the fundamentals of computer networks, network architecture, OSI reference model and physical layer concepts.
CO2	Describe data link layer and network layer concepts including error detection techniques, ARQ protocols, addressing and routing algorithms.
CO3	Illustrate transport layer and application layer protocols such as TCP, UDP, DNS, WWW and FTP and compare TCP/IP with the OSI model.
CO4	Classify wireless and mobile networking technologies like WLAN, cellular networks,adhoc networks etc.
CO5	Analyze wireless communication systems, cellular network evolution, frequency reuse, channel assignment and handoff strategies.

Detailed Syllabus

Section-A

UNIT–I: Computer Networks: Uses of computer Networks, Goals and applications of networks, Computer Network Structure and Architecture, Reference models: OSI model

Physical Layer: Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared).

(10 Hrs)

UNIT–2 Data Link Layer: Design issues, Framing, Error detection and correction codes: parity, checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go- back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP

Network Layer: Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms

Medium Access Sub-Layer: Static and dynamic channel allocation, Random Access: ALOHA, CSMA-CA/CD protocols, Controlled Access: Polling, Token Passing.

(11 Hrs)

UNIT–3 Transport Layer: Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de- multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison.

Application Layer: World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP)
TCP/IP model, Comparison of TCP/IP and OSI models.

(11 Hrs)

Section-B

UNIT–4: An Overview of Select Wireless and Mobile Networking Technologies: Principles, WLANs: IEEE 802.11, Cellular Networks, Issues in Seamless Mobility

Adhoc networks: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies.

(10 Hrs)

UNIT–5: **Wireless Communication Systems:** Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.

Wireless System Design: Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity,improving coverage and capacity in cellular systems.

(10 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"Computer Networks	A.S. Tannenbaum,	Prentice Hall	5th (2010/2011)
2	Computer Networks: A Systems Approach,	Larry L. Peterson & Bruce S. Davie	Addison Wesley / Morgan Kaufmann	6th (2020/2021)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Computer and Communication Networks	Nader F. Mir	Pearson Prentice Hall	1st (2006)
2	Computer Networks and Internets (with Internet Applications)	Douglas E. Comer	Pearson Education	4th (2009)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-302	Artificial intelligence & machine learning	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Basic programming and fundamental knowledge of Artificial Intelligence, Machine Learning, and Mathematics.

Course Outcomes:

At the end of the course the student will be able to	
CO1	Explain the fundamentals of Artificial Intelligence, intelligent agents and apply search algorithms for problem solving.
CO2	Apply knowledge representation techniques and reasoning methods including logic, inference and expert systems for solving problems.
CO3	Describe Machine Learning concepts and implement basic algorithms for regression, classification and model evaluation.
CO4	Classify advanced Machine Learning techniques such as SVM, ensemble methods, clustering and artificial neural networks.
CO5	Analyze Deep Learning, NLP and Reinforcement Learning concepts along with the AI applications and ethical issues.

Detailed Syllabus

Section-A

UNIT– Introduction to Artificial Intelligence: definition, history, and applications. Characteristics of intelligent agents and rationality. Problem-solving framework and state space representation. Uninformed search techniques (BFS, DFS, Uniform Cost Search). Informed search strategies (Greedy Best First Search, A* Algorithm). Game playing strategies and introduction to adversarial search (Minimax algorithm, Alpha-Beta pruning).

(8 Hrs)

UNIT–2 Knowledge representation schemes: propositional logic, predicate logic, syntax and semantics. Inference rules and resolution. First-order logic and unification. Semantic networks, frames, and production systems. Introduction to expert systems and their architecture. Reasoning under uncertainty: probability theory, Bayes theorem, Bayesian networks, fuzzy logic concepts.

(7 Hrs)

UNIT–3 Introduction to Machine Learning and its types: supervised, unsupervised, and reinforcement learning. Data preprocessing: data cleaning, normalization, feature engineering. Regression techniques (Linear Regression, Polynomial Regression). Classification algorithms (k-NN, Decision Trees, Logistic Regression). Model evaluation methods: confusion matrix, precision, recall, F1-score, ROC curve, cross-validation.

(8 Hrs)

Section-B

UNIT–4: Support Vector Machines (SVM) and kernel functions. Ensemble learning methods: Bagging, Boosting, Random Forest, AdaBoost. Clustering techniques: K-Means, Hierarchical clustering, DBSCAN. Artificial Neural Networks: perceptron model, multilayer perceptron, activation functions, backpropagation algorithm. Bias-variance tradeoff, regularization, hyperparameter tuning.

(8 Hrs)

UNIT–5: Introduction to Deep Learning and its architecture. Convolutional Neural Networks (CNN) for image processing. Recurrent Neural Networks (RNN) and LSTM for sequence modeling. Natural Language Processing basics. Reinforcement Learning fundamentals and Q-learning. AI ethics, fairness, explainability, and real-world applications in healthcare, finance, robotics, and autonomous systems.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Artificial Intelligence	A Modern Approach, Russel and Norvig,	Prentice Hall.	4th (2020)
2	Artificial Intelligence	Elaine Rich, Kevin Knight and SB Nair	MedTech Science Press	4th (Revised 2020)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Soft Computing: With Matlab Programming	N. P. Padhy, S. P. Simon,	Oxford Higher Education.	4th (2020)
2	Artificial Intelligence: A Modern Approach	Stuart Russell & Peter Norvig	Pearson 4th Education	(2020)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-303	Theory of Computation	Core Theory	4	4	0	0	30	70	100

Prerequisite: -Discrete Mathematics and basic knowledge of Data Structures.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe formal languages, paradoxes and automata models and finite automata minimization.
CO2	Apply regular expressions, grammars and context-free grammar techniques, including simplification and normal forms, to characterize languages.
CO3	Analyze pushdown automata concepts, including parse trees, derivation trees, PDAs.
CO4	Interpret Turing machine models, variations and Church-Turing thesis for solving simple computational problems.
CO5	Categorize the various problems and measure the computational complexity.

Detailed Syllabus

Section-A

UNIT–I: Formal Language, Non-Computational Problems, Diagonal Argument,Russels's Paradox.
Theory of Automata: Deterministic Finite Automaton (DFA), Non- Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

(11 Hrs)

UNIT–2: Regular Sets and Regular Grammars: Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis. **Context Free Language:** Properties of Context Free Language, Chomsky Classification of Languages, Context Free Grammar, Simplification of Context Free Grammar, Chomsky Normal Form,Greibach Normal Form.

(11 Hrs)

UNIT–3: Push Down Automata: Definition and motivation of PDA, Difference between finite automata and PDA, Components of a PDA, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context-Free Grammars, Non-Deterministic Pushdown Automaton (NPDA) .

(10 Hrs)

Section-B

UNIT–4: Turing Machines (TM): Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis.Recursive and Recursively-Enumerable Languages; Context- Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.

(10 Hrs)

UNIT–5: Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.

(10 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	" Introduction to Automata Theory Languages, and Computation"	Jeffrey Ullman and John Hopcroft	3e, Pearson Education India,	4th (2015)
2	Introduction to Languages and the Theory of Computation	John Martin	O'Reilly	7th (2025)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Computer Theory	Daniel. I.A. Cohen	John Wiley & Sons	2nd (2009)
2	Theory of Computer Science: Automata, Languages and Computation	K. L. P. Mishra and N. Chandrasekharan	PHI Learning	3rd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE1-01	Software Project Management	Core Theory	3	3	0	0	30	70	100

Prerequisite: Basic knowledge of Software Development Life Cycle (SDLC), basic management principles, and a functional understanding of programming and database concepts

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe project management fundamentals, stakeholder roles, project processes and techniques.
CO2	Explain project evaluation,process and planning techniques including COCOMO 2, PERT and Monte Carlo simulation.
CO3	Classify the project execution strategies to develop teams, manage stakeholders and ensure quality delivery.
CO4	Apply monitoring and control processes of project strategies for effective project control.
CO5	Analyze strategies for quality assurance, team building, leadership, organizational behavior and apply software project management tools for effective project execution.

Detailed Syllabus

Section-A

UNIT–I: Project Management Fundamentals- Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes.
Planning and Resourcing a Project - Identifying Requirements, Creating the Work Breakdown structure, Developing the Project Schedule, Developing a Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks

(8 Hrs)

UNIT–2: Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning,

(8 Hrs)

UNIT–3: Executing and Managing a Project -Project Executing Processes- Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

(7 Hrs)

Section-B

UNIT–4: Project Monitoring and Controlling Processes - Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process, Collecting Data, Visualizing Progress, Cost Monitoring review techniques, Project termination review, Earned Value analysis,Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance.

(8 Hrs)

UNIT–5: Quality Management and People Management- Introduction, Understanding Behaviour, Organizational Behaviour, Selecting The Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. Overview of project management tools for software.

(8 Hrs)

Textbook

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Project Management	Bob Hughes, Mike Cotterell	Tata McGraw Hill	6th (2015)
2	Software Project Management: A Unified Framework	Royce	Pearson Education	2nd (2010)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Effective Software Project Management	Robert K. Wysocki	Wiley	2nd (2009)
2	Software Engineering: A Practitioner's Approach	R.S. Pressman	McGraw-Hill.	3rd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE1-02	Optimization Techniques	Core Theory	3	3	0	0	30	70	100

Prerequisite: - A strong grasp of calculus, linear algebra, and basic programming logic

Course Outcomes:

At the end of the course the student will be able to	
CO1	Summarize the scope of Operations Research and formulate linear and non-linear programming models for different applications.
CO2	Analyze linear programming techniques, including simplex, duality, sensitivity analysis, and branch-and-bound methods to solve optimization problems.
CO3	Examine the methods to find initial feasible and optimal solutions for transportation and assignment problems.
CO4	Explain network construction, CPM computations, floats, and crashing techniques, and formulate strategies for effective project scheduling.
CO5	Develop solutions for two-person zero-sum games using graphical methods, mixed strategies, and linear programming approaches.

Detailed Syllabus

Section-A

UNIT–I: Introduction to Operations Research (OR): Definition, objectives, and applications in industry, business, and engineering, Introduction to linear and non-linear programming formulation of different models, Steps in problem formulation Converting real-life problems into mathematical models.

(7 Hrs)

UNIT–2: Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.
Integer Programming: Branch and bound technique.

(8 Hrs)

UNIT–3: Transportation and Assignment Problem: Balanced and unbalanced TP, Formulation and constraints, Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solution using MODI method. Hungarian method for optimal assignment, Dealing with unbalanced assignment problems

(8 Hrs)

Section-B

UNIT–4: Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM),Identification of critical path, Scheduling project activities, Crashing, Reducing project duration at minimum cost, Cost-time trade-offs and decision-making.

(8 Hrs)

UNIT–5: Game Theory: Two person zero-sum game, Definition and basic concepts: players, strategies, payoff matrix, Saddle point and value of the game, Game with mixed strategies, Graphical method and solution by linear programming, Formulating game problems as LP problems, Solving using simplex method.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Numerical Optimization and Applications,	Chandra, S., Jayadeva, Mehra,	Narosa	5th (2015)
2	Operations Research-An Introduction	Taha H.A	PHI	2nd (2010)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to optimization: Operations Research	Pant J. C	Jain Brothers	2nd (2009)
2	Linear Programming and Network flows	Bazaarra Mokhtar S.,	John Wiley .	3rd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE1-03	Data Mining and Business Intelligence	Core Theory	3	3	0	0	30	70	100

Prerequisite: - A solid understanding of database management systems (SQL), basic statistics and probability, and a foundational knowledge of data structures and algorithms.

Course Outcomes

At the end of the course the student will be able to	
CO1	Illustrate the lifecycle of data, building blocks of data warehouses and marts along with the concepts, roles and processes of business intelligence.
CO2	Identify BI and DW architectures, OLAP/OLTP concepts, and dimensional analysis techniques.
CO3	Classify data mining ,data preprocessing,data clearing and data reduction methods.
CO4	Explain association rule mining and classification methods,prediction methods with neural networks.
CO5	Analyze data mining and analytics strategies for business intelligence applications in various industries.

Detailed Syllabus

Section-A

UNIT–I: Introduction: Reporting and Analysing data, Raw data to valuable information-Lifecycle of Data, The building Blocks: Defining Features – Data Warehouses (DW) and Data Marts - Overview of the components – Metadata, Need, Basic elements, trends. Business Intelligence (BI) Definitions and Concepts, BI Process and Technology, BI Roles and Responsibilities.

(8 Hrs)

UNIT–2: The Architecture of BI and DW: BI and DW architectures and its types, Relation between BI and DW - OLAP and OLTP definition and its differences, Dimensional analysis: Drill-down and roll-up – slice and dice or rotation, schemas: Stars, snowflakes and fact constellations .

(7 Hrs)

UNIT–3: Introduction to data mining (DM) and Data Preprocessing: Motivation for Data Mining, Data Mining Definition, and Functionalities, Classification of DM Systems - DM task and its applications, Integration of a Data, KDD Process, Steps of pre-processing data - Data cleaning: Missing Values, Noisy Data - Data, Integration, and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression .

(8 Hrs)

Section-B

UNIT–4: XConcept Description and Association Rule Mining: Introduction, Data Generalization and summarization-based characterization, Association Rule Mining; Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm Classification and Prediction: Introduction, Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression.

(8 Hrs)

UNIT–5: Data Mining for Business Intelligence Applications: Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., Introduction to Advance Topics Clustering, Spatial mining, web mining, text mining, Data Analytics Life Cycle: Big data Business Analytics, State of the practice in analytics role of data scientists, Hadoop architecture .

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"Data Mining Concepts and Techniques	J. Han	M. Kamber,	2nd (2015)
2	Data mining: Concepts, models, methods and algorithms,	M. Kantardzic	John Wiley &Sons Inc.	3rd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Mining and Business Intelligence	Dr. Jyotiranjan Hota	BPB Publications	Latest (2025)
2	Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel® with XLMiner®	Galit Shmueli, Nitin R. Patel, Peter C. Bruce	Wiley	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE1-04	Enterprise Resource Planning	Core Theory	3	3	0	0	30	70	100

Prerequisite: - A functional understanding of business processes, database management systems (SQL)

Course Outcomes:

At the end of the course the student will be able to	
CO1	Explain the fundamental concepts and models of ERP along with the related technologies like BPR, OLAP, SCM, PLM and CRM.
CO2	Apply ERP functional modules across finance, manufacturing, HR, plant maintenance and material management.
CO3	Make use of ERP implementation strategies, project teams, vendor roles and employee training to address challenges and ensure effective deployment.
CO4	Examine post-implementation maintenance, organizational impact, ERP success factors, ROI calculations and formulate strategies to overcome ERP inhibitors.
CO5	Interpret the strategies using emerging ERP technologies, extended ERP systems, e-commerce, e-governance and analyze case studies.

Detailed Syllabus

Section-A

UNIT–I: Basic ERP Concepts: Enterprise-An overview, Benefits & Risk, Evolution and Structure, Conceptual Model of ERP.ERP & Related Technologies: Business Process Reengineering (BPR), Data Warehousing and Data Mining, OLAP, Product Life Cycle Management, Supply Chain management, CRM.

(8 Hrs)

UNIT–2: ERP Functional Module: Introduction, Finance, Manufacturing, Human Resource, Plant maintenance, Material Management, Integration of ERP, Supply Chain and Customer Relationship Application.

(7 Hrs)

UNIT–3: ERP Implementation: Implementation Challenges / Strategies / Methodologies, ERP Project Teams, Vendors and Consultants, Dealing with employee resistance, Training and Education, data migration, Project Management and monitoring Strategic Grid: Useful guidelines for ERP Implementations. .

(8 Hrs)

Section-B

UNIT–4: Post Implementation : Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Calculation of ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators.

(8 Hrs)

UNIT–5: Emerging Trends on ERP: Technologies in ERP Systems and Extended ERP, ERP Market Place and Dynamics Future Directives in ERP; ERP E Commerce & E – Governance: Concept, frame work, area of application like public sector service industry, Case Studies: Development and Analysis of ERP Implementations

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"Enterprise Resource Planning	Alexis Leon	TMH	2nd (2015)
2	Enterprise Resource Planning Concepts and Practice,	Vinod Kumar Garg	PHI.	3rd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	ERP A Managerial Prospective	S Sadagopan	TMH	Latest 2025
2	Enterprise Integration	Sandoe	John Wiley	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-05	Mobile Application Development	Core Theory	3	3	0	0	30	70	100

Prerequisite: - A strong proficiency in Object-Oriented Programming (OOP), a solid understanding of Web Technologies

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the characteristics, benefits, frameworks, tools, and device profiles for mobile applications.
CO2	Apply user interface design principles, data handling techniques and testing strategies to develop and debug mobile applications.
CO3	Explain features of various mobile operating systems, including Android, iOS, Windows, Symbian and BlackBerry in context of application development.
CO4	Make use of Android toolkit components, memory management, communication protocols and deployment strategies to develop effective Android applications.
CO5	Build iOS applications using development environment, architecture, UI toolkit, event handling, graphics and animation techniques for advanced app features.

Detailed Syllabus

Section-A

UNIT–I: Introduction: Definition and scope of mobile applications, Evolution of mobile applications from feature phones to smartphones, Importance in business, education, healthcare, and entertainment, Characteristics and Benefits – Frameworks and Tools, Types, Application Model. Profiles of Mobile devices

(7 Hrs)

UNIT–2: **Building Blocks of Mobile Applications:** User Interface Designing, Layout, User Interface elements, Functionality based user interface, Naïve Data Handling, Sprucing up Mobile applications **.**
Testing Mobile Applications: Debugging Applications, Testing Strategies, Test Automation of Applications.

(8 Hrs)

UNIT–3: Mobile Operating System --Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc.

(8 Hrs)

Section-B

UNIT–4: Android programming: Android toolkit, Components of an Android application, Android Software Development using Eclipse – Concepts, Terminology, Views and Perspectives, memory management, communication protocols, application development methods, deployment.

(8 Hrs)

UNIT–5: IOS: Development environment, iOS Layers, Architecture, User Interface tool kit interfaces, Event handling, Graphics services, Layer Animation,BasiciPhone Styling, Advanced iPhone Styling.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Mobile Apps Development	Anubhav Pradhan	M. Kamber,	2nd (2015)
2	Professional Mobile Application Development	Jeff McWherter	John Wiley &Sons Inc.	3rd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Programming Android	Zigurd Mednieks, L. Dornin	O'Relly Publications	Latest (2025)
2	Learning iPhone Programming	A. Allan	O'Relly	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-06	Simulation & Modelling	Core Theory	3	3	0	0	30	70	100

Prerequisite: - A strong foundation in probability and statistics, differential equations

Course Outcomes

At the end of the course the student will be able to	
CO1	Illustrate simulation concepts, system types, modeling techniques, Monte Carlo method and differences between simulation and analytical methods.
CO2	Apply statistical methods to model simulation inputs, estimate parameters and perform goodness-of-fit tests for discrete and continuous data.
CO3	Analyze the techniques of verification, validation, calibration, and output analysis for terminating and steady-state simulations.
CO4	Explain queuing theory principles and formulate simulation models for single-server and multi-server queueing systems.
CO5	Create simulation experiments using industry-standard software and languages and apply statistical tools for experimentation and analysis.

Detailed Syllabus

Section-A

UNIT–I: Inventory Concept: The technique of Simulation, Major application areas, concept of a System, Environment, Continuous and discrete systems, systems modeling types of models progress of a Simulation Study, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Numerical Computation Technique for discrete and continuous models, Continuous System Simulation.

(8 Hrs)

UNIT–2: **Input Modeling-** Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile- Quantile Plots.100 Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests applied to Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, pValues and Best Fits.

(8 Hrs)

UNIT–3: Verification and Validation of Simulation Models- Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation.

(7 Hrs)

Section-B

UNIT–4: Simulation of Queuing Systems: Rudiments of queuing theory, Simulation of single-server queue, Simulation of two-server queue.**Output Analysis of a Single Model**- Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means forInterval Estimation.

(8 Hrs)

UNIT–5: Simulation Software- Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.**Simulation Languages**: Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete-Event System and Simulation	Jerry Banks	M. Kamber,	2nd (2015)
2	System Simulation	Gordon, G	Prentice-Hall	2nd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete-event modeling and simulation: a practitioner's approach	Gabriel A. Wainer	CRC press	Latest (2025)
2	Building software for simulation: heory and algorithms, with pplications in C++	James J. Nutaro	Wiley	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-07	E-Commerce & Digital Marketing	Core Theory	3	3	0	0	30	70	100

Prerequisite: - Understanding of web technologies (HTML/CSS), basic marketing principles, and data analytics

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the technical components, frameworks, applications and architectural models of e-commerce and electronic business.
CO2	Apply knowledge of electronic payment systems, including digital tokens, smart cards and risk management, to design secure payment solutions.
CO3	Analyze EDI concepts, standards, software implementation, legal and security issues and apply them to business applications.
CO4	Explain online marketing components including email, social media and mobile marketing by prioritizing the strategies for effective digital campaigns.
CO5	Implement search engine optimization, social media marketing and content strategies, for website creation to enhance web presence and engagement.

Detailed Syllabus

Section-A

UNIT–I: Introduction to Electronic Commerce: Technical Components of E- commerce, E-Commerce Framework, E-Commerce Applications and Electronic Business. Internet Service provider and World wide web. Architectural Framework for Electronic Commerce, WWW as the Architecture and Hypertext publishing.

(8 Hrs)

UNIT–2: **Electronic payment System :** Types and Traditional payment, Value exchange system, Electronic funds transfer, Digital Token Based Electronic Payment System, Smart Cards – Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.

(7 Hrs)

UNIT–3: Electronic Data Interchange : Concepts and applications of EDI and Limitation. EDI and Electronic Commerce standardization and EDI – EDI Software Implementation. EDI Applications in Business – EDI: Legal, Security and Privacy issues.E- Governance for India : Indian customer EDI system and Service centres.

(8 Hrs)

Section-B

UNIT–4: Introduction to Digital Marketing : Components of Online Marketing (Email, Forum, Social network, Banner, Blog) , Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing, Online Advertising, Mobile Marketing, Web analytics and Email Marketing.

(8 Hrs)

UNIT–5: Search Engine Optimization (SEO) and Social Engine Marketing (SEM).: Importance of Internet and Search Engine and Role of Keywords in SEO, On-Page Optimization (Onsite) and Off Page Optimization. Introduction to Social Media Marketing (SMM). **Website Planning & Creation** : Content Marketing Strategy, Keywords Research and Analysis, Web Presence and Creating content.Successful content marketing strategies and case studies

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	E-Commerce Strategy, Technologies and Applications	Whitley, David	Tata McGraw Hill.	1st (2015)
2	E-Commerce: Business, Technology & Society	Laudon and Traver	Pearson Education	2nd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Digital Marketing	Seema Gupta	McGraw Hill.	Latest (2025)
2	Fundamentals of Digital Marketing	Puneet Singh Bhatia	Pearson	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-08	Software Testing & Quality Assurance	Core Theory	3	3	0	0	30	70	100

Prerequisite: -Basics of DBMS, Statistics, and Programming

Course Outcomes

At the end of the course the student will be able to	
CO1	Summarize software testing concepts, verification and validation, test strategies, debugging processes and various types of testing.
CO2	Make use of black-box, white-box and object-oriented testing techniques to design and execute effective test cases.
CO3	Analyze test planning, phase testing and specialized system testing including web, client-server and real-time systems.
CO4	Explain software quality assurance concepts, standards, metrics, and methodologies and formulate strategies to enhance software quality.
CO5	Develop risk management and software configuration management plans to ensure project stability.

Detailed Syllabus

Section-A

UNIT–I:Software Testing: Testing, Verification and Validation, Test Strategies for Conventional andObject Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha andBeta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing,Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies.

(8 Hrs)

UNIT–2: **Testing Techniques**: Software Testing Fundamentals, Black Box and White Box Testing,Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices,Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph BasedTesting Methods, Equivalence Partitioning,
Object Oriented Testing Methods:Applicability of Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-BasedTesting, Scenario-Based Testing, Random Testing and Partition Testing for Classes,InterClass Test Case Design.

(8 Hrs)

UNIT–3: Testing Process and Specialized Systems Testing: Test Plan Development, RequirementPhase, Design Phase and Program Phase Testing, Testing Client/Server Systems, TestingWeb based Systems, Testing Off-the-Shelf Software, Testing in Multiplatform Environment,Testing for Real Time Systems, Testing Security.

(7 Hrs)

Section-B

UNIT–4: Software Quality Assurance Concepts and Standards: Quality Concepts, Quality Control,Software Quality Attributes, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, ReviewGuidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000,ISO 9001:2000, ISO 9126 Quality Factors, CMM, CMMI, PCMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics.

(8 Hrs)

UNIT–5: Risk Management and Change Management: Software Risks, Risk Identification, RiskProjection, Risk Refinement, The RMMM Plan, Software Configuration Management,Baselines, Software Configuration Items, SCM Process: Version Control, Change Control,Configuration Audit, Configuration Management for Web Engineering.

(8 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Quality Assurance – From Theory to Implementation	Daniel Galin	Galin	1st (2015)
2	Software Testing Techniques	Boris Beizer	Pearson Education	2nd (2019)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Engineering,	Roger S. Pressman,	McGraw Hill.	Latest (2025)
2	Effective Methods for Software Testing	William	Wiley	2nd (2010)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-311	Advanced Computer Networking Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: Understanding of TCP/IP protocols, OSI model layers, and basic socket programming

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe networking components, transmission media, LAN topologies and basic TCP/IP configuration in Windows and Linux environments.
CO2	Identify cabling techniques, configure file and printer sharing, set up networks and implement subnet planning for practical network scenarios.
CO3	Classify network designs and simulate routing algorithms for Adhoc networks using packet capture and network simulation tools.
CO4	Configure WLAN, wireless access points and Wireless Local Loop to optimize network performance.
CO5	Design wired and wireless network solutions, including Adhoc and infrastructure networks, using open-source tools and protocols.

Exp. No.	Experiment Title & Technical Task
1	Familiarization with Networking Components and devices: LAN Adapters, Switches, Routers etc.
2	Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
3	Preparing Straight and Cross Cables.
4	Study of various LAN Topologies and their creation using Network devices,Cables and Computers..
5	Configuration of TCP/IP Protocols in Windows and Linux.
6	Implementation of File and Printer sharing.
7	Designing and Implementing Class A, B, C Network
8	Subnet Planning and its Implementation.
9	Installation of ftp server and client.
10	To develop programs for simulating routing algorithms for Adhoc networks.
11	To install any one open source packet capture software like packet tracer etc.
12	To configure Wireless Local Loop.
13	To configure WLAN.
14	To configure Adhoc Networks.
15	To install and configure wireless access points.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Computer Networks	A.S. Tannenbaum.	Prentice Hall,	Latest (2022/23)
2	Data Communications & Networking	Behrouz A	Packt Publishing	3rd (2020)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Computer Networks and Internet	D.E.Corner	No Starch Press	3rd (2018)
2	Data Networks	D. Bertsekas	Prentice-Hall	2nd (2021)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-312	AI & ML Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: Basics of Python Programming and Statistics,Artificial Intelligence & Machine Learning

At the end of the course the student will be able to	
CO1	Summarize the role of Python with NumPy and Pandas in data handling, preprocessing and analysis.
CO2	Create visualizations using Matplotlib and Seaborn along with the exploratory data analysis(EDA).
CO3	Design machine learning models such as Linear Regression, Logistic Regression, KNN, Decision Trees, and SVM.
CO4	Apply unsupervised learning and dimensionality reduction techniques such as K-Means clustering and PCA to solve real world problems.
CO5	Analyze deep learning models and end-to-end ML applications using TensorFlow/Keras, model evaluation, optimization, and simple deployment.

Course Outcomes:

Exp. No.	Experiment Title & Technical Task
1	Installation and setup of Python (Anaconda/Jupyter). Introduction to NumPy arrays and basic operations.
2	Implement programs for matrix operations, statistical functions, and data structures in Python.
3	Load datasets using Pandas. Perform filtering, grouping, and handle missing values.
4	Create visualizations using Matplotlib and Seaborn (line plots, bar charts, histograms, scatter plots).
5	Implement feature scaling (Normalization & Standardization) and categorical encoding.
6	Perform EDA on a real dataset and summarize insights using statistical measures.
7	Implement train-test split and k-fold cross-validation techniques.
8	Implement Simple and Multiple Linear Regression. Evaluate using MSE, RMSE, and R^2 score.
9	Implement Logistic Regression for binary classification and evaluate using confusion matrix and accuracy.
10	Implement KNN algorithm and analyze the effect of different K values.
11	Implement Decision Tree and Support Vector Machine classifiers and compare performance.
12	Implement K-Means clustering and determine optimal K using Elbow Method.
13	Implement PCA for dimensionality reduction and visualize transformed data.
14	Build a basic ANN using TensorFlow/Keras for classification tasks.
15	Implement Multi-Layer Perceptron (MLP) for image or tabular dataset classification.
16	Implement CNN for image classification using a standard dataset.
17	Evaluate models using Precision, Recall, F1-score, ROC Curve, and AUC.
18	Perform Grid Search and Random Search for model optimization.

19	Save and load trained models. Demonstrate simple deployment using Flask or Streamlit.
20	Develop an end-to-end AI/ML project including preprocessing, model building, evaluation, and result interpretation.

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson	3rd/4th (2019)
4	Hands-On Machine Learning with Scikit-Learn, Keras&TensorFlow	AurélienGéron	O'Reilly Media	2nd/3rd (2017)

Text Books

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Deep Learning	Ian Goodfellow, YoshuaBengio, Aaron Courville	MIT Press	2nd (2015)
2	Machine Learning: A Probabilistic Perspective	Kevin P. Murphy	MIT Press	1st (2013)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-15	Mobile Application Development Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: basic understanding of Database Management Systems, Object-Oriented Programming (Java/Kotlin or Swift), familiarity with XML/JSON data formats

Course Outcomes

At the end of the course the student will be able to	
CO1	Implement the process of deploying and running mobile applications on Android and iOS emulators, and the use of basic GUI components and layouts.
CO2	Apply Android and iOS programming concepts to develop applications with user input, GUI components, layouts, event handling, and multimedia features.
CO3	Create mobile application designs by implementing graphical primitives, layout managers, event listeners, and login/browser integration functionalities.
CO4	Explain mobile application testing techniques including unit testing, black-box testing, and test automation.
CO5	Develop complex mobile applications on Android and iOS, integrating database operations, multimedia handling, and advanced graphical and interactive components.

Exp. No.	Experiment Title & Technical Task
1	Using emulator to deploy and run mobile apps
2	Create an Android application that shows Hello + name of the user and run it on an emulator.
3	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
4	Develop an ANDROID application that uses GUI components, Font and Colors
5	Write an application that draws basic graphical primitives on the screen
6	Develop an application that uses Layout Managers and event listeners.
7	Create and Login application as above. On successful login, open browser with any URL
8	Testing mobile app - unit testing, black box testing and test automation.
9	Create an iOS application that can play audio and video files
10	Write an iOS application that creates alarm clock
11	Devise an iOS application that draws basic graphical primitives (rectangle, circle) on the screen.
12	Build an iOS mobile application that create, save, update and delete data in a database.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Mobile Apps Development	Anubhav Pradhan	Anil V D	3rd/4th (2017)
2	Professional Mobile Application Development	Jeff McWherter	Wiley	2nd (2015)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Learning iPhone Programming	A. Allan	O'Relly	1st (2016)
2	Phone Application Development All-In-One For Dummies"	Neal Goldstein	John Wiley	1st (2015)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Interna	External	Total
25C2CAP-PE2-16	Simulation & Modelling Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: basic understanding of numerical methods, probability and statistics, proficiency in a high-level programming language

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe MATLAB installation, basic syntax, branching statements, matrix operations, and graph plotting techniques.
CO2	Implement MATLAB programming to perform matrix operations, plot graphs, and simulate real-time continuous and discrete systems.
CO3	Experiment with MATLAB programs for testing random number sets, and simulating single and multi-server queuing systems.
CO4	Demonstrate the simulation techniques for inventory and automation systems, and formulate models for continuous and discrete system simulations.
CO5	Develop MATLAB-based solutions for complex simulation problems, integrating statistical tests, queuing systems, and inventory management models.

Exp. No.	Experiment Title & Technical Task
1	Installation of MATLAB.
2	Write a program in MATLAB using different types of branching statement
3	Write a program to perform basic matrix operations.
4	WAP to plot different types of graphs in MATLAB
5	Write a MATLAB code to plot with the elements of its vector representation
6	Programs on simulation of real time systems for automation purpose.
7	Simulation of continuous and discrete systems.
8	Programs on testing the random number set for uniformity and independence – Kolmogorov-Smirnov test, Chisquare test, Runs test and Autocorrelation test.
9	Programs on simulation of single and two-server queuing systems..
10	Programs on simulation of an inventory system.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete-Event System and Simulation	Jerry Banks	Anil V D	3rd. (2019)
2	System Simulation,	Gordon	Prentice-Hall	2nd (2016)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Discrete-event modeling and simulation:a practitioner's approach	Gabriel	CRC Press	1st (2015)
2	Theory of modeling and simulation	Bernard P	Academic Press	2nd(2018)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-17	E-Commerce and Digital Marketing Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: A functional knowledge of Web Technologies, familiarity with Content Management Systems

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the concepts of social media marketing, content marketing, mobile advertising and digital marketing platforms.
CO2	Implement digital marketing tools and techniques including YouTube, Facebook, LinkedIn, Twitter, and email marketing for online promotion.
CO3	Evaluate website and campaign performance using analytics tools and apply strategies to improve digital marketing outcomes.
CO4	Explain social media optimization and formulate strategies for mobile advertising and user experience improvement.
CO5	Create & publish blogs and optimize campaigns using analytics and content marketing techniques.

Exp. No.	Experiment Title & Technical Task
1	Social media marketing and optimization
2	YouTube Marketing
3	Facebook marketing
4	Email marketing
5	LinkedIn
6	Twitter
7	Google Analytics
8	Mobile Advertising
9	Content Marketing: Optimize customer and user experience
10	Creating & publishing Blogs

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	E-Commerce Strategy, Technologies and Applications	Whitley, David	McGraw Hill	5th (2019)
2	Fundamentals of Digital Marketing	Puneet Singh	Pearson	5th (2020)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Digital Marketing	Seema Gupta	McGraw Hill	2nd (2012)
2	E-Commerce: Business, Technology & Society	Laudon and Traver	Pearson	3rd (2015)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE2-18	Software Testing & Quality Assurance Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: A solid grasp of the Software Development Life Cycle (SDLC), proficiency in at least one programming language

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain the concepts of software testing, test cases, and the process of documenting test scenarios and results.
CO2	Classify the manual testing techniques to validate functionalities such as login, registration, and flight reservation systems while recording test cases.
CO3	Experiment with the data flow and path testing techniques for application scenarios including product description, payment, and order history..
CO4	Implement boundary value conditions, image upload features, and web templates to formulate effective testing strategies including load and performance testing.
CO5	Develop automated testing solutions using tools such as Selenium, LoadRunner, or Rational Test Manager to improve testing efficiency.

Exp. No.	Experiment Title & Technical Task
1	Introduction to Test Cases, How to create a simple test case and record it in the excel file.
2	Developing Login functionality and testing them manually and storing the data in the sheet.
3	Testing the registration functionality
4	Testing flight reservation system and recording test cases
5	Testing the date field scenario programmatically and recording test cases.
6	Taking scenario of product description functionality in ecommerce website.
7	Taking a scenario of payment functionality and order history in ecommerce website
8	Practicing the data flow testing taking some another logic and implying path testing
9	Taking up path testing
10	Developing a logical code to test boundary value exemptions
11	Create an image upload functionality and make their test case
12	Teams will make HTML CSS design templates in hours and perform load and performance testing
13	Developing applications to automate basis path testing
14	Exposure to automated testing tools such as Rational test manager,Selennium,Loadrunner or any other similar tools

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Quality Assurance – From Theory to Implementation	Daniel Galin	Pearson	1st (2015)
2	Software Testing Techniques	Boris Beizer	Dream Tech Press	Latest (2021)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Software Engineering	Roger S	McGraw Hill	1st (2017)
2	Effective Methods for Software Testing	William E. Perry	Wiley	Latest (2020)

Course Code	Course Type	Course Title	C d	L	T	P	Marks		
							Internal	External	Total
25C2CAP-314	**Skill Enhancement Course**	**Career and Placement Planning-1**	**1**	**0**	**0**	**2**	**50**	**-**	**50**

Prerequisites: Basic understanding of C++ Language with STL

Course Outcomes:

At the end of the course, the student will be able to	
CO1	Explain fundamental concepts of data structures and abstract data types.
CO2	Analyze algorithms using time and space complexity and asymptotic notations.
CO3	Implement linked list data structures with insertion, deletion, and traversal operations.
CO4	Apply and analyze searching algorithms for different datasets.
CO5	Compare and implement sorting algorithms based on efficiency and stability.

Detailed Syllabus

Unit 1: Introduction to Data Structures Concept and classification of data structures, abstract data types, importance of data structures in problem solving, and basic algorithm design concepts.

(5 Hours)

Unit 2: Algorithm Complexity Analysis Time and space complexity, asymptotic notations including Big-O, Omega, and Theta, recursion fundamentals, and analysis of simple algorithms.

(5 Hours)

Unit 3: Linked List Singly linked list, doubly linked list, circular linked list, insertion and deletion operations, traversal techniques, memory representation, and applications of linked lists.

(6 Hours)

Unit 4: Searching Techniques Linear search, binary search, interpolation search, algorithm comparison, complexity analysis, and coding practice for searching problems.

(5 Hours)

Unit 5: Sorting Techniques Bubble sort, selection sort, insertion sort, merge sort, quick sort, heap sort, comparison of sorting algorithms based on time complexity, stability, and efficiency.

(5 Hours)

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Structures using C/C++	TPP Dept.	TPP	6th Edition (2025)
2	Object Oriented Programming In C++	Balaguruswami, E.	Tata McGraw-Hill	8th Edition, (2020)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Pub.Yr.)
1	The C++ Programming Language	Bjarne Stroustrup	Pearson Education	4th Edition (2013)
2	An Introduction to Object-Oriented Application Development	Richard Johnson	Thomson Learning	1st Edition, (2007)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-315	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 IV

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-401	**Machine Learning and Data Analytics using Python**	**Core Theory**	**4**	**4**	**0**	**0**	**30**	**70**	**100**

Prerequisite: A solid proficiency in Python programming , a strong grasp of Linear Algebra and Calculus, and a foundational understanding of Probability and Statistics

At the end of the course the student will be able to	
CO1	Describe basic Machine Learning concepts and fundamental Python concepts like data types, operators, control structures, functions, modules and basic NumPy operations.
CO2	Apply linear regression models to analyze relationships between variables and implement logistic regression techniques to solve linear classification problems.
CO3	Analyze clustering and classification techniques such as KNN, Decision Trees and Random Forest to solve the ML problems.
CO4	Differentiate classification and dimensionality reduction techniques like Naïve Bayes and PCA and role of neural networks in solving complex problems.
CO5	Categorize data handling and visualization methods using Pandas and Matplotlib .

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I: Machine Learning Overview: Introduction to Machine Learning, Types of Learning: Supervised, Unsupervised, and Reinforcement Learning. Python Programming Basics: Data types, operators, control structures (loops, conditionals), functions, and modules. Introduction to Numpy: Arrays, array indexing, and operations in Numpy.

(10 Hrs)

UNIT–2: Linear Regression: Definition and purpose of linear regression, Applications in prediction and forecasting, Understanding and implementing linear regression models. Introduction to linear classification problems and their solutions. Application of logistic regression for classification tasks.

(10 Hrs)

UNIT–3: Clustering Techniques: Introduction to K-Nearest Neighbors (KNN) for clustering. Understanding decision trees and their use in both regression and classification tasks. Concept and application of Random Forest for improving model performance and accuracy.

(10 Hrs)

Section-B

UNIT–4: Classification and Advanced Topics: Introduction to Naïve Bayes and its applications in classification problems, Types of Naïve Bayes, Dimensionality reduction using PCA and its significance. Basics of neural networks and their role in solving complex problems, Applications of neural networks.

(11 Hrs)

UNIT–5: Data Handling and Visualization: Introduction to Pandas, Series, DataFrames, groupby, merging, joining, concatenating, handling missing data. Data visualization techniques using Matplotlib—creating plots, adding markers, labels, grids, subplots, scatter plots, bar charts, histograms, and pie charts.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Simplified Machine Learning	Pooja Sharma	BPB Publications	Latest (2024)
2	Machine Learning using Python	M. Pradhan & U. Dinesh Kumar	Wiley	4th(2015)
3	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas Müller	O'Reilly	5th (2016)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Preparation and Analysis	Pooja Sharma	Not Specified	Latest(2025)
2	Machine Learning Applications Using Python: C ase Studies from Healthcare, Retail, and Finance	Puneet Mathur	Apress	2nd (Updated 2019)
3	Python for Data Science For Dummies	John Paul Mueller & Luca Massaron	Wiley	2nd (2019)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-PE3-06	Advanced Web Technologies	Core Theory	4	4	0	0	30	70	100

Prerequisite: A strong understanding of Client-Server Architecture, and familiarity with Relational and NoSQL Databases

At the end of the course the student will be able to	
CO1	Explain PHP server-side scripting basics, including installation, embedding in HTML, syntax, variables, data passing between pages, strings, arrays, numbers, and error handling.
CO2	Apply PHP and MySQL functions to build dynamic web applications using forms, queries, sessions, cookies, type conversions, string handling, regular expressions, and OOP concepts.
CO3	Differentiate the types of Web Services and classify Content Management Systems (CMS) based on their types, usages, and benefits.
CO4	Classify XML components and organize Ajax and jQuery features such as date picker, autocomplete, tooltip, accordion, content retrieval, manipulation, and event handling.
CO5	Interpret the web application features using Bootstrap components, Node.js, and React concepts.

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I: PHP: Introduction to PHP, Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/ problems, Numbers and Mathematical Operations.

(10 Hrs)

UNIT–2: Advanced PHP and MySQL: PHP/MySQL Functions, Displaying queries in tables, Introduction to PHP OOPs concepts, Building Form Handling from Queries, Dynamic forms using database data, Validating and sanitizing form input, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions, E-Mail

(10 Hrs)

UNIT–3: Introduction to Web Services: Use of Web Services, Types of Web Services SOAP-Based Web Services (Simple Object Access Protocol),RESTful Web Services (Representational State Transfer), Comparison of SOAP vs REST, Introduction to Content Management System CMS (Types, Usages, Benefits).

(10 Hrs)

Section-B

UNIT–4: XML: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents. Ajax : Introduction and Use of Ajax in Website. jQuery : Introduction, jQuery UI: Date picker, auto complete, tooltip, accordion, retrieving page content, manipulating page content, working with events.

(11 Hrs)

UNIT–5: Introduction to Bootstrap : Components of Bootstrap Introduction to Node.js: Node Package Manager (NPM), Node.js Webserver – Server and Clients. React: Introduction to ReactJS, Environment Setup, JSX, Components, State, Props, Validating Props, Component API, Component Life Cycle, Forms, Events

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	"PHP: The Complete Reference"	Steven Holzner,	TATA McGraw Hill,	4th (2015)
2	Learning PHP, MySQL, JavaScript, CSS and HTML 5	Robin Nixon	O'Reilly	7th (2025)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book	Kogent Learning Solutions	Wiley (India)	4th (2009)
2	Developing Web Applications	Ralph Moseley & M. T. Savaliya	Wiley-India	7th (2013)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-01	Cloud Computing	Core Theory	4	4	0	0	30	70	100

Prerequisite: A strong understanding of Computer Networks (TCP/IP), Operating Systems (Virtualization & Storage), and a foundational knowledge of Distributed Systems and Web Technologies

Course Outcomes

At the end of the course the student will be able to	
CO1	Explain cloud models and computing paradigms including Grid, Cluster, Distributed, Utility and Cloud computing.
CO2	Apply virtualization concepts to explain virtual environments and virtualization techniques along with the capacity planning, baseline metrics, load testing, scaling, and server types.
CO3	Interpret policy-based SLA management and cloud security practices like encryption and auditing.
CO4	Categorize cloud storage provisioning methods and interoperability standards with advanced concepts.
CO5	Compare cloud platforms such as AWS, Google App Engine, and Microsoft Azure and their architecture, core concepts, lifecycle, and service features.

Detailed Syllabus

Section-A

UNIT–I: Overview of Computing Paradigm:Recent trends in Computing: Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. Introduction to Cloud Computing: Vision of Cloud Computing, Defining a Cloud, Cloud Reference Model, Deployment Models, Characteristics, Benefits of Cloud Computing, Challenges.Cloud Computing vs. Cluster Computing vs. Grid Computing. Migrating into a Cloud: Broad approaches to migration. The Seven-Step Model of Migration Into a Cloud

(10 Hrs)

UNIT–2: Virtualization:Introduction and characteristics of a Virtualized environment. Taxonomy of Virtualization techniques.Virtualization and its relation to Cloud Computing. Pros and Cons of Virtualization. Technology Examples: Xen, VMware, Microsoft Hyper-V. Introduction to Capacity Planning. Defining baseline and metrics (Baseline Measurements, System Metrics). Load Testing, Resource Ceilings, Server and Instance types. Network Capacity and Scaling.

(10 Hrs)

UNIT–3: SLA Management in Cloud Computing: Inspiration and Traditional Approaches to SLO Management.Types of SLA and their life cycle. SLA management in Cloud. Automated Policy-based Management. Cloud Security basics. Securing Data in the Cloud: Brokered Cloud Storage Access, Storage location and tenancy.Encryption, Auditing, and Compliance.

(10 Hrs)

Section-B

Unit-4 Cloud Storage: Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management, Advance Topics in Cloud:Energy Efficiency in cloud, Market Oriented Cloud Computing, Federated Cloud Computing, Mobile Cloud Computing, Fog computing, BigData Analytics, Basics of IoT.

(11 Hrs)

UNIT–5: Cloud Platforms in Industry: Amazon Web Services (AWS): Compute Services, Storage Services, Communication Services, and Additional Services. Google App Engine: Architecture, Core Concepts, Application Life Cycle, and Cost Model. Microsoft Azure: Core Concepts, SQL Azure, Windows Azure Platform Appliance.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, & S. Thamarai Selvi	Tata McGraw Hill	3rd (2013)
2	Cloud Computing Bible	Barrie Sosinsky	Wiley India Pvt. Ltd.	2nd (2011)
1	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, & S. Thamarai Selvi	Tata McGraw Hill	3rd (2013)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Cloud Computing For Dummies	Judith Hurwitz, Robin Bloor, Marcia Kaufman, & Fern Halper	Wiley India Pvt. Ltd.	2nd (2016)
2	Cloud Computing: Insights Into New-Era Infrastructure	Dr. Saurabh Kumar	Wiley India Pvt. Ltd.	1st (2011)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-02	Digital Image Processing	Core Theory	4	4	0	0	30	70	100

Prerequisite: A strong A strong command of Linear Algebra (Matrices), Calculus, and Signal Processing

At the end of the course the student will be able to	
CO1	Describe the basic concepts of Digital Image Processing and its processing steps along with the sampling, quantization, color models, pixel relationships, and image operations.
CO2	Apply spatial and frequency domain image enhancement techniques by utilizing histogram processing, spatial filtering, smoothing, sharpening, and frequency filtering.
CO3	Classify image restoration processes involving image degradation models, and organize multiresolution methods.
CO4	Illustrate image compression techniques and types of redundancy by explaining lossless and lossy methods.
CO5	Interpret image segmentation techniques like edge detection and Hough transform by applying thresholding, region-based segmentation, and watershed methods.

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I: Introduction: Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models Digital Image Processing Operations: Pixel relationships and distance metrics -Image coordinate system, Image topology, Connectivity, Relations, Distance measures. Classification of image processing Operations - Arithmetic, Logical, Geometrical (Translation, Scaling, Zooming, Linear Interpolation, Mirror or Reflection, Shearing, Rotation, Affine and Inverse transformation) Operations, Image interpolation Techniques (Downsampling and upsampling), Set operations, Statistical operations, Convolution and Correlation operations**.**

(10 Hrs)

UNIT–2: Image Enhancement in Spatial Domain: Image enhancement point operations- Linear and non-linear functions, Piecewise linear functions, Histogram processing. Spatial filtering - basics of filtering in the spatial domain, Vector representation, Smoothing linear and non-linear filters, sharpening filters. Image Enhancement in Frequency Domain: Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters.

(10 Hrs)

UNIT–3: Image Restoration: A model of the image degradation/restoration process, Noise models, Noise filters, Degradation function.Multiresolution Analysis: Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising.

(10 Hrs)

Section-B

UNIT–4: Image Compression: Image compression model, Compression measures, Compression algorithm and its types (Entropy,
Predictive, Transform and layered coding), Types of redundancy (Coding, Inter-pixel, Psycho-visual and Chromatic), Lossless compression algorithms – Run-length, Huffman, Bit-plane, Arithmetic, Predictive coding. Lossy compression algorithms – Lossy predictive, Block transform coding.

(10 Hrs)

UNIT–5: Image Segmentation: Classification of image segmentation algorithms, Point, Line and Edge detection, Hough transforms, Corner detection, Global thresholding, Otsu's method, Multivariable thresholding, Region-based segmentation, Watershed segmentation.

(10 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Digital Image Processing	R. C. Gonzalez and R. E. Woods	Pearson Education	2nd (2013)
2	Digital Image Processing	S. Sridhar	Oxford University ress	1st (2011)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Image Processing, Analysis and Machine Vision	M. Sonka, V. Hlavac, and Roger Boyle	Thomas Learning	2nd (2007)
2	Digital Signal Processing	K. R. Castleman	Pearson Education	3rd (2007)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-03	NLP and Speech Recognition	Core Theory	4	4	0	0	30	70	100

Prerequisite: A strong foundation in Probability and Statistics, Linear Algebra, and Python programming.

At the end of the course the student will be able to	
CO1	Explain NLP basics and N-gram models with smoothing techniques and perplexity evaluation.
CO2	Summarize Naive Bayes classifiers for sentiment analysis and text classification along with the training methods, optimization, evaluation metrics, and cross-validation.
CO3	Apply logistic regression techniques for classification tasks using the sigmoid function, cross-entropy loss, gradient descent, and regularization.
CO4	Differentiate chatbot and dialogue system components while interpreting phonetic concepts such as speech sounds, transcription, prosody, and acoustic phonetics.
CO5	Interpret Automatic Speech Recognition and Text-to-Speech systems along with the understanding of log Mel spectrum features, CTC architecture, and word error rate evaluation.

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I: Introduction to Natural Language Processing Regular Expressions, Text Normalization, Edit Distance: Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance. N-gram Language Models: N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, Huge Language Models and Stupid Backoff, Advanced: Perplexity's Relation to Entropy.

(10 Hrs)

UNIT–2: Naive Bayes and Sentiment Classification: Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross- validation, Statistical Significance Testing, Avoiding Harms in Classification.

(10 Hrs)

UNIT–3: Logistic Regression: Classification: the sigmoid, Learning in Logistic Regression, The cross-entropy loss function, Gradient Descent, Regularization, Multinomial logistic regression, Interpreting models, Advanced: Deriving the Gradient Equation

(10 Hrs)

Section-B

UNIT–4: Chatbots & Dialogue Systems: Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue- State Architecture, Evaluating Dialogue Systems, Dialogue System Design Phonetics: Speech Sounds and Phonetic Transcription, Contents, Articulatory Phonetics, Prosody, Acoustic Phonetics and Signals, Phonetic Resources

(11 Hrs)

UNIT–5:Automatic Speech Recognition and Text-to-Speech: The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture, CTC, ASR Evaluation: Word Error Rate,TTS, Other Speech Tasks.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Speech and Language Processing: An Introduction to NLP, Computational Linguistics, and Speech Recognition	Daniel Jurafsky and James H. Martin	Pearson	7th (2020)
2	The Oxford Handbook of Computational Linguistics	Ruslan Mitkov	Oxford	5th (2017)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Taming Text	Grant Ingersoll, Thomas Morton, and Drew Farris	Manning	Latest (2023)
2	Natural Language Processing with Python	Steven Bird, Ewan Klein, and Edward Loper	O'Reilly	5th (2019)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-04	IOT & Blockchain Technology	Core Theory	4	4	0	0	30	70	100

Prerequisite: A solid understanding of Computer Networks (Protocols & Security), proficiency in a programming language

At the end of the course the student will be able to	
CO1	Describe the concepts, architecture and enabling technologies of the Internet of Things (IoT).
CO2	Analyze the hardware, software components and communication protocols used in IoT systems.
CO3	Make Use of domain-specific IoT applications for solving various real-world problems.
CO4	Explain the core concepts and mechanisms of blockchain including transactions, consensus and smart contracts.
CO5	Apply blockchain technologies to Bitcoin operations and enterprise applications.

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I:**Introduction to Internet of Things (IoT):** Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, Protocols, Logical Design of Functional Blocks, Communication Models, Communication APIs. Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates.

(10 Hrs)

UNIT–2: **Elements of IoT :** Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- familiarity with API's for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. Solution Framework for IoT applications.

(10 Hrs)

UNIT–3: **Domain Specific IoTs:** Role of sensors, actuators, and connectivity in IoT solutions, Benefits of IoT, IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

(10 Hrs)

Section-B

UNIT–4 :Concept of Blockchain: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain

(11 Hrs)

UNIT–5:.Bitcoin and Enterprise Application of Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade — Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Blockchain: Blueprint for a New Economy	Melanie Swan	O'Reilly	2nd (2015)
2	Mastering Bitcoin: Unlocking Digital Cryptocurrencies	Andreas Antonopoulos	O'Reilly	1st (2014)
3	The Internet of Things: Enabling Technologies, Platforms, and Use Cases	ethuru Raj and Anupama C. Raman	CRC Press	3rd (2017)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Mastering Blockchain	Imran Bashir	Packt ublishing*	2nd (2018)
2	Blockchain Basics	Daniel Drescher	Apress	1st (2017)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-05	Full Stack Development	Core Theory	4	4	0	0	30	70	100

Prerequisite:A strong command of HTML5, CSS3, and JavaScript (ES6+), a solid understanding of Data Structures and Algorithms

At the end of the course the student will be able to	
CO1	Describe web architecture concepts, UI/UX principles, advanced HTML5, CSS3 and modern CSS frameworks for responsive web design.
CO2	Apply modern JavaScript (ES6+), asynchronous programming, DOM manipulation and TypeScript to develop dynamic client-side web applications.
CO3	Analyze component-based frameworks such as React or Angular, including state management and routing for single-page applications.
CO4	Explain Node.js and Express.js environments to formulate secure RESTful services with authentication, middleware and API design principles.
CO5	Classify full-stack web solutions using relational or NoSQL databases, version control, CI/CD practices and deploy applications on cloud platforms

Course Outcomes

Detailed Syllabus

Section-A

UNIT–I:The Frontend Foundation (UI/UX) Web Architecture: Client-Server model, Request-Response cycle, MVC architecture.Advanced HTML5 & CSS3: Semantic HTML, Media queries for Responsive Design, Flexbox, and CSS Grid. Modern CSS Frameworks: Introduction to Bootstrap 5 and Tailwind CSS. UX Principles: Visual hierarchy, accessibility (WCAG), and wireframing basics.

(10 Hrs)

UNIT–2: Client-Side Scripting & Logic Modern JavaScript (ES6+): Let/Const, Arrow functions, Destructuring, Template literals, and Spread/Rest operators. Asynchronous JS: Callbacks, Promises, and Async/Await; Fetch API for data retrieval. DOM Manipulation: Selecting elements, Event handling, and Dynamic UI updates. Introduction to TypeScript: Types, Interfaces, and Classes for scalable development.

(10 Hrs)

UNIT–3: React.js Essentials: Component-based architecture, JSX, Props vs. State. Hooks & State Management: useState, useEffect, and introduction to Context API or Redux. Angular Overview: Modules, Components, Data Binding, and Directives. Routing: Single Page Application (SPA) routing using React Router or Angular Router.

(10 Hrs)

Section-B

UNIT–4: Node.js Environment: Event Loop, Package management (NPM/Yarn), and Modules (CommonJS vs ES Modules). Express.js Framework: Middleware, Routing, and Error handling. RESTful Services: Principles of REST, HTTP methods, and status codes. Authentication & Security: JSON Web Tokens (JWT), Password hashing with Bcrypt, and CORS management.

(11 Hrs)

UNIT–5: Relational vs NoSQL: When to use MySQL vs MongoDB. MongoDB: Schema design, CRUD operations, and Mongoose ODM (Object Data Modeling). Version Control & DevOps: Advanced Git (Branching, Merging), CI/CD pipelines, and Docker basics. Deployment: Hosting applications on platforms like AWS, Heroku, or Vercel.

(11 Hrs)

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Full Stack Web Development	Y. Subbarayudu & Kumar	IIP Books	1st (2024)
2	Web Technologies: A Computer Science Perspective	Jeffrey C. Jackson	Pearson Education	1st (2011/Reprint 24)
3	Full Stack Developer: Guide to Modern Skills	Chris Northwood	Apress	2nd (2023)
4	Eloquent JavaScript: A Modern Introduction	Marijn Haverbeke	No Starch Press	4th (2024)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Pro MERN Stack: Full Stack Web App Development	Vasan Subramanian	Apress	2nd (2019/Reprint 24)
2	MongoDB: The Definitive Guide	Shannon Bradshaw	O'Reilly Media	3rd (2020)
3	Modern Full-Stack React Projects	Shama Hoque	Packt Publishing	1st (2024)
4	Designing Data-Intensive Applications	Martin Kleppmann	O'Reilly Media	1st (Reprint 2025)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-410	**Machine Learning and Data Analytics using Python Laboratory**	**Practical**	**2**	**0**	**0**	**4**	**70**	**30**	**100**

Prerequisite: **Basics of Python Programming and Statistics.**

Course Outcomes:

At the end of the course the student will be able to	
CO1	Explain Python-based data science environments and fundamental concepts of NumPy, Pandas, and data visualization tools.
CO2	Make use of Python libraries to perform data preprocessing, statistical analysis, feature scaling, and exploratory data analysis on datasets.
CO3	Create a program of machine learning such as Linear Regression, Logistic Regression, KNN, Decision Trees, and SVM for predictive modeling.
CO4	Implement clustering and dimensionality reduction techniques such as K-Means and PCA and formulate deep learning models using ANN, MLP, and CNN.
CO5	Demonstrate end-to-end AI/ML solutions including model evaluation, hyperparameter optimization, deployment, and interpretation of results.

Exp. No.	Experiment Title & Technical Task
1	Installation and setup of Python (Anaconda/Jupyter). Introduction to NumPy arrays and basic operations.
2	Implement programs for matrix operations, statistical functions, and data structures in Python.
3	Load datasets using Pandas. Perform filtering, grouping, and handle missing values.
4	Create visualizations using Matplotlib and Seaborn (line plots, bar charts, histograms, scatter plots).
5	Implement feature scaling (Normalization & Standardization) and categorical encoding.
6	Perform EDA on a real dataset and summarize insights using statistical measures.
7	Implement train-test split and k-fold cross-validation techniques.
8	Implement Simple and Multiple Linear Regression. Evaluate using MSE, RMSE, and R^2 score.
9	Implement Logistic Regression for binary classification and evaluate using confusion matrix and accuracy.
10	Implement KNN algorithm and analyze the effect of different K values.
11	Implement Decision Tree and Support Vector Machine classifiers and compare performance.
12	Implement K-Means clustering and determine optimal K using Elbow Method.
13	Implement PCA for dimensionality reduction and visualize transformed data.
14	Build a basic ANN using TensorFlow/Keras for classification tasks.
15	Implement Multi-Layer Perceptron (MLP) for image or tabular dataset classification.
16	Implement CNN for image classification using a standard dataset.

17	Evaluate models using Precision, Recall, F1-score, ROC Curve, and AUC.
18	Perform Grid Search and Random Search for model optimization.
19	Save and load trained models. Demonstrate simple deployment using Flask or Streamlit.
20	Develop an end-to-end AI/ML project including preprocessing, model building, evaluation, and result interpretation.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Machine Learning with Python	Andreas C. Müller & Sarah Guido	O'Reilly Media	1st (2016)
2	Python for Data Analysis	Wes McKinney	O'Reilly Media	3rd (2022)
3	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	O'Reilly Media	3rd (2022)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Machine Learning using Python	Manaranjan Pradhan & U Dinesh Kumar	Wiley India	1st (2019)
2	Python Data Science Handbook	Jake VanderPlas	O'Reilly Media	2nd (2022)
3	Data Science and Machine Learning using Python	Reema Thareja	Oxford University Press	1st (2023)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
26C2CAP-PE3-16	**Advanced Web Technologies Laboratory**	**Practical**	**2**	**0**	**0**	**4**	**70**	**30**	**100**

Prerequisite: Basics of Web Technologies (HTML, CSS, JavaScript).

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe responsive layouts, component architecture, hooks, directives, and client-server communication concepts in full stack web development.
CO2	Apply frontend and backend development techniques including event delegation, asynchronous JS, form validation, REST API development, and file handling.
CO3	Analyze state management, SPA routing, complex forms, database schemas and relational data operations for dynamic applications.
CO4	Explain security mechanisms like JWT authentication, middleware, GraphQL endpoints, and real-time communication using Socket.io.
CO5	Demonstrate end-to-end MERN stack applications integrating cloud hosting, real-time notifications, authentication, database modeling, and advanced full stack features.

Exp. No.	Experiment Title & Technical Task
1	Responsive Layouts: Design a multi-column dashboard using CSS Grid and Flexbox with media queries.
2	Features: Implement a script demonstrating Promises, Async/Await, and Array Destructuring for data fetching.
3	Event Delegation: Create a dynamic "To-Do" app where event listeners are managed efficiently for added elements.
4	Regex & API: Build a registration form with complex Regex validation and real-time "Username Availability" via Fetch API.
5	Component Architecture: Create a reusable "Product Card" component using Props and State management.
6	Hooks/Directives: Implement useEffect (React) or ngOnInit (Angular) to fetch and display data from a public API.
7	Context/Redux: Manage a "User Authentication State" globally across multiple components without prop drilling.
8	SPA Navigation: Implement Nested Routing and Protected Routes to prevent unauthorized access to a "Profile" page.
9	Formik/Reactive Forms: Build a complex multi-step form with validation schemas (Yup) and error handling.
10	FileSystem: Create a command-line tool that reads, writes, and zips log files using Node.js built-in modules.
11	Server Setup: Build a basic Express server with custom Middleware for logging request timestamps and IP addresses.
12	REST API I: Develop endpoints for a "Bookstore" (GET, POST) with proper status codes and JSON responses.
13	REST API II: Implement PUT and DELETE operations with error handling for non-existent resource IDs.
14	File Upload: Implement a "Profile Picture" upload feature using the Multer middleware.
15	NoSQL Schema: Design a Mongoose schema with validation, timestamps, and virtuals for a "Blogging Platform."
16	Relational Data: Use .populate() to link "Comments" to "Posts" and perform advanced aggregate queries.
17	JWT: Implement User Login/Sign-up with Bcrypt for password hashing and JSON Web Tokens for authorization.
18	GraphQL: Create a simple GraphQL server with Resolvers and Schema for querying "Author" and "Book" data.

19	Socket.io: Develop a real-time "Notification System" where the server pushes alerts to all connected clients.
20	Cloud Hosting: Prepare the MERN stack application for deployment on platforms like Render, Vercel, or AWS.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Fullstack React: The Complete Guide	Anthony Accomazzo et al.	Fullstack.io	Latest (2022/23)
2	Node.js Design Patterns	Mario Casciaro	Packt Publishing	3rd (2020)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Eloquent JavaScript	Marijn Haverbeke	No Starch Press	3rd (2018)
2	Angular Projects	Aristeidis Bampakos	Packt Publishing	2nd (2021)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-13	NLP and Speech Recognition Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: A strong proficiency in Python programming, a solid understanding of Linguistics, Probability, Statistics, and Signal Processing

At the end of the course the student will be able to	
CO1	Explain the basic concepts of natural language processing including word analysis, word generation, and morphology.
CO2	Apply statistical language modeling techniques such as N-grams and smoothing method for solving problems.
CO3	Utilize Part-of-Speech (POS) tagging techniques with Hidden Markov Models and Viterbi decoding for NLP tasks.
CO4	Make use of Formulate predictive models with machine learning techniques such as Linear and Logistic Regression for real-world data.
CO5	Design a vocabulary dataset and apply NLP techniques for linguistic analysis.

Course Outcomes

Exp. No.	Experiment Title & Technical Task
1	Write a Program for Word Analysis.
2	Write a Program for Word Generation.
3	Write a program to implement Morphology.
4	Write a Program to implement N-Grams.
5	Write a Program to implement N-Grams Smoothing.
6	Write a Program to implement POS Tagging: Hidden Markov Model.
7	Write a Program to implement POS Tagging: Viterbi Decoding
8	Design and evaluate a data model using Linear Regression.
9	Design and evaluate a data model using Logistic Regression.
10	Design a vocabulary of about 20 words. Choose words with a variety of segmental structure and length: place names or animal names for example. Add in a few minimal pairs.

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Speech and Language Processing: An Introduction to NLP, Computational Linguistics, and Speech Recognition	Daniel Jurafsky and ames H. Martin	Pearson	6th (2020)
2	The Oxford Handbook of Computational Linguistics	Ruslan Mitkov	Oxford	Latest (2023)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas C. Müller and Sarah Guido	O'Reilly Media	7th (2016)
2	Understanding Machine Learning: From Theory to Algorithms	Shai Shalev-Shwartz and Shai Ben-David	Cambridge University Press	5th (2014)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-12	Digital Image Processing Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: A strong proficiency in Python (specifically NumPy) or MATLAB, a solid understanding of Matrix n Algebra

Course Outcomes

At the end of the course the student will be able to	
CO1	Make the use of image processing software and perform basic image processing operations.
CO2	Apply image processing techniques to generate and manipulate lines, arrays, matrices, and images for practical tasks.
CO3	Implement image processing techniques to read, display and convert images across different formats and color models, including monochrome conversion.
CO4	Experiment with images using restoration techniques, including histogram analysis and pseudo-coloring.
CO5	Create solutions for image analysis using edge and boundary detection, color image processing, wavelet transforms and image compression techniques.

Exp. No.	Experiment Title & Technical Task
1	Installation of image processing software and use of basic image processing commands.
2	Generation of lines, array, matrix and image
3	Reading and displaying images in different formats using different color models
4	Converting color images into monochrome images
5	Displaying of image Histogram
6	Image color enhancements using pseudo coloring techniques
7	Image restoration techniques.
8	Application of image processing operations
9	Point, Line, and Edge Detections in images
10	Boundary Detections in images
11	Color image processing
12	Wavelet transforms.
13	Image compression techniques

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Image Processing, Analysis and Machine Vision	M. Sonka, V. Hlavac, and Roger Boyle	Thomas Learning	2nd (2007)
2	Digital Signal Processing	K. R. Castleman	Pearson Education	1st (2007)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Image Processing, Analysis and Machine Vision	M. Sonka, V. Hlavac, and Roger Boyle	Thomas Learning	2nd (2007)
2	Digital Signal Processing	K. R. Castleman	Pearson Education	1st (2007)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-14	IOT & Blockchain Technology Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: Basics of IoT concepts, Computer Networks, and Cryptography.

Course Outcomes

At the end of the course the student will be able to	
CO1	Describe the fundamental concepts, terminology and enabling technologies of Internet of Things (IoT) and Blockchain.
CO2	Implement the steps involved in IoT system design methodology.
CO3	Explain the working of Bitcoin cryptocurrency, including blockchain, mining, transactions and security mechanisms.
CO4	Apply the fundamentals of blockchain technology including hashing, peer-to-peer networks, smart contracts and cryptocurrency transactions to solve real world problems .
CO5	Design integrated IoT and blockchain-based applications for secure data monitoring and management.

Exp. No.	Experiment Title & Technical Task
1	Study of IoT architecture, components, and platforms (Arduino/NodeMCU/Raspberry Pi).
2	Write programs to blink LED and interface push button using Arduino/ESP8266.
3	Interface temperature and humidity sensor (DHT11/DHT22) and display readings.
4	Interface ultrasonic or IR sensor and measure distance/object detection.
5	Control relays, buzzer, and servo motor using microcontroller.
6	Implement MQTT/HTTP protocol for data transmission between device and server.
7	Send sensor data to cloud platforms (ThingSpeak/AWS IoT/Blynk) and visualize data.
8	Implement Wi-Fi or Bluetooth-based communication between devices.
9	Store IoT sensor data in local/remote database (MySQL/Firebase).
10	Create a simple web dashboard to monitor and control IoT devices.
11	Develop a basic mobile interface to control IoT devices remotely.
12	Design a mini IoT project (Smart Home/Smart Irrigation/Smart Parking).
13	Implement basic encryption and authentication for IoT communication.
14	Study blockchain architecture, hashing (SHA-256), and peer-to-peer concepts.
15	Implement a simple blockchain structure in Python (block creation and hashing).
16	Develop and deploy a smart contract using Solidity on Ethereum test network.
17	Create Ethereum wallet and perform test transactions.
18	Develop a simple decentralized application (DApp) using Web3.js.

19	Integrate IoT sensor data with blockchain for secure logging.
20	Develop an end-to-end IoT&Blockchain based application (e.g., Secure Supply Chain Monitoring System).

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Internet of Things: A Hands-On Approach	ArshdeepBahga, Vijay Madisetti	Universities Press	1st (2007)
2	Internet of Things	Raj Kamal	McGraw Hill	Latest (2022)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Building the Internet of Things	MaciejKranz	Wiley	1st (2007)
2	Ethereum Smart Contract Development	MayukhMukhopadhyay	Packt Publishing	Latest (2022)

Course Code	Course Title	Course Type	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-PE3-15	Full Stack Development Laboratory	Practical	2	0	0	4	70	30	100

Prerequisite: A strong command of HTML5, CSS3, and JavaScript (ES6+), a solid understanding of Data Structures and Algorithms

Course Outcomes

end of the course the student will be able to
Design responsive web pages using HTML5, CSS Flexbox/Grid and frameworks like Bootstrap.
Develop interactive front-end applications using JavaScript and React (useState, props, useEffect).
Build multi-page React apps and integrate APIs using Fetch/Axios for dynamic data handling.
Create backend services using Node.js, Express and MongoDB with CRUD operations and pagination.
Implement full-stack applications with state management, validation, real-time features and Docker-based deployment.

.	Experiment Title & Technical Task
	Create a multi-column webpage using HTML5 Semantic tags and CSS Flexbox/Grid.
	Implement a "Product Landing Page" using Tailwind CSS or Bootstrap 5.
	Build a "Dynamic Image Gallery" with filtering using JavaScript DOM manipulation.
	Fetch and display user data from a public API (like JSONPlaceholder) using Fetch/Axios.
	Build a "Digital Counter" and "To-Do List" to demonstrate useState and props.
	Implement a "Live Search Filter" for a list of items using the useEffect hook.
	Create a multi-page Portfolio (Home, About, Projects) using React Router v6.
	Implement a "Shopping Cart" with global state using Context API or Redux Toolkit.
	Build a "User Registration Form" with validation using Formik and Yup.
	Build a "Digital Counter" and "To-Do List" to demonstrate useState and props.
	Implement a "Live Search Filter" for a list of items using the useEffect hook.
	Create a multi-page Portfolio (Home, About, Projects) using React Router v6.
	Implement a "Shopping Cart" with global state using Context API or Redux Toolkit.
	Build a "User Registration Form" with validation using Formik and Yup.
	Design and connect a MongoDB database using Mongoose Schemas.
	Connect the React frontend to the Express backend to display database records.
	Implement the "Create" and "Delete" functionality from the UI to the Database.
	Implement a "Search & Pagination" feature using MongoDB regex and limit/skip.
	Build a "Live Notification" or "Chat Box" system using Socket.io.
	Containerize the app with Docker and deploy to Vercel (Frontend) and Render (Backend).

Textbooks

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	MERN Projects: Build and Deploy Full Stack Apps	Shama Hoque	Packt Publishing	2nd (2023)
2	Web Coding & Development All-in-One	Paul McFedries	For Dummies (Wiley)	1st (2024)
3	JavaScript: The Definitive Guide	David Flanagan	O'Reilly Media	7th (2020/Reprint 2024)
4	React Key Concepts	Maximilian Schwarzmüller	Packt Publishing	1st (2022/Reprint 2024)

Reference Books

S. No.	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Full-Stack React, TypeScript, and Node	David Moise	Packt Publishing	1st (2023)
2	Postman Cookbook (API Testing & Automation)	James Messinger	O'Reilly Media	1st (2023)
3	Docker for Web Developers	James Quigley	Leanpub	2nd (2024)
4	Clean Code: A Handbook of Agile Software Craftsmanship	Robert C. Martin	Pearson	1st (Reprint 2025)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-413	**Skill Enhancement Course**	**Career and Placement Planning - 2**	**1**	**0**	**0**	**2**	**50**	**-**	**50**

Prerequisites: Basic understanding of Sorting and Searching techniques.

Course Outcomes:

At the end of the course, the student will be able to	
CO1	Explain stack concepts and implement stack operations using arrays and linked lists.
CO2	Apply stack techniques to solve expression evaluation and conversion problems.
CO3	Implement queue data structures including circular queue, deque, and priority queue.
CO4	Analyze binary trees and perform traversal, insertion, and deletion operations.
CO5	Evaluate graph algorithms such as breath first search, depth first search, and shortest-path techniques.

Detailed Syllabus

Data Structures and Problem Solving

Unit 1: Stack: Stack concepts, stack operations including push, pop, and peek, implementation using arrays and linked lists, and applications of stack.

(5 Hours)

Unit 2: Stack Applications: Expression evaluation, infix to postfix conversion, postfix expression evaluation, and practical problem-solving using stack.

(5 Hours)

Unit 3: Queue: Queue operations including enqueue and dequeue, circular queue, deque, priority queue, and applications such as scheduling and simulation problems.

(5 Hours)

Unit 4: Trees:Binary tree, binary search tree, tree traversals including preorder, inorder, and postorder, insertion and deletion operations, and heap data structure.

(6 Hours)

Unit 5: Graphs: Graph representation using adjacency matrix and adjacency list, breadth-first search, depth-first search, minimum spanning tree concepts, Dijkstra's algorithm, and topological sorting.

(5 Hours)

Text Books

S. No	Name of the Books	Author	Publisher	Edition (Pub. Yr.)
1	Data Structures using C/C++	TPP Dept.	TPP	6th Edition(2025)
2	Object Oriented Programming In C++	Balaguruswami, E.	Tata McGraw-Hill	8th Edition, (2020)

Reference Books

S. No	Name of the Books	Author	Publisher	Edition (Pub.Yr.)
1	The C++ Programming Language	Bjarne Stroustrup	Pearson Education	4th Edition (2013)
2	An Introduction to Object-Oriented Application Development	Richard Johnson	Thomson Learning	1st Edition, (2007)

Course Code	Course Type	Course Title	Cd	L	T	P	Marks		
							Internal	External	Total
25C2CAP-414	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