CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
An Autonomous Institute I Affiliated to Osmania University
Kokapet Village, Gandipet Mandal, Hyderabad, Telangana-500075, www.cbit.ac.in
Approved by | Affiliated to | UGC Autonomous | 10 Programs Accredited by | Grade A++ in | All India Ranking 151-200 Band

COMMITTED TO RESEARCH, INNOVATION AND EDUCATION 46 years

Scheme of Instruction and Syllabi

of

I - IV SEMESTERS

of

TWO YEAR POST GRADUATE PROGRAMME

in

MASTER OF COMPUTER APPLICATIONS (MCA)

R-25 Regulation

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
(An Autonomous Institution)
Affiliated to Osmania University
Kokapet Village, Gandipet Mandal,
Hyderabad–500075.Telangana
E-Mail: principal@cbit.ac.in; Website: www.cbit.ac.in
Phone Nos. : 040-24193276/277/279

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

The Vision of the MCA Department:

To become a premier center in the field of Computer Applications that produces innovative, skillful and socially responsible professionals who can contribute significantly to academics, research and industry.

The Mission of the MCA Department:

1. Equip students with cutting-edge knowledge and skills in Computer Science and Applications to meet evolving global demands.
2. Foster technical expertise through collaborative learning, research, and innovative practices.
3. Promote lifelong learning, ethical values, social responsibility, and professionalism to address contemporary challenges.

Programme Educational Objectives of the MCA Department:

Graduates will

PEO 1	:	Possess a strong foundation in Computer Science Applications, demonstrating proficiency in programming languages, software development and other core areas
PEO 2	:	Excel in career by exhibiting societal consciousness, creativity and technical competency in emerging areas of computer applications.
PEO 3	:	Demonstrate a commitment to professional and social responsibility while applying computational thinking, adapting to industry demands, and undertaking professional development activities

Programme Outcomes of the MCA Department:

After completion of two year MCA course, the students will be able to:

PO 1	**:**	Apply mathematical foundations and concepts of Computer Science to meet the Industry requirements
PO 2	**:**	Analyse, design and investigate complex problems to formulate solutions using domain knowledge with Emerging tools and technologies
PO 3	**:**	Develop creative applications with acquired skills to become Information Technology professional.
PO 4	**:**	Communicate effectively through oral and written forms and demonstrate strong interpersonal skills in diverse teams.
PO 5	**:**	Recognize societal needs and develop solutions with professional ethics
PO 6	**:**	Acquire the software project management skills, lifelong learning, career enhancement and to adopt in evolving professional environments

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Scheme of Instructions for I Semester of **MCA (Master of Computer Applications)**

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L/T	P/S		CIE	SEE	
THEORY								
1	25MCC101	Data Structures Using C++	4	-	3	40	60	4
2	25MCC102	Computer Architecture	4	-	3	40	60	4
3	25MCC103	Object-oriented programming using Java	4	-	3	40	60	4
4	25MTC101	Mathematical Foundation for Computer Science	3/1	-	3	40	60	4
5	25MTC102	Probability and Statistics for Data Science	3/1	-	3	40	60	4
PRACTICALS								
6	25MCC104	Data Structures Using C++ Lab	-	3	3	50	50	1.5
7	25MCC105	Object Oriented Programming using Java Lab	-	3	3	50	50	1.5
8	25EG101	Professional Communication Skills Lab	-	2	3	50	50	1
		TOTAL	**18/2**	**8**	**-**	**350**	**450**	**24**

L: Lecture **CIE: Continuous Internal Evaluation**

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Scheme of Instructions for II Semester of **MCA (Master of Computer Applications)**

SEMESTER-II

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L	P/S		CIE	SEE	
THEORY								
1	25MCC106	Database Management Systems	4	-	3	40	60	4
2	25MCC107	Web Technologies	4	-	3	40	60	4
3	25MCC108	Operating Systems	4	-	3	40	60	4
4	25MCC109	Data Engineering with Python	4	-	3	40	60	4
5	25MCE101/ 25MCE102/ 25MCE103/ 25MCE104	Professional Elective - I	3	-	3	40	60	3
PRACTICALS								
6	25MCC110	Database Management Systems Lab	-	3	3	50	50	1.5
7	25MCC111	Web Technologies Lab	-	3	3	50	50	1.5
8	25MCC112	Operating Systems Lab	-	3	3	50	50	1.5
		TOTAL	**19**	**9**	**-**	**350**	**450**	**23.5**

CIE: Continuous Internal Evaluation

L: Lecture

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

Internship is compulsory after II Semester with 3 credits

Professional Elective - I	
25MCE101	Design and Analysis of Algorithms
25MCE102	Business Analytics
25MCE103	Free and Open Source Technologies
25MCE104	Digital Marketing and E-Commerce

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Scheme of Instructions for III Semester of **MCA (Master of Computer Applications)**

SEMESTER - III

S. No.	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Max. Marks		
			L	P/S		CIE	SEE	
THEORY								
1	25MCC113	Artificial Intelligence and Machine Learning	4	-	3	40	60	4
2	25MCC114	Software Engineering and DevOps	4	-	3	40	60	4
3	25MCC115	Computer Networks	4	-	3	40	60	4
4	25MCE105/ 106/107/108	Professional Elective- II	3	-	3	40	60	3
5	25MCE109/ 110/111/112	Professional Elective-III	3	-	3	40	60	3
PRACTICALS								
6	25MCC116	Machine Learning Lab using Python	-	3	3	50	50	1.5
7	25MCC117	Software Engineering Lab	-	3	3	50	50	1.5
8	25MCC118	Mini Project with Seminar	1	3	-	50	-	2.5
9	25MCC119	Internship	-	5 weeks (135 hours)	-	100	-	3
		TOTAL	**19**	**9**	**-**	**450**	**400**	**26.5**

L: Lecture **CIE: Continuous Internal Evaluation**

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

Professional Elective – II	
25MCE105	Cloud Computing
25MCE106	Big Data Analytics
25MCE107	Distributed Application Development
25MCE108	Soft Computing

Professional Elective - III	
25MCE109	Internet of Things
25MCE110	User Interface and User Experience Design
25MCE111	Software Reuse Techniques
25MCE112	Social Network Analysis

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

Scheme of Instructions for IV Semester of **MCA (Master of Computer Applications)**

SEMESTER - IV

S. No	Course Code	Title of the Course	Scheme of Instruction		Scheme of Examination			Credits
			Hours per week		Duration of SEE in Hours	Maximum Marks		
			L	P/S		CIE	SEE	
THEORY								
1	25MCE113 / 114 / 115 / 116	Professional Elective – IV	3	-	3	40	60	3
2	25MCE117/ 118 / 119 / 120	Professional Elective – V	3	-	3	40	60	3
3	25MEO201/ 25MBO104/ 25MEO202 / 25CEO102	Open Elective	3	-	3	40	60	3
4	25MCC121	Project Work	-	24	3	100	100	12
TOTAL			**9**	**24**	**-**	**220**	**280**	**21**

L: Lecture **CIE: Continuous Internal Evaluation**

P: Practical/Project Seminar/Dissertation **SEE: Semester End Examination**

Professional Elective – IV	
25MCE113	Cyber Security
25MCE114	Quantum Computing
25MCE115	Block Chain Technology
25MCE116	Natural Language Processing

Professional Elective – V	
25MCE117	High Performance Computing
25MCE118	Software Project Management
25MCE119	Explainable Artificial Intelligence
25MCE120	Deep Learning

Open Elective	
25MEO201	Intellectual Property Rights
25MBO104	Organization Behavior
25MEO005	Research Methodologies and Innovation.
25CEO102	Disaster Control and Response

CREDIT DISTRIBUTION TABLE

S. No	Syllabus Component	No. of Courses	No. of credits	Credits %
1.	Core Theory	10	40	42.10
2.	Core Practical	7	10.5	11.05
3.	Project/Mini Project with Seminar	2	14.5	15.26
4.	Internship	1	3	3.15
5.	Core Electives	5	15	15.80
6.	Open Elective	01	03	3.15
7.	Mathematics	02	08	8.44
8.	English	01	01	1.05
	Total	**29**	**95**	**100%**

Total No. of Courses: 29 **Total No. of Credits: 95**

Plan of Study of I-IV Semesters of MCA (R25 Curriculum)

SNO	I Semester		II Semester		III Semester		IV Semester	
	Course Name	**L-P-C**	**Course Name**	**L-P-C**	**Course Name**	**L-P-C**	**Course Name**	**L-P-C**
1	Data Structures using C++	4-3-5.5	Database Management Systems	4-3-5.5	Artificial Intelligence & Machine Learning	4-3-5.5	Professional Elective – IV	3-0-3
2	Computer Architecture	4-0-4	Web Technologies	4-3-5.5	Software Engineering and DevOps	4-3-5.5	Professional Elective – V	3-0-3
3	Object-oriented programming using Java	4-3-5.5	Operating Systems	4-3-5.5	Computer Networks	4-0-4	Open Elective	3-0-3
4	Probability and statistics for Data Science	4-0-4	Data Engineering with Python	4-0-4	Professional Elective- II	3-0-3	Project Work	0-24-12
5	Mathematical Foundation for Computer Science	4-0-4	Professional Elective-I	3-0-3	Professional Elective –III	3-0-3	--	--
6	Professional Communication Skills Lab	0-2-1			Mini Project	1-3-2.5	--	--
7	--	--	--	--	Internship	0-0-3	--	--
Hours		**28**		**28**		**28**		**21**
Credits		**24**		**23.5**		**26.5**		**21**

25MCC101

DATA STRUCTURES USING C++

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Basic Mathematical Knowledge, Programming for problem solving, Object Oriented Programming.

COURSE OBJECTIVES: This course aims to

1. Learn fundamental concepts of CPP and Object oriented programming
2. Learn linear and non-linear data structures concepts

COURSE OUTCOMES*:* After completion of this course, student will be able to

1. Understand the basic concepts of C++, build classes with functions, constructors and destructors.
2. Apply OOPS concepts like Inheritance, Polymorphism, Virtual Functions wherever required.
3. Make use of various linear data structures and their implementation according to situations.
4. Apply and Distinguish different sorting techniques and their implementation in real world environment. Implement different collision resolution techniques on hashing.
5. Make use of various non-linear data structures and their implementation according to situations

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	2	1
CO2	3	3	3	1	1	1
CO3	2	1	1	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT- I

C++ Introduction: Overview, Program Structure, Tokens, Keywords, Identifiers, Variables, Constants, Data Types, Namespace, Enumerated Data Types, Operators, console I/O Statements, Arrays, Pointers, Parameter Passing Techniques, Overloading of functions, Default Arguments, Inline Functions, Dynamic Memory Allocation and De Allocation (new and delete).

C++ Class Overview: Class Definition, Objects, Class Members, Access Control, Class Scope, Constructors and Destructors.

UNIT- II

OOPS Concepts: Inheritance basics, Base and Derived Classes, Inheritance Types, Base Class Access Controls, Friend Functions, this pointer, Templates, Function and Class Templates, Polymorphism, Function Overriding, Runtime Polymorphism using Virtual Functions, Operator Overloading of Unary and Binary Operators , Exception Handling.

UNIT- III

Stacks: Definition and Operations and Applications, Array and Linked Representation of Stacks. Queues: Definition and Operations, Array and Linked Representation of Queues and their Applications. Linked Lists: Definition and Operations, Double Linked List representation, Circular Linked Lists.

UNIT- IV

Sorting: Bubble Sort, Merge Sort, Selection Sort, heap Sort, Quick Sort, Insertion Sort, Asymptotic Notations, Sequential Search, Binary search.

Hashing: Hash Table and its implementation, Hash Table Representation, Types of Hashing and Collision Resolution Techniques.

UNIT- V

Trees: Definitions and Properties, Representation of Binary Trees, Operations. Binary Tree Traversal, Binary Search Trees, Operations- insertion, deletion and searching, Heap trees. AVL Tress and Operations on AVL Trees, B-Trees and its operations.

Graphs: Definition and Representation of Graphs, Data Structures for representing Graphs- Edge List Structures, Adjacency List Structures, Adjacency Matrix, Graph traversals – BFS and DFS. Spanning Trees, Minimum Spanning Trees.

TEXT BOOKS:

1. E. Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw Hill, 4th Edition, 2008.
2. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++", Universities Press. 2nd Edition, 2008.

SUGGESTED READING:

1. Langsam, Augenstein and Tanenbaum, "Data structures using C and C++", PHI, 2nd Edition, 2002.
2. Dr. B. Indira, Dr. Keshetti Sreekala, Mr. C.N.V.B.R. Sri Gowrinath, Mr. Ramesh Ponnala, "Data Structures and Algorithms using C" 2022, SIPH International Publishers.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Pearson Education. Ltd., 2007.

25MCC102

COMPUTER ARCHITECTURE

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Basic knowledge of Computer components and Digital circuits

COURSE OBJECTIVES: This course aims to

1. Understand the basic operations of Digital logic circuits, register operations, computer instructions
2. Able to assess the role & operations of CPU, I/O organization, memory organization, pipelining & parallel processing

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

1. Apply the operations and utilities of Boolean algebra and K Maps, flip flops
2. Evaluate the working of Registers and types of Computer instructions
3. Analyze the micro programmed control, addressing modes and data transfer operations.
4. Classify the operations of CPU and their functionality.
5. Assess the input–output, memory organization and concepts of parallel processing.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	1	1
CO2	1	2	1	1	1	1
CO3	2	3	3	1	1	1
CO4	2	3	3	1	1	1
CO5	3	3	3	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT -I

Basic operations of Logic Circuits: Fundamentals of Computer components– Memory – I/O devices - Logic Gates, Boolean algebra, 3 and 4 Variable K Maps, Half Adder and Full Adder, flip flops, Multiplexer – Decoder.

UNIT -II

Register Transfer and Micro Operations: Registers, and Shift Registers, Register Transfer language, Arithmetic, logical and Shift Micro operations, Instruction codes, CPU Registers, Common bus system, ALU circuit & operation, Computer Instructions, Memory Reference Instructions, Interrupts

UNIT -III

Central Processing Unit: Micro programmed Control, Control Memory, Address sequencing, General Register Organization, Stack Organization, Instruction Formats, Nine Addressing Modes, Data Transfer operations

UNIT -IV

Input–Output and Memory Organization: Peripheral Devices, I/O output interface, Asynchronous data transfer, Modes of transfer, Priority Interrupts, DMA controller and DMA process, Input output Processor, 3 types of Cache Memory mapping procedures

UNIT -V

Parallel Processing: CISC & RISC architectures, pipe lining, parallel Processing, Parallelism V/S Pipelining, Time – space chart mechanism, Shared Memory Multiprocessing, , Multi Programming and Time Sharing. Assessing and Understanding Performance: CPU performance and its factors, evaluating performance.

TEXT BOOKS:

1. M. Morris Mano, "Computer System Architecture", Pearson Asia/Prentice Hall, Revised 3rd Edn.2017.
2. M.Sasi Kumar, Dinesh Shikhare, P. Ravi Prakash, “Introduction to Parallel Processing”, Published by PHI- 2nd Edition. 2014.

SUGGESTED READING:

1. William Stallings, "Computer Organization & Architecture", Pearson Education, 11th Edition, 2022.
2. Kai Hwang and Faye A.Briggs, “Computer Architecture and Parallel Processing” International Edition.

25MCC103

OBJECT-ORIENTED PROGRAMMING USING JAVA

Instruction	4L Hours per week
Duration of Semester-End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Problem Solving Skills, Basic knowledge of any programming language

COURSE OBJECTIVES*:* This course aims to

1. Learn object oriented programming principles and fundamentals of Core Java.
2. Understand the basic concepts of Collection Framework, Stream API.

COURSE OUTCOMES*:* After completion of this course, student will be able to

1. Make use of conceptual and practical knowledge of basic Object-Oriented Programming concepts.
2. Develop complex Object-Oriented Programs using distinct OOP principles, interfaces, packages
3. Develop exception handling mechanism and multithreading.
4. Apply string functions and latest concept like Lambda Expressions, Annotations.
5. Identify the importance of the Collections framework, Stream API to develop complex applications

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	2	3	3
CO2	2	3	3	2	3	2
CO3	2	3	3	2	3	2
CO4	2	2	2	1	3	3
CO5	3	3	3	3	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT -I

Object Oriented Programming**:** Introduction to java, Object Oriented Programming, Data types, Variables and Arrays, Operators, Lexical Issues, Control Statements.

UNIT -II

Introduction to Classes**:** Classes, Methods, Constructors, This keyword, Garbage Collection, Overloading, Recursion, nested classes, inner classes,

Inheritance**:** Inheritance and its types, super, Overriding, Dynamic method dispatch, Abstract Classes, Using final.

Packages and Interfaces: packages, Access protection, importing packages, Interfaces.

UNIT -III

Exceptional Handling**:** Exception–handling fundamentals, Exception types, Using try and Catch, throw, throws, and finally clauses.

Multithreaded Programming**:** Java Thread Model, Creating Threads, Suspending, Resuming, and Stopping Threads, T hread Priorities, Synchronizing Threads, Inter-thread Communication.

UNIT – IV

String Handling**:** String class, String buffer class, String length, Special String operations, string

comparison, modifying a string, string builder,Enumerations, Primitive type wrappers and Auto boxing, Overview of Annotations

Lambda Expressions: Introducing Lambda Expressions, Passing Lambda Expressions as Arguments, Method References, and Constructor References
Java I/O: Classes and Interfaces, File class, Stream and Byte Classes, Reading and Writing Files.

UNIT –V

The Collections Framework: overview of Collections framework, The Collection interfaces-Collection Interface, List Interface, Set Interface, Sorted Set Interface, Navigable Set Interface , Queue Interface, Deque Interface Collection classes – Array List, Linked List, Hash Set, Linked Hash Set, Tree Set, and Priority Queue, Accessing Collections via Iterator, working with Maps, Comparator, Comparable Vs Comparator
Stream API**:** Stream Basics, Stream Interfaces, Reduction Operations, Using Parallel Streams, Mapping, Collecting, Iterators and Streams

TEXT BOOKS:

1. Herbert Schildt "Java, The Complete Reference" McGraw Hill Education, JavaTM 10th Edition 2018.
2. R. Nageshwar Rao, "Core Java: An Integrated Approach, New: Includes All Versions Upto Java 8",DreamTech Press, 2016
3. Richard A.Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India Edition 2009.

SUGGESTED READINGS:

1. John Dean and Raymond "Introduction Programming with Java A problem-solving approach", McGraw Hill 2008.
2. G.N.R Prasad and Premchand. P, "OOP through JAVA" National Publishing House 2010 New Delhi.
3. Joe Wigglesworth and Paula McMillan, "Java Programming: Advanced Topics" Cengage Learning. 3rd Edition 2009.

25MTC101

MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE

Instruction	3L + 1T hrs per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites:- Analytical thinking and logical reasoning, Permutations and Combinations, Algebraic Structures.

COURSE OBJECTIVES: This course aims
1. To Understand logical Connectives, implications and inference rules.
2. To use Hasse diagrams to visualize the data and to learn Graph Theory Applications.

COURSE OUTCOMES: After completion of the course the students will be able to:
1. Understand the required propositional logic to test the logic of a program.
2. Examine various properties of Relations and Functions.
3. Identify the basics of Linear Algebra in the form of Matrices and Vectors.
4. Expose the principle of Inclusion and Exclusion as a basis for various Permutations and Combinations.
5. Impart the procedural knowledge on Graphs and Trees to derive applications in Computer science.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	-	1
CO2	3	2	1	-	-	-
CO3	3	1	2	-	-	1
CO4	3	2	1	-	-	-
CO5	3	1	2	-	-	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I
Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems. Boolean algebra: Switching functions, Disjunctive and Conjunctive Normal forms, Gating Networks, Minimal sum of Products.

UNIT – II
Functions: Cartesian product, Functions, Onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions. Relations: Partial Order Relations, Hasse diagrams, Lattices, Equivalence Relations.
Introduction to Gradient Descendent Algorithm and its applications.

UNIT – III
Linear Algebra: Linear Algebraic Systems- Matrices and Vectors, Matrix Inverses, Transposes and Symmetric Matrices. Vector Spaces: Real Vector Spaces and Sub spaces, Span and Linear Independence, Basis and Dimension of Vector Space, Eigen values and Eigen Vectors and its real-world applications.

UNIT – IV
Principles of Inclusion and Exclusion: Introduction, Generalization of principle, Derangements, Rooks Polynomial, Arrangements with Forbidden Positions. Recurrence Relations: First and second order

linear Recurrence relations.

UNIT – V

Graph Theory: Definitions and examples, Sub graphs, Vertex degree, Complements and graph isomorphism. Trees: Definitions, Properties and examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees, Shortest path problems using DFS, BFS , Planar graphs, Eulerian and Hamiltonian paths and Cycles, Graph coloring.

TEXT BOOKS:

1. Ralph P. Grimaldi, “Discrete and Combinatorial Mathematics”, Pearson Education, 4th Edition,2003.
2. Peter J. Olver, ChehrzadShakiban, “Applied Linear Algebra”, Springer International Publishing, 2nd Edition, 2018.

SUGGESTED READING:

1. Kenneth H Rosen, “Discrete Mathematics and its Applications” Tata McGraw Hill, 6th Edition, 2007.
2. J.P Tremblay & R. Manohar, “Discrete Mathematical Structures with Applications to computer science” McGraw Hill. 1987.
3. Joe L. Mott, A.kandal& T.P. Baker, “Discrete Mathematics for Compute Scientists & Mathematicians", Prentice Hall N.J., 1986
4. Kevin Ferland, “Discrete Mathematics”, Houghton Mifflin Company, 2009

25MTC102

PROBABILITY AND STATISTICS FOR DATA SCIENCE

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites:- Basic calculus, Set Theory and Combinations.

COURSE OBJECTIVES: This course aims
1. To provide the fundamental concepts of basic statistics, random variables, and probability distributions for analyzing the data.
2. To formulate the statistical hypothesis for solving real world problems.

COURSE OUTCOMES: Upon completing this course, students will be able to**:**
1. Calculate the measures of skewness.
2. Apply probability on continuous and discrete random variables.
3. Use the basic probability for fitting the Random phenomenon.
4. Apply various tests for testing the significance of sample data.
5. Use the principle of Least Squares approximation for estimation of the data.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	-	1	-
CO2	3	2	1	-	1	-
CO3	3	2	1	-	1	-
CO4	3	2	1	-	1	-
CO5	3	2	1	-	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I: Basic statistics

Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Quartile deviation, Standard deviation, Coefficient of dispersion, Coefficient of variation. Skewness: Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness and Kurtosis. Moments about a point and Moments about the Mean.

UNIT-II: Probability and Mathematical Expectation

Probability, Addition Theorem of probability, Conditional Probability, Multiplication theorem of probability, Bayes Theorem, Random variable, discrete random variable, continuous random variable, Properties of probability mass function and probability density function. Mathematical expectation, properties of expectation, properties of variance and covariance. Discrete probability distribution: Poisson distribution, Mean, Variance, MGF, CGF, fitting of Poisson distribution.

.

UNIT-III: Probability Distributions

Continuous probability distributions: Normal distribution, Standard Normal random variable Expectation, Variance, MGF (without proof), CGF, Properties of Normal Curve and Areas under Normal curve. Exponential distribution, Expectation, Variance, MGF, CGF, Uniform Distribution, Expectation, Variance, MGF& CGF.

UNIT-IV: Testing of Hypotheses

Test of significance, Null and alternative hypotheses, Errors in sampling, level of significance. Large sample test: Test of significance for single proportion, difference of proportions, single mean and difference of means. T-Test for single mean, differences of Means. F- test for equality of two

population variances. Chi-Square test of Goodness of fit. Analysis of Variance, One way classification, Two way classification and their applications for data science.

UNIT-V: Regression and Curve fitting.

Correlation: Karl Pearson's coefficient of correlation. Linear Regression: Lines of regression, properties of regression coefficients. Curvilinear regression: Fitting of Parabola, fitting of a power curve, Fitting of Exponential curve, fitting of the data for real-world problems.

TEXTBOOKS:

1. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Murray R Spiegel, John J Schiller, R Alu Srinivasan, " Probability and Statistics", 3rd Edition,Tata McGraw Hill Education Private Ltd, 2012
3. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

SUGGESTED READING:

1. Walpole, H.Myers, L.Myers, Ye, " Probability and statistics for engineers & Scientists" 9th edition, Pearson publications, 2016.
2. S.C.Gupta, "Fundamentals of Statistics", Himalaya publishing, 7th Edition ,2014.

25MCC104

DATA STRUCTURES USING C++ LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Basic Mathematical Knowledge, Programming for problem solving, Object Oriented Programming.

COURSE OBJECTIVES*:* This course aims to

1. Learn and do programs on fundamental concepts of CPP and Object oriented programming
2. Learn and do programs on linear and non-linear data structures concepts

COURSE OUTCOMES: After completion of this course, student will be able to

1. Build Programs on basic concepts of C++, Classes with member functions, Constructors and Destructors.
2. Analyze the different Templates and various kinds of Inheritance types and its functionalities.
3. Make use of various Linear Data structures concepts in real world environment.
4. Apply and distinguish different Sorting Techniques and their requirement according to the situations. Implement Collision Resolution Technique of hashing.
5. Distinguish the DFS and BFS of graph traversals and their implementations.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	2	1
CO2	3	3	3	1	1	1
CO3	2	1	1	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

List of C++Programs:

1. Build C++ Programs on Arrays.
2. Build C++ Programs for Call by Value and Call by Reference.
3. Build a C++ program for Inline functions.
4. Build C++ programs for Overloading of Functions, Default Arguments.
5. Write a C++ program for Dynamic Memory allocation and De allocation.
6. Illustrate the concept of Class with member functions, Constructors and destructors.
7. Illustrate the concept of Templates with suitable Programs.
8. Illustrate the concept of Inheritance and its types with suitable programs.
9. Implement Stack using Arrays and Linked Lists
10. Write a C++ programs for implementing Queues using Arrays and Linked Lists
11. Implement Linked Lists using Single, double and Circular Linked Lists and its Applications.
12. Write a C++ program for infix to postfix conversion.
13. Implement Quick Sort.
14. Implement Insertion Sort.
15. Implement Selection Sort.
16. Implement Merge Sort.
17. Implement Heap Sort.

18. Implement Linear Searching.
19. Implement Binary Searching
20. Implement Hashing.
21. Implement Graph Traversals DFS and BFS.

SUGGESTED READING:

1. Herbert Schildt, "Complete reference to C++", 5th Edition, 2015.
2. E. Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw Hill, 4th Edition, 2008.
3. Varsha H. Patil, "Data Structures using C++", OXFORD Higher Education, 2012.

25MCC105

OBJECT-ORIENTED PROGRAMMING USING JAVA LAB

Instruction	3 Hours per week
Duration of Semester-End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Problem Solving Skills, Basic knowledge of programming languages

COURSE OBJECTIVES: This course aims to
1. Learn the concept of classes, Inheritance, and abstract classes
2. Demonstrate real-world applications using Java Collection Framework and Stream API.

COURSE OUTCOMES: After completion of this course, student will be able to
1. Demonstrate and model various mathematical computation programs using OOP concepts.
2. Identify the restrictions on class members using package-level access protection.
3. Apply the forecasting of multiple clients' task execution using Multithreading and exception-handling
Concepts.
4. Analyze the input as well as output data for String and Stream programming.
5. Identify the usage of Collections framework, Lambda Expressions, and Stream API

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	2	2
CO2	2	3	3	2	2	2
CO3	2	2	2	2	3	3
CO4	2	2	3	3	3	3
CO5	3	3	3	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

List of Java Programs

1. Demonstrate the usage of Operators, Control Structures, Arrays, etc.
2. Create classes, objects, nested classes, inner classes, abstract class,
3. Demonstrate the usage of constructors
4. Implement Method overloading
5. Implement Method overriding, dynamic method dispatch
6. Demonstrate the concept of Inheritance, types of inheritance
7. Implement Interfaces
8. Create and import Packages
9. Implement Exception handling
10. Create multiple threads, synchronization, thread priorities
11. Demonstrate String and String Buffer classes, string Builder
12. Demonstrate Wrapper classes, Enumerations, Auto boxing
13. Create I/O streams and files

14. Demonstrate Collections, Lambda Expressions, Annotations

15. Implement Stream API

SUGGESTED READING:

1. Herbert Schildt "Java, The Complete Reference" McGraw Hill Education, JavaTM 10th Edition 2018.
2. Richard A.Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India Edition 2009.

25EG101

PROFESSIONAL COMMUNICATION SKILLS LAB

Instruction	2 Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Basic interpersonal and communication skills

COURSE OBJECTIVES: This course aims to:

1. Create awareness about the significance and types of soft skills in formal settings.
2. Develop writing skills for professional communication viz., writing cover letter, Résumé, e-mail, minutes of the meeting, memos and SoP.
3. Analyze their presentation and public speaking skills.
4. Demonstrate their ability to discuss in groups and resolve issues.
5. Understand the process and techniques of attending an interview positively.

COURSE OUTCOMES: Upon completion of this course, students will be able to:

1. Differentiate various soft skills and build an impressive personality.
2. Draft cover letter, Résumé, e-mail, minutes of the meeting, memos and SoP effectively.
3. Deliver effective presentations in professional contexts confidently.
4. Participate in Group discussions and resolve issues proficiently.
5. Face interviews successfully.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	1	1	2	3	2
CO2	1	1	1	1	1	3
CO3	1	1	1	2	2	3
CO4	1	1	1	3	3	3
CO5	1	1	1	2	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Behavioral Skills: Introduction to Various Forms of Soft Skills – Hard Skills vs Soft Skills, Self-Awareness and SWOT Analysis –Techniques of Personality Development – Corporate Culture - Intercultural Communication, Grooming and Professional Etiquette.

UNIT - II

Writing Skills: Cover Letter and Résumé Writing – Structure, Planning and Presentation: Thinking Skills, Defining the Career Objective, Projecting Ones Strengths and Skill-sets–Email Writing– Mechanics of Professional Meetings – Preparation of Agenda, Participation, Writing Minutes of a Meeting and Memorandum –Writing an Effective Statement of Purpose (SOP).

UNIT - III

Presentation Skills: Elements of Effective Presentation – Structure of a Presentation, Presentation Tools, Self-confidence and Assertiveness, Body Language, Eye-contact, Visual Aids, Preparing an Effective PPT**,** Time Management–Public Speaking - Conversational Skills, Oral Review based on TV/Radio/TED Talks/Podcasts/YouTube Videos.

UNIT - IV

Group Discussion: GD as Part of Selection Procedure and its Dynamics, Intervention, Summarizing, Modulation of Voice, Relevance of Body Language, Fluency, and Coherence – Advanced Group

Discussion with Case Studies, Team Building & People Management, Decision Making and Problem Solving and Leadership Skills.

UNIT - V

Interview Skills: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Stress Management & Conflict Resolution– Mock Interviews. LinkedIn Profile Building.

TEXT BOOKS:

1. Sen, Leena, "Communication Skills", Prentice-Hall of India, New Delhi, 2005.
2. Verma, Shalini. "Body Language - Your Success Mantra", S Chand & Company, New Delhi, 2006.
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills: Attitude, Communication and Etiquette for Success", Pearson, New Delhi, 2010.
4. Gulati and Sarvesh, "Corporate Soft Skills", Rupa and Co., New Delhi, 2006.

SUGGESTED READING:

1. Thorpe, Edgar. and Showick Thorpe, "Objective English", 2nd edition, Pearson Education, 2007.
2. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", Palgrave Macmillan, New York, 2004.
3. Covey, Stephen R. "The 7 Habits of Highly Effective People", Free Press, New York, 1989.

25MCC106

DATABASE MANAGEMENT SYSTEMS

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Discrete mathematics of computer science, Programming skills

COURSE OBJECTIVES*:* This course aims to

1. Learn the basic fundamentals of database, data models, SQL and relational database design.
2. Gain Knowledge in transaction processing, concurrency control techniques, crash and recovery management, NoSQL and security of distributed databases.

COURSE OUTCOMES*:* After completion of this course, student will be able to

1. Make use of basic concepts of the database.
2. Create the data models. Map ER models into Relations and. Common Table Expressions (CTE), and Window Functions
3. Demonstrate query evaluation, normalize the relations, data storage accessing , introductory concepts of NoSQL
4. Illustrate concurrent execution and transaction management.
5. Analyze the issues of system crash, recovery measure and Security in distributed systems relevant to modern data management.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	1	3
CO2	2	3	3	1	2	3
CO3	2	3	3	1	1	2
CO4	3	3	2	1	2	1
CO5	3	2	3	1	2	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to DBMS and DB Models: File system Vs. DBMS, Advantages of DBMS, Data Abstraction, Database Design, and ER diagrams, Entities, Attributes and Entity Sets, Relationship Sets, Additional features of ER model, Conceptual Design with the ER model. The Relational Model: Introduction to the Relational Model, Integrity Constraints over relations,

UNIT-II

Introduction to SQL, creating tables, views, destroying / Altering Tables and Views, Set Operations, Null Values, Additional Basic Operations, Aggregate Functions, Nested Sub queries, Join Expression. Advanced SQL: SQL Data Types, Integrity Constraints, Cursors, Procedures, functions Authorization and Triggers. Common Table Expressions (CTE), and Window Functions.

UNIT-III

JSON data representation and basic query model in document-based NoSQL systems (e.g., MongoDB)., Functional Dependencies, Normal Forms, Basic Concepts of File Organization, Indexing, Index Data Structures, B+ Trees: A dynamic index structure, format of a node, search, Insert, Delete. Hash-Based Indexing: Static Hashing, Extendable Hashing, Linear Hashing, Extendable Hashing

versus Linear Hashing.

UNIT-IV

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control. Concurrency Control: 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlock, Specialized Locking Techniques, Concurrency Control without Locking.

UNIT-V

Crash Recovery: Introduction to ARIES, The Log, Other Recovery Related Structures, The WAL, Check pointing, recovering from a system Crash, Media recovery. Security and Authorization: Introduction to database security, Access Control Discretionary Access control, Mandatory access control. Additional Issues related to Security. Overview of security challenges in cloud-based and distributed databases.

TEXT BOOK:

1. Silberschatz, Korth, Sudarshan, “Database System Concepts”, 7th Edition, McGraw Hill, 2020

SUGGESTED READING:

1. Raghu Ramakrishna, Johannes, Gehrke "Database Management Systems", 3rd Edition, Mc-Graw Hill 2003
2. Ramez Elmasri, Shamkant B. Navathe, Somayajulu, Gupta "Fundamentals of Database Systems", Pearson Education 2006.

25MCC107

WEB TECHNOLOGIES

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Knowledge of programming fundamentals and web basics

COURSE OBJECTIVES: This course aims to

1. Build client-side web applications using HTML5, Java Script and XML.
2. Develop web applications using React JS

COURSE OUTCOMES: After completion of this course, student will be able to

1. Develop web pages using HTML 5.
2. Apply CSS concepts to present the document in an effective way
3. Examine client-side validations and create interactive web pages using JavaScript.
4. Create XML documents.
5. Build an application using React JS

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	3	3
CO2	2	2	3	2	3	3
CO3	2	2	3	2	3	3
CO4	2	2	3	2	2	2
CO5	2	2	3	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

HTML5: Introduction to web technologies, Exploring new features of HTML5, Fundamentals of HTML: Understanding Elements, Describing Data Types, Working with text: formatting tags, Organizing text in HTML: DIV and SPAN tags, Working with Links and URL: Exploring Hyperlinks and URL, Creating Tables: CAPTION,COLGROUP, COL,TR,TD,TH, Working with images, colors and canvas, Working with forms: types of input: password, text, date time, hidden, check box, radio, submit, reset, TEXTAREA, LABEL,FEILDSET, OUTPUT, submitting form Working with multimedia

UNIT – II

JavaScript: overview of JavaScript: Features, Programming fundamentals, Functions, Events, image maps and animation, Java Script Objects: properties and methods of object, built-in objects Working with Browser objects: Window object, Navigator Object, History Object, Screen object, Location object Working with Document Object: Describing Document Object, Exploring Cookies

UNIT-III

Java Script advanced concepts: Document Object Model: DOM Node, DOM Levels, DOM Interfaces Validation, Errors, Debugging, Exception handling and Security: Form Validation, Errors, Debugging, Handling Exceptions, Security Cascading Style Sheets (CSS): Overview of CSS: Evolution, Syntax, CSS Selectors, inserting CSS in HTML Document Backgrounds, and color Gradients, Fonts and Text styles, Creating Boxes and columns , Displaying , positioning and Floating

an element, Pseudo-classes and Pseudo-Elements, Effects, frames and controls

UNIT –IV

XML: Working with Basics of XML, Implementing Advanced features of XML, Converting XML documents in other formats.

React JS: Fundamentals of react: Requirements, setting up react project, Meet the React component, React JSX, Lists, Components, React DOM, Handler Function in JSX, props, state, Call back Handlers in JSX, React Side Effects

UNIT-V

React JS : Hooks , Custom Hooks, React Fragments**,** Reusable React components**,** Imperative React**,** Inline Handler**,** Asynchronous Data, Data Fetching & Re-Fetching with React, Memorized Handler, Async/Await, Forms in React, class component, CSS ,Styled components in React, SVG'**s**

TEXT BOOKS:

1. "HTML 5 Black Book", DT Editorial Services, DreamTech Press, 2019
2. Robin Wieruch, "The Road to React: Your journey to master plain yet pragmatic React" , 2020.

SUGGESTED READING:

1. Thomas Powell "HTML & XHTML: The Complete Reference", 4th Edition, Tata McGraw-Hill, 2003.
2. Thomas A Powell, Fritz Schneider "JavaScript: The Complete Reference", 3rd Edition, Tata McGraw Hill, 2013.

25MCC108

OPERATING SYSTEMS

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Computer Architecture and Programming Fundamentals

COURSE OBJECTIVES*:* This course aims to

1. Learn fundamentals of Operating system concepts system calls, processes, threads and process scheduling.
2. Learn the concepts of process synchronization, dead locks, memory management, file systems, I/O sub system, System Protection.

COURSE OUTCOMES: After completion of this course, student will be able to

1. Understand the fundamental components of a computer operating system and the interactions among them, Process Management, Threads concept.
2. Analyze the CPU scheduling algorithms, Build applications using Semaphores and Monitors to synchronize their operations.
3. Illustrate the deadlock handling methods, Memory management Techniques, analyze the performance of CPU scheduling and page replacement algorithms.
4. Implement File System concepts, analyze the disk scheduling algorithms and RAID Levels.
5. Illustrate the I/O Sub System Concepts, analyze the System Security and System Protection.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	1	1	1
CO2	2	2	2	1	1	1
CO3	2	2	2	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	2	1	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Operating System Introduction: Operating Systems Objectives and functions, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems, Computer System Architecture, OS Structure, OS Operations, Storage management.

System structures: Operating System Services, System Calls, Types of System Calls.

Process Concept: Process Concept, Process Scheduling, Operations on process, Inter process Communication.

Multithreaded Programming: Thread Definition, Single Thread, Multi threads, Multithreading Models.

UNIT–II

Process Scheduling: Scheduling Criteria, Scheduling Algorithms, Multiple Processor Scheduling. Process Synchronization: Critical Section Problem, Peterson's Solution, Semaphores, Classic Problems of Synchronization, Monitors.

UNIT- III

Deadlocks: System Model, Deadlock Characterization, Methods in Handling Deadlocks, Deadlock

Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation, Paging with Segmentation. Virtual Memory Management: Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

UNIT- IV

File System: File Concept, Access Methods, Directory and Disk Structure, File Sharing, Protection. Implementing File System: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management.

Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling, Swap Space Management, RAID Structure.

UNIT- V

I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, STREAMS.

System Security: The Security Problem, Program Threats, Cryptography, System and Network Threats, User Authentication, Implementing Security Defenses.

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix.

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons, 2018.

SUGGESTED READING:

1. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson Education, 2017.
2. Harvey M. Deital, "Operating Systems", 3rd Edition, Pearson Education, 2004.

25MCC109

DATA ENGINEERING WITH PYTHON

Instruction	4L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Pre-requisites: Basic computer skills, including data entry and file management.

COURSE OBJECTIVES: This course aims to

1. Build a strong foundation in data engineering concepts, tools, and databases (Relational & NoSQL) while learning to design basic data pipelines for data acquisition, processing, and storage.
2. Develop Python skills for data handling, including structures, file operations, manipulation, and visualization.

COURSE OUTCOMES: After successful completion of this course, the student will be able to:

1. Analyze the concepts of data engineering, its tools, and its relation to data science.
2. Apply Python programming fundamentals, including control structures, data structures, and string handling, for solving data-related problems.
3. Implement file handling techniques in Python to store, retrieve, and manage different types of data formats.
4. Use Pandas and data visualization libraries to manipulate, analyze, and visualize datasets effectively.
5. Integrate Python with relational and NoSQL databases to insert, extract, and process data for end-to-end data pipelines.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	1	1	1
CO2	1	2	3	1	1	1
CO3	1	2	3	1	1	1
CO4	2	2	3	1	1	1
CO5	2	3	3	1	3	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Data Engineering : Data engineers, Required skills and knowledge to be a data engineer, Data engineering versus data science, Data engineering tools, Programming languages , Databases, Data processing engines, Data pipelines. Introduction to Data Science: Data Analysis Sequence, Data Acquisition Pipeline, Report Structure

UNIT - II

Python: Introduction, Control Structures, Boolean Expressions (Conditions), Selection Control, Iterative Control, Lists: List Structures, Lists (Sequences) in Python, and Dictionary Type in Python. And String handling.

UNIT - III

Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python OS and OS.path Modules.

UNIT – IV

Working with Data Series and Frames: Pandas Data Structures, Reshaping Data, Handling Missing Data, Combining Data, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O. Plotting: Basic Plotting with PyPlot, Getting to Know Other Plot Types, Mastering Embellishments, Plotting with Pandas.

UNIT - V

Working with Databases Inserting and extracting relational data in Python: Purpose of relational databases in data engineering, Common relational database systems: MySQL, PostgreSQL, SQLite, Oracle, Understanding Python database connectivity (DB-API). Inserting data into PostgreSQL, Inserting and extracting NoSQL database data in Python Extracting data from databases, running the data pipeline.

TEXT BOOKS:

1. Data Engineering with Python by Paul Crickard, Packt Publications, 2020
2. Learning Python, 5th Edition by Mark Lutz Oreilly Publications, 2013

SUGGESTED READINGS:

1. Fundamentals of Data Engineering: Plan and Build Robust Data Systems by Joe Reis, Matt Housley, Oreilly Publications, 2022
2. Data Engineering for Machine Learning Pipelines: From Python Libraries to ML Pipelines and Cloud Platforms by Pavan Kumar Narayanan, Apress publications**,** 2024.

25MCE101

DESIGN AND ANALYSIS OF ALGORITHMS
(PROFESSIONAL ELECTIVE-I)

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Basics of Data Structures and Algorithms

COURSE OBJECTIVES: This course aims to

1. Provide an introduction to understand, analyze the time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.

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

1. Recognize and apply asymptotic notations to analyze the performance of algorithms
2. Apply Divide & Conquer approach and Greedy strategies to solve application-oriented problems
3. Apply e dynamic programming techniques to solve optimization problems and evaluate the performance of graph traversal algorithms.
4. Develop backtracking and branch-and-bound techniques to solve combinatorial and decision problems and evaluate their efficiency.
5. Demonstrate NP-completeness through problem reductions and classify problems into appropriate complexity classes.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	1	1
CO2	2	3	2	1	1	1
CO3	2	3	3	1	1	1
CO4	2	3	3	1	1	1
CO5	3	2	1	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs.

Analysis of Elementary Data Structures: Stacks, Queues, Trees, Dictionaries, Priority Queues, Sets and Disjoint Set Union.

UNIT-II

Divide and Conquer: General Method, Finding the Maximum and Minimum, Analysis of recursive algorithms through recurrence relations - Merge Sort, Quick Sort, Stassen's Matrix Multiplication. Greedy Method: General method, Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Optimal Storage on Tapes, Optimal Merge Patterns.

UNIT-III

Dynamic Programming: General Method, Multistage Graphs, All-Pairs Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Traveling Salesmen Problem.

Basic Traversal and Search Techniques: Breadth First Search (DFS) and Traversal, Depth First Search (DFS) and Traversal, Connected Components and Spanning Trees, Bi-connected Components and DFS.

UNIT-IV

Backtracking: General Method, 8-Queen's Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.

Branch and Bound: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem using FIFO branch and bound, Travelling Salesperson problem using LC branch and bound.

UNIT -V

Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility. Standard NP-Complete Problems and Reduction Techniques.

TEXT BOOKS:

1. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, Universities Press, 2008.
2. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press/McGraw-Hill, 4th Edition, 2022.

SUGGESTED READING:

1. R. Pannerselvam “Design and Analysis of Algorithms”, PHI, 2007.
2. Hari Mohan Pandey, “Design and Analysis of Algorithms”, University Science Press, 2009.
3. Anany Levitin “Introduction to the Design & Analysis of Algorithms”, Pearson Education, 2003.
4. Parag H.Dave, Himanshu B. Dave “Design and Analysis of Algorithms”, Pearson Education, 2nd Edition, 2014.

25MCE102

BUSINESS ANALYTICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Basic statistics and probability, Spreadsheet proficiency and understanding of business fundamentals

COURSE OBJECTIVES: The course aims to

1. Provide a strong foundation in business analytics concepts, tools, and techniques, including spreadsheets, statistics, optimization, machine learning, and visualization.
2. Apply analytical frameworks to real-world business problems for effective decision-making, market insights, and strategic planning

COURSE OUTCOMES: At the end of the Course, Student will be able to:

1. Outline the historical development of business analytics from its origins to the present day.
2. Demonstrate proficiency in using Excel for data manipulation, formula application, and data queries.
3. Formulate and solve linear optimization models.
4. Analyze market data using frameworks like PESTLE and Porter's Five Forces to gain strategic insights.
5. Implement strategies for effective Master Data Management to ensure data consistency and accuracy across organizations.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	1	1	1
CO2	1	2	3	1	1	1
CO3	1	2	2	1	1	1
CO4	2	2	2	1	1	1
CO5	2	3	3	1	3	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

Introduction to Business Analytics: Evolution, scope, data types, models, problem-solving, analytics integration, competitive advantage, types of analytics (descriptive, predictive, prescriptive), dashboards, analytics process cycle.

UNIT – II

Analytics on Spreadsheets: Basic Excel, formulas, functions, data queries. Descriptive Analytics: Populations, samples, notations, measures of location, dispersion, association. Statistical Inference: Hypothesis testing, one/two-sample tests, ANOVA. Predictive Analytics: Simple/multiple regression, residual analysis, categorical variables.

UNIT – III

Machine Learning: Supervised/unsupervised learning, clustering, segmentation, association analysis, data reduction. Visual Analytics: Data visualization. Prescriptive Analytics: Linear optimization models, spreadsheet implementation, solving models.

UNIT – IV

Marketing Analytics: Models, metrics, data sources, market sizing, PESTLE, Porter's Five Forces, basket analysis, text analytics, and spreadsheet modelling. Sales Analytics: E-commerce modes, sales, profitability, and support metrics.

UNIT – V

Introduction to Big Data: Master data management, types of data/patterns, technologies, applications, issues. Data Understanding: Data objects, attribute types, statistical descriptions, visualization, similarity /dissimilarity measures.

TEXT BOOKS:

1. Vernon Richardson and Marcia Watson, Introduction to Business Analytics, McGraw Hill Publication, 1st Edition 2023.
2. Sanjiv Jaggia, Alison Kelly, Kevin Lertwachara, and Leida Chen, Business Analytics (2025), McGraw Hill, 2nd Edition 2025.

SUGGESTED READING:

1. Richard Huntsinger, Business Analytics: Methods and Cases for Data-Driven Decisions, Cambridge University Press, 2025.
2. Brennan Davis, Business Analytics Stukent, Incorporat, 2025.

25MCE103

FREE AND OPEN SOURCE TECHNOLOGIES

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Programming for problem solving, Object Oriented Programming.

COURSE OBJECTIVES: This course aims to

1. Provide an understanding of the concepts, history, and philosophy of Free and Open Source Software (FOSS), including licensing, communities, and business models.
2. Develop practical skills in using, installing, and configuring open source operating systems, tools, databases, programming languages, and web technologies

COURSE OUTCOMES: After completion of this course, student will be able to

1. Apply the principles, history, and licensing of open source software.
2. Analyze open source operating systems and tools.
3. Develop programs using open source programming languages and frameworks.
4. Make use of open source databases and CMS for application development.
5. Evaluate the role of open source in software development, business, and research.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	2	1	1	1
CO2	3	2	2	1	1	1
CO3	2	2	2	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	2	1	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction to Free and Open Source Software, Definition of Free Software and Open Source Software, History and evolution of FOSS, Philosophy of the Free Software Foundation (FSF) and the Open Source Initiative (OSI) , Advantages and disadvantages of FOSS, Overview of free software licenses (GNU GPL, LGPL, BSD, Apache, MIT, MPL) and Open source development models.

UNIT – II

Open Source Operating Systems : Introduction to Linux and GNU/Linux distributions, Linux architecture and kernel basics, Linux installation and package management (RPM, DEB, YUM, APT), Linux command line essentials, Shell scripting basics and System administration in Linux

UNIT – III

Open Source Development Tools : Open source compilers and interpreters (GCC, G++, Python, PHP), Version control systems: Git and GitHub basics, Open source IDEs (Eclipse, NetBeans, VS Code), Open source debugging and profiling tools and Makefiles and build automation tools

UNIT – IV

Open Source Databases and Web Technologies : Introduction to MySQL, MariaDB, and PostgreSQL, Database installation, configuration, and administration, SQL basics and advanced queries, Introduction

to PHP and Python web frameworks (Django, Flask) and Open source content management systems (WordPress, Drupal, Joomla)

UNIT – V

Open Source Communities, Trends, and Case Studies : Role of communities in open source development, Contribution guidelines and code repositories, Business models in open source (support, dual licensing, SaaS), Government policies and open source adoption in India and worldwide, Open source success stories (Linux, Apache, Mozilla, Android, LibreOffice) and Future of open source technologies

TEXT BOOKS:

1. Kailash Vadera, Bhavyesh Gandhi "Open Source Technology", University Science Press, 1st Edition, 2009.
2. Fadi P. Deek and James A. M. McHugh, "Open Source Technology and Policy", Cambridge University Press.

SUGGESTED READING:

1. Wale Soyinka, "Linux Administration- A beginner's Guide", Tata McGraw Hills.
2. Andrew M. St. Laurent, "Understanding Open Source and Free Software Licensing", O'Reilly Media.
3. Dan Woods, Gautam Guliani, "Open Source for the Enterprise", O'Reilly Media.
4. Bernard Golden, "Succeeding with Open Source", Addison-Wesley Professional.
5. Clay Shirky and Michael Cusumano, "Perspectives on Free and Open Source Software", MIT press.

25MCE104

DIGITAL MARKETING AND E-COMMERCE

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Pre-requisites: Basic understanding of marketing principles and business processes, be familiar computer applications, search engines and online communication tools

COURSE OBJECTIVES: The course aims to

1. Understand the fundamental concepts, evolution, and scope of digital marketing and e-commerce and analyze consumer behavior in the digital environment and the impact of technology on buying decisions.
2. Develop skills to design and implement social media, email, mobile, and emerging digital marketing strategies and apply relevant tools, techniques, and platforms for effective digital campaigns.
3. Examine various e-commerce business models, payment systems, and security practices.

COURSE OUTCOMES: After completion of this course, student will be able to

1. Explain the concepts, strategies, applications, and benefits of digital marketing and e-commerce.
2. Analyze consumer behavior patterns and derive marketing intelligence from online user data.
3. Design and implement effective social media and emerging platform marketing strategies.
4. Utilize tools and techniques for email marketing, mobile marketing, and AI/VR-based campaigns.
5. Evaluate e-commerce business models, payment systems, and operational mechanisms for online business.

CO-PO Articulation Matrix

PO/CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	2
CO2	2	3	2	2	2	1
CO3.	1	2	3	3	2	2
CO4	2	2	3	3	1	2
CO5	2	3	2	2	3	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT I

Introduction to Digital Marketing: Evolution of digital Marketing, Traditional vs Digital Marketing, Digital Marketing Channels, Digital Marketing Plan, Digital Marketing Strategy, Digital Marketing Application and Benefits, Digital Marketing in India.

UNIT II

The Consumer and Digital Marketing: Consumer Behaviour on internet, Impact of Digital Technology on Consumer Behaviour, Attributes of online buying behavior, Marketing Intelligence from user's online data understanding consumer demands, brand building on web.

UNIT III

Social Media Marketing: Social Networking, Objectives of Social Media Stratergy , Building social mediastrategy, Types of Social media marketing , Facebook marketing , LinkedIn marketing, Instagram

marketing , You tube Marketing, Twitter Marketing,

UNIT IV

Emerging Platforms of digital marketing: E-mail marketing, Mobile marketing, Video Marketing, Artificial intelligence and virtual Reality in Digital Marketing.

UNIT V

Introduction to E-Commerce: Meaning of electronic commerce, business applications of ecommerce, comparison with traditional commerce. Business Models in E-Commerce-e-shops, e-procurement, e-auctions, value chain integrators, information brokerage, telecommunication, collaboration platforms, etc.; Electronic payment system; E-Banking-Concept, operations, online fund transfer-RTGC, ATM, etc.,

TEXT BOOKS:

1. Gupta Seema (2020), Digital Marketing, Mc Graw Hill Publications.
2. 2. Puthussery Antony (2020), Digital Marketing. Notion Press.

SUGGESTED READING:

1. Bhatia Puneet (2019), Fundamentals of Digital Marketing, Pearson Publications.
2. Greenstein, Electronic Commerce, Tata McGraw Hill, New Delhi. 5. Norton, Peter: Introduction to Computer 4/E, Tata McGraw Hill (P) Ltd., New Delhi.

25MCC110

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Knowledge of programing skills**,** Concepts of Database Management System

COURSE OBJECTIVES: This course aims to

1. Gain familiarity with the concepts of structured query language.
2. Understand about PL/SQL.and MongoDB

COURSE OUTCOMES: After completion of this course, student will be able to

1. Experiment with SQL commands.
2. Apply integrity constraints on a database.
3. Build the views with multiple options.
4. Develop PL/SQL programs using stored procedures, functions, cursors and packages.
5. Create Mango DB and perform basic operations.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	3	3	3
CO2	3	2	3	2	2	2
CO3	3	3	2	2	2	3
CO4	3	3	2	3	1	2
CO5	3	2	3	3	2	3

1 - Slightly, 2 - Moderately, 3 – Substantially

List of Programs

I. SQL

1. Creating tables using commands in DDL
2. Manipulating the data using DML
3. Apply the built-in function and write simple queries on various databases
4. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
5. Using Aggregate functions Set operators
6. Simple condition query creation using SQL Plus
7. Complex condition query creation using SQL Plus
8. Exercising all types of Joins, views
9. Exercising Data Control Language and Transaction Control Language

II. PL/SQL

9. Demonstration of Blocks
10. Cursors, implicit and explicit
11. Procedures,
12. Functions
13. Packages.
14. Creation of Triggers
15. Create a sample MongoDB and basic operations

SUGGESTED READING:

1. Silberschatz, Korth, Sudarshan, Database System Concepts, 7th Edition, McGraw Hill, 2020
2. Nilesh Shah "Database Systems Using Oracle", PHI, 2016.
3. Rick F Van der Lans "Introduction to SQL", 4th Edition, Pearson Education, 2007.
4. Benjamin Rosenzweig, Elena Silvestrova "Oracle PL/SQL by Example", 3rd Edition, Pearson Education, 2004.Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education.

25MCC111

WEB TECHNOLOGIES LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Knowledge of programming fundamentals and web basics

COURSE OBJECTIVES: This course aims to

1. Gain knowledge of developing web pages
2. Learn building applications using latest Technologies

COURSE OUTCOMES: After completion of this course, student will be able to

1. Develop static web pages.
2. Show the documents in professional way.
3. Construct interactive web pages.
4. Examine client side validations.
5. Build web applications using React JS.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	3	2	3	3
CO2	2	2	3	2	3	3
CO3	2	2	3	2	3	3
CO4	2	2	3	2	3	3
CO5	2	2	3	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

HTML5

1. Text, Markup Tags, Formatting tags
2. Images., colors and canvas
3. Hyperlinks., internal , external hyper links
4. Ordered and Unordered Lists, Nested list
5. Tables and Nested Tables
6. Multimedia
7. Forms: student registration form, patient registration form

JAVASCRIPT

8. Selection statements, switch statements and loop statements: student grade, prime perfect
9. Pre-defined objects (Date, String, Math etc.,).
10. Functions.: Factorial, recursion
11. Array object.: sorting: Bubble sort, Selection sort
12. User-defined objects
13. Handle various events occurred in the HTML document
14. Positioning elements, moving elements, elements visibility,

	stacking elements and slow movement of elements.
CSS	15. Inline Stylesheet, Internal Stylesheet. External Stylesheet and Pseudo
	16. Backgrounds, and color Gradients, Fonts and Text styles, Creating Boxes & columns
	17. Positioning and Floating an element, List styles, Table Layouts , frames and controls
XML	18. Store the information in the XML Documents: patient information
	19. CSS style sheets for the XML documents
REACT JS	20. Components, React DOM, Handler Function in JSX, props, state
	21. Hooks, Custom Hooks, React Fragments, Asynchronous Data
	22. Data Fetching & Re-Fetching, Forms: Patient Information
	23. Class component, CSS , SVG's: Apply styles and icons, buttons for student information

SUGGESTED READING:

1. HTML 5 Black Book, DT Editorial Services, DreamTech Press, 2019
2. Robin Wieruch, "The Road to React: Your journey to master plain yet pragmatic React" , 2020-04-20

25MCC112

OPERATING SYSTEMS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	1.5

Pre-requisites: Operating system Concepts and Programming for problem solving Using C

COURSE OBJECTIVES: This course aims to

1. Learn basic shell programs, programs on process scheduling algorithms
2. Learn programs on Inter process Communication, programs on synchronization problems, programs on Page Replacement algorithms and files

COURSE OUTCOMES: After completion of the course, the students would be able to:

1. Implement basic shell programs
2. Build programs on process scheduling algorithms
3. Implement programs on Inter process Communication.
4. Build programs on synchronization problems
5. Implement programs on Page Replacement Algorithms and files.

CO-PO Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	1	1	1
CO2	2	2	2	1	1	1
CO3	2	2	2	1	1	1
CO4	1	1	1	1	1	1
CO5	1	1	1	1	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

List of Programs:

1. Basic shell scripts.
2. Construct a C program for fork system call.
3. Implement a C program for FCFS scheduling algorithm.
4. Implement a C program for SJF scheduling algorithm.
5. Implement a C program for PRIORITY scheduling algorithm.
6. Implement a C program for Round - Robbin scheduling algorithm
7. Construct a C program for IPC by using pipes
8. Construct a C Program for Echo server-using pipes.
9. Construct a C Program for Echo server-using message Queues.
10. Implement a C Program for Producer & Consumer Problem using Semaphores
11. Construct a C Program for Readers & Constructrs Problem using Semaphores
12. Implement a C Program for Dining Philosopher’s problem using semaphores.
13. Construct a C Program for FIFO Page Replacement algorithm.

14. Construct a C Program for LRU Page Replacement algorithm
15. Construct a C program for printing home directory Path of the current user
16. Construct a C program for printing password information of the current user by user id or user name
17. Construct a C program for Create and construct the contents and red the contents of file
18. Construct a C program for Copying content of one file to another file

SUGGESTED READING:

1. W. Richard Stevens, "Unix Network Programming", Pearson Education Inc, PHI Learning 1990.
2. Behrouz A. Forouzan, Richard F. Gilberg, "UNIX and Shell Programming: A Textbook", Books/Cole-Thomson Learning, 2003.
3. Yashvant Kanetkar “Let Us C “, BPB Publication, 15th Edition -2018.