Government of Maharashtra
ISMAIL YUSUF COLLEGE OF ARTS, SCIENCE & COMMERCE
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COURSE OUTCOMES

Course: Programming with Python- I (SEM-I)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Reasons for Python as the learner's first programming language. Introduction to the IDLE interpreter (shell) and its documentation. Expression evaluation: similarities and differences compared to a calculator; expressions and operators of types in, float, Boolean. Built-in function type. Operator precedence. Enumeration of simple and compound statements. The expression statement. The assert statement, whose operand is a Boolean expression (values true or false). The assignment statement, dynamic binding of names to values, (type is associated with data and not with names); automatic and implicit declaration of variable names with the assignment statement; assigning the value None to a name. The del (delete) statement. Input/output with print and input functions. A statement list (semicolon separated list of simple statements on a single line) as a single interpreter command.	1) Students should be able to understand the concepts of programming before actually starting to write programs. 2) Students should be able to develop logic for Problem Solving	1) Students should be able to understand the concepts of programming before actually starting to write programs. 2) Students should be able to develop logic for Problem Solving. 3) Students should be made familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc.

The import statement for already-defined functions and constants. The augmented assignment statement. The built-in help () function. Interactive and script modes of IDLE, running a script, restarting the shell. The compound statement def. to define functions; the role of indentation for delimiting the body of a compound statement; calling a previously defined function. Compound data types stir, tuple and list (enclosed in quotes, parentheses and brackets, respectively). Indexing individual elements within these types. Strings and tuples are immutable, lists are mutable. Built-in functions min, max, sum. Interactive solution of model problems, (e.g., finding the square root of a number or zero of a function), by repeatedly executing the body of a loop (where the body is a statement list).		4) Students should be able to apply the problem solving skills using syntactically simple language i.e.
UNIT 2: Advantages of functions, function parameters, formal parameters, actual parameters, global and local variables. The range function, the iterative for statement. The conditional statements if, if-else.The iterative statements while, while-else, for-else. The continue statement to skip over one iteration of a loop, the break statement to exit the loop. Nested compound statements. Dictionaries: concept of key-value pairs, techniques to create, update and delete dictionary items. Problem-solving using compound types and statements.	1. Students should be made familiar about the basic constructs of programming such as data, operations, conditions, loops, functions etc. 2. Students should be able to apply the problem solving skills using syntactically simple	

	language i.e. Python (version: 3.X or higher)	
UNIT 3: Anonymous functions. List comprehensions. Gentle introduction to object-oriented programming; using the built-in dir. () function, enumerate the met of strings, tuples, lists, dictionaries. Using these methods for problem-solvi with compound types.		

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Course: Digital Systems & Architecture (SEM-I)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Boolean algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. Combinational Circuits: Adders, Mux, De-Mux, Sequential Circuits: Flip-Flops (SR, JK & D), Counters: synchronous and asynchronous Counter Comparison of Computer Organization & Architecture, Computer Components and Functions, Interconnection Structures. Bus Interconnections, Input / Output: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access.	1. Student should be able to learn about mathematical and logical operation in computer. 2. Student should be able to understand how circuit work in device. 3.Student should be able to understand about how to design circuit.	1.Student should be able to learn about how computer systems work and underlying principles. 2.Student should be able to understand the basics of digital electronics needed for computers. 3.Student should be able to understand the basics of instruction set architecture for reduced and complex instruction sets. 4.Student should be able to understand the basics of
UNIT 2: Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. Cache Memory: Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence. Virtual Memory, External Memory: Magnetic Discs, Optical Memory, Flash Memories, RAID Levels Instruction	1.Students come to know how data communicate between device and User.	

Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085/8086 CPU], Processor Organization, Structure and Function. Register Organization, Basic Microprocessor operations: Data Transfer (Register /Memory) Operations, Arithmetic & Logical Operations, Instruction Cycle, Instruction Pipelining. Introduction to RISC and CISC Architecture, Instruction Level Parallelism and Superscalar Processors: Design Issues	2.Students come to know Solve problems based on algorithm. 3.Students come to know How design architecture.	processor structure and operation 5.Student should be able to understand how data is transferred between the processor and I/O devices
UNIT 3: Micro-Operations, Functional Requirements, Processor Control, Hardwired Implementation, Micro-programmed Control. Parallel Architecture: Classification of Parallel Systems, Flynn‟s Taxonomy, Array Processors, Clusters, and NUMA Computers. Multiprocessor Systems: Structure & Interconnection Networks, Multi-Core Computers: Introduction, Organization and Performance.	1.Students come to know about Flynn's Taxonomy, Parallel and serial circuit design	

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Course: Soft Skills(SEM-I)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to Soft Skills and Hard Skills Personality Development: Knowing Yourself, Positive Thinking, Johari's Window, Communication Skills, Non-verbal Communication, Physical Fitness Emotional Intelligence: Meaning and Definition, Need for Emotional Intelligence, Intelligence Quotient versus Emotional Intelligence Quotient, Components of Emotional Intelligence, Competencies of Emotional Intelligence, Skills to Develop Emotional Intelligence Etiquette and Mannerism: Introduction, Professional Etiquette, Technology Etiquette Communication Today: Significance of Communication, GSC's 3M Model of Communication, Vitality of the Communication Process, Virtues of Listening, Fundamentals of Good Listening, Nature of Non-Verbal Communication, Need for Intercultural Communication, Communicating Digital World	1.To understand the communication skills, Emotional Intelligence and the skills to develop to be fit. 2.To explore various technologies in today's world to be able to communicate in this digital world	1) To know about various aspects of soft skills and learn ways to develop personality. 2) Understand the importance and type of communication in personal and professional environment. 3) To provide insight into much needed technical and non-technical qualities in career planning. 4) Learn about Leadership, team building, decision making and stress management
UNIT 2: Academic Skills Employment Communication: Introduction, Resume, Curriculum Vitae, Schnabel Resume, Developing an Impressive Resume, Formats of Resume, Job Application or Cover Letter Professional Presentation: Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation Job Interviews: Introduction, Importance of Resume, Definition of Interview, Background Information, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips, Changes in the Interview Process, FAQ During	1.To have a good knowledge on creating resume for any kind of job application 2. To explore various steps in the interview and types, techniques to face the group discussion	

Interviews Group Discussion: Introduction, Ambience/Seating Arrangement for Group Discussion, Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Traits, Types of Group Discussions, topic based and Case based Group Discussion, Individual Traits		
UNIT 3: Professional Skills Creativity at Workplace: Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method Ethical Values: Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics Capacity Building: Learn, Unlearn and Relearn: Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building Leadership and Team Building: Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams, Decision Making and Negotiation: Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts Stress and Time Management: Stress, Sources of Stress, Ways to Cope with Stress.	1. To understand the skills required to be a good employee at workplace. 2. To learn ethics and correlation between values and behavior	

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Course: Database Systems(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: 1. Introduction to DBMS, 2. Data model 3. Entity Relationship Model 4. DDL Statements. DML Statements	1. Students should gain a comprehensive understanding of Database Management Systems (DBMS), data models, Entity Relationship (ER) modelling, and practical skills in using Data Definition Language (DDL) and Data Manipulation Language (DML) statements. The unit aims to equip students with the foundational knowledge and skills required for effective database design and management.	1.To make students understand the basic principles of algorithm design 2.To give idea to students about the theoretical background of the basic data structures 3.To familiarize the students with fundamental problem-solving strategies like searching, sorting, selection, recursion and help them to evaluate efficiencies of various algorithms. 4. To teach students the important algorithm design paradigms and how they can be used to solve various real world problems.
UNIT 2: 1. Relational data model 2. Relational Algebra 3. Functions 4. Joining Tables 5. Subqueries	1. Upon completion of this unit, students should have a solid understanding of the relational data model, be proficient in performing basic operations using relational algebra, master joining tables, and be able to use subqueries effectively. The unit aims to provide students with	

	the foundational skills necessary for working with relational databases and querying data using SQL.	
UNIT 3 1. Schema refinement and Normal forms 2. Database Protection 3. Views 4. DCL Statements 5. Index Structures of Files	1. Upon completion of this unit, students should have a solid understanding of schema refinement, normalization, database protection measures, views, DCL statements, and index structures. The unit aims to equip students with the knowledge and skills required to design and manage secure and efficient databases.	

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Course: Design & Analysis of Algorithms(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to algorithms - Ethical Values Introduction to Data Structures ER to Table	1. Students should have a solid foundation in understanding algorithms, their analysis, and the fundamentals of data structures. 2. They should be able to analyze and compare algorithms, estimate their performance, and implement basic data structures for various applications. 3.The unit aims to provide a comprehensive introduction to algorithmic thinking and data organization.	1.To make students understand the basic principles of algorithm design 2.To give idea to students about the theoretical background of the basic data structures. 3.To familiarize the students with fundamental problem-solving strategies like searching, sorting, selection, recursion and help them to evaluate efficiencies of various algorithms. 4. To teach students the important algorithm design paradigms and how they can
UNIT 2: 1. Recursion 2. Basic Sorting Techniques 3. Searching Techniques 4. Selection Techniques 5. String Algorithms	Students should acquire a deep understanding of recursion, basic sorting techniques, searching techniques, selection techniques, and string algorithms. They should be able to analyze and implement these algorithms, comparing their efficiency in various scenarios. The unit aims to equip students with fundamental problem-solving skills in algorithm design and analysis.	
UNIT 3:		

1. Algorithm Design Techniques 2. Greedy Technique 3. Divide-n-Conquer 4. Dynamic Programming 5. Backtracking Programming	1.Students should be able to distinguish between different algorithm design techniques, understanding their classifications and criteria. 2.Students should understand the concept of Greedy Technique and be able to Discuss advantages and disadvantages of the Greedy approach. Identify applications where Greedy algorithms are suitable. Implement the Greedy Technique to solve practical problems, such as the file merging problem. 3.Students should grasp the concept of Divide and Conquer and be able to. Implement Backtracking techniques for specific problems, such as the N-Queen Problem. 4.Students should have a comprehensive understanding of various algorithm design techniques, their respective advantages and disadvantages, and be capable of implementing these techniques to solve specific problems. 5.The unit aims to equip students with problem-solving skills using different algorithmic paradigms.	be used to solve various real world problems.

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Course: Programming with Advanced Python- I(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Working with files: Files, opening and closing a file, working with text files containing strings, knowing whether a file exists or not, working with binary files, the 'with' statement, the seek () and tell () methods, random accessing of binary files, zipping and unzipping files, working with directories, running other programs from python program Regular expressions: What is a regular expression? sequence characters' in regular expressions, quantifiers in regular expressions, special characters' in regular expressions, using regular expression on files, retrieving information from an html file, Threads in python: Difference between process and thread, types of threads, benefits of threads, creating threads, single tasking and multitasking, thread synchronization, deadlock in threads, daemon threads Date and time in python: Date and time now, combining date and time, formatting dates and times, finding durations using "time delta", comparing two dates, sorting dates, stopping execution temporarily, knowing the time taken by a program, calendar module.	1.Students will learn about Files, Opening, and Closing. 2. Also Define what regular expressions are and their applications. 3. How multiple processes handle by Thread Synchronization and Deadlock. 4. How to work with Calendar Module	1.After successful completion of this course, students would be able to. 2.Ability to implement O concepts in Python includ Inheritance and Polymorphism. 3. Ability to work with files and perform operations on it using Python. 4. Ability to implement regular expression and concept of threads for developing efficient Program. 5.Ability to implement exception handling in Python applications for error handling.

UNIT 2: Database in python: Using SQL with python, retrieving rows from a table, inserting rows into a table, deleting rows from a table, updating rows in a table, creating database tables through python, Exception handling in databases. Exceptions in python: Errors in a python program, compile & run-time errors, logical error, exceptions-exception handling, types of exceptions, the except block, the assert statement, user-defined exceptions, logging the exceptions Networking: Protocols, server-client architecture, tcp/ip and up communication Graphical user interface: Creating a GUI in python, Widget classes, working with Fonts and Colors, working with Frames, Layout manager, Event handling.	1. Understand the integration of Python with SQL databases. 2. Learn to execute SQL queries using Python. 3.Handle database-related exceptions in Python. 4. Implement error-catching mechanisms for robust database interactions. 5.Develop graphical user interfaces using Python with various widgets.	6. Knowledge of working with databases, designing GUI in Python and implement networking in Python.
UNIT 3: OOPs in python: Features of Object Oriented Programming system (oops)-classes and objects, encapsulation, abstraction, inheritance, polymorphism, constructors and destructors Classes and objects: Creating a class, the self-variable, types of variables, namespaces, types of methods, instance methods, class methods, static methods, passing members of one class to another class, inner classes Inheritance and polymorphism: Inheritance in python, types of inheritance- single inheritance, multilevel inheritance,	1. Understand the fundamental concepts of classes and objects. 2. Define and create classes in Python. 3.Define and create classes with attributes and methods.	

hierarchical inheritance, multiple inheritance, constructors in inheritance, overriding super class constructors and methods, the super() method, method resolution order (mro), polymorphism, duck typing, operator overloading, method overloading, method overriding, Abstract classes and interfaces: Abstract class, abstract method, interfaces in python, abstract classes vs. Interface	4. Understand the structure of a class in Python. 5.Define abstract classes and abstract methods in Python.	

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Course: Database System(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to DBMS – Database, DBMS – Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture Data models - Client/Server Architecture, Object Based Logical Model, Record Based Logical Model (relational, hierarchical, network) Entity Relationship Model - Entities, attributes, entity sets, relations, relationship sets, Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization, Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER) Relational data model– Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint, Check constraint ER to Table- Entity to Table, Relationship to tables with and without key constraints.	1.To understand the fundamental principles and components of database systems. 2.To explore various models, constraints and conceptual design and conversion of ER to table.	1)To evaluate business information problem and find the requirements of a problem in terms of data. 2) To design the database schema with the use of appropriate data types for storage of data in database. 3) To create, manipulate, query and back up the databases.

UNIT 2: Schema refinement and Normal forms: Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition. Relational Algebra operations (selection, projection, set operations union, intersection, difference, cross product, Joins – conditional, equip join and natural joins, division) DDL Statements - Creating Databases, Using Databases, datatypes, Creating Tables (with integrity constraints – primary key, default, check, not null), Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables, Backing Up and Restoring databases DML Statements – Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, avg, sum), group by clause, having clause.	1.To create Scheme, refine the scheme and perform normalization	
UNIT 3: Functions – String Functions (concept, instar, left, right, mid, length, laces/lower, ukase/upper, replace, strum, trim, trim, trim), Math Functions (abs, ceil, floor, mod,	1. To solve the queries and understand functions ,create tables perform all data operations along with database protection	

pow, sort, round, truncate) Date Functions (add date, datediff, day, month, year, hour, min, sec, now, reverse) Joining Tables – inner join, outer join (left outer, right outer, full outer) Subqueries – subqueries with IN, EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated subqueries Database Protection: Security Issues, Threats to Databases, Security Mechanisms, Role of DBA, Discretionary Access Control Views (creating, altering dropping, renaming and manipulating views) DCL Statements (creating/dropping users, privileges introduction, granting/revoking privileges, viewing privileges		

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Course: E-Commerce & Digital Marketing(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to E-Commerce and E- Business: Definition and competing in the digital economy, Impact of E-Commerce on Business Models, Factors Driving e-commerce and e-Business Models, Economics and social impact of e-Business, opportunities and Challenges, e-Commerce vs m Commerce, Different e-Commerce Models (B2B, B2C, C2B, C2C, B2E), e-Commerce Applications: e-Trading, e-Learning, e-Shopping, Virtual Reality & Consumer Experience, Legal and Ethical issues in e-Commerce. Overview of Electronic Payment systems: Types of Electronic payment schemes (Credit cards, Debit cards, Smartcards, Internet banking), E checks, E-Cash Concepts and applications of EDI and Limitation Introduction & origin of Digital Marketing: Traditional v/s Digital Marketing. Digital Marketing Strategy, The P-O-E-M Framework, Segmenting & Customizing Messages, The Digital landscape, Digital Advertising Market in India. Skills required in Digital Marketing. Digital Marketing Plan.	1. Student should be able to learn about Introduction to E-Commerce and E- Business. 2. Student should be able to understand Overview of Electronic Payment systems. 3. Student should be able to understand about Introduction & origin of Digital Marketing.	1. Student should be able to understand the core concepts of E-Commerce. 2. Student should be able to understand the various online payment techniques. 3. Student should be able to understand the core concepts of digital marketing and the role of digital marketing in business. 4. Student should be able to understand how to apply digital marketing strategies to increase sales and growth of business. 5. Student should be able to understand how Apply digital marketing through different channels and platforms. 6. Student should be able to understand the significance of Web Analytics

UNIT 2: Social Media Marketing: Meaning, Purpose, types of social media websites, Social Media Engagement, Target audience, Facebook Marketing: Business through Facebook Marketing, Creating Advertising Campaigns, 15 Page 48 of 49 Adverts, Facebook Marketing Tools, LinkedIn Marketing Importance of LinkedIn Marketing, Framing LinkedIn Strategy, Lead Generation through LinkedIn, Content Strategy, Analytics and Targeting, Twitter Marketing: Framing content strategy, Twitter Advertising Campaigns, YouTube Marketing: Video optimization, Promoting on YouTube, Monetization, YouTube Analytics Email Marketing: Types of Emails, Mailing List, Email Marketing tools, Email Deliverability & Email Marketing automation Mobile Marketing: Introduction, Mobile Usage, Mobile Advertising, Mobile Marketing Types, Mobile Marketing Features, Mobile Campaign Development, Mobile Advertising Analytics Content Marketing: Introduction, Content marketing statistics, Types of Content, Types of Blog posts, Content Creation, Content optimization, Content Management & Distribution, Content Marketing Strategy, Content creation tools and apps, Challenges of Content Marketing.	1. Students come to know how Social Media Marketing. 2. Students come to know Email Marketing. 3. Students come to know Email Marketing, Mobile Marketing and Content Marketing.	and Google Analytics and apply the same.
UNIT 3: Search Engine Optimization: Meaning, Common SEO techniques, Understanding Search Engines, basics of	1. Students come to know about Search Engine Optimization.	

Keyword search, Google rankings, Link Building, Steps to optimize website, On-page and off-page optimization Search Engine Marketing: Introduction to SEM, Introduction to Ad Words - Google Ad Words, Ad Words fundamentals, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation, Display marketing, Buying Models: Cost per Click (CPC), Cost per Milli (CPM), Cost per Lead (CPL), Cost per Acquisition (CPA). Web Analytics: Purpose, History, Goals & objectives, Web Analytic tools & Methods. Web Analytics Mistakes and Pitfalls. Google Analytics: Basics of Google Analytics, Installing Google Analytics in website, Parameters of Google Analytics, Reporting and Analysis.	2. Students come to know about Search Engine Marketing. 3. Students come to know Web Analytics and Google Analytics.	

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Course: Programming with Python- II(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Python File Input-Output: Opening and closing files, various types of file modes, reading and writing to files, manipulating directories. Inerrable, iterators and their problem solving applications. Exception handling: What is an exception, various keywords to handle exceptions such try, catch, except, else, finally, raise. Regular Expressions: Concept of regular expression, various types of regular expressions, using match function	1.Students will know about Reading and writing to files: Use the read (), write (), and read lines () methods for reading and writing data to files. 2. Students should be able to understand error handling using Keywords like try, except, else, finally, and raise are used for handling exceptions.	1. Students will know about Reading and writing to files: Use the read (), write(), and read lines() methods for reading and writing data to files. 2. Students should be able to understand error handling using Keywords like try, except, else, finally, and raise are used for handling exceptions. 3. Students will come to know how to work with Network Connectivity in Python. 4. Database Connectivity to read, insert and update , delete data for further use.
UNIT 2: GUI Programming in Python (using Tkinter/wx Python/Qtr.) What is GUI, Advantages of GUI, Introduction to GUI library. Layout management, events and bindings, fonts, colors, drawing on canvas (line, oval, rectangle, etc.) Widgets such as: frame,	1. Students should be made familiar for Layout Management, fonts and Colors, Drawing on Canvas: etc.	

label, button, check button, entry, list box, message,radio button, text, spin box etc.		
UNIT 3: Database connectivity in Python: Installing my SQL connector, accessing connector module, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, executing transactions, understanding exceptions in database connectivity. Network connectivity: Socket module, creating server-client programs, sending email, reading from URL	1.Students will come to know how to work with Network Connectivity in Python: 2.Database Connectivity to read, insert and update, delete data for further use	

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Course: Programming with C(SEM-II)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Structure of C program: Header and body, Use of comments. Interpreters vs compilers, Python vs C. Compilation of a program. Formatted I/O: print f (), scan f (). Data: Variables, Constants, data types like: int. float char, double and void, short and long size qualifiers, signed and unsigned qualifiers. Compare with datatypes in Python. Compare static typing in C vs dynamic typing in Python Variables: Declaring variables, scope of the variables according to block, hierarchy of data types. Compare explicit declarations in C with implicit declarations in Python. Types of operators: Arithmetic, relational, logical, compound assignment, increment and decrement, conditional or ternary, bitwise and comma operators. Precedence and order of evaluation, statements and Expressions. Automatic and explicit type conversion. Iterations: **Control statements for decision making**: (i) Branching: if statement, else. if	1. Illustrate the flowchart and design an algorithm for a given problem and to develop IC programs using operators 2.To understand the branching statements	1) To write, compile and debug programs in C language. 2) To use different data types in a computer program. 3) To design programs involving decision structures, loops and functions. 4) To explain the difference between call by value and call by reference. 5) To understand the dynamics of memory by the use of pointers. 6) To use different data structures and create/update basic data files.

statement, (does the writer mean if-else or nested ifs) switch statement. (ii) Looping: while loop, do while, for loop. (iii) Jump statements: break, continue and go to.		
UNIT 2: Arrays: (One and two dimensional), declaring array variables, initialization of arrays, accessing array elements. Compare array types of C with list and tuple types of Python. Data Input and Output functions: Character I/O format: getch(), getche(), getchar(), getc(), gets(), putchar(), putc(), puts(). Manipulating Strings: Declaring and initializing String variables, Character and string handling functions. Compare with Python strings. Functions: Function declaration, function definition, Global and local variables, return statement, calling a function by passing values. Recursion: Definition, Recursive functions.	1.Develop conditional and iterative statements to write C programs. 2. Develop Arrays, Strings and functions in C. 3. Exercise user defined functions to solve real time problems	

UNIT 3: Pointer: Fundamentals, Pointer variables, Referencing and de-referencing, Pointer Arithmetic, Using Pointers with Arrays, Using Pointers with Strings, Array of Pointers, Pointers as function arguments, Functions returning pointers. Dynamic Memory Allocation: malloc(), calloc(), reallot(), free() and size of operator. Compare with automatic garbage collection in Python. Structure: Declaration of structure, reading and assignment of structure variables, Array of structures, arrays within structures, structures within structures. Compare C structures with Python tuples. Unions: Defining and working with unions. File handling: Different types of files like text and binary, Different types of functions: fopen(), fclose(), fgetc(), fputc(), fgets(), fputs(), fscanf(), fprintf(), getw(), putw(), fread(),fwrite(), fseek().	1.Inscribe C programs that use Pointers to access arrays, strings and functions 2.Inscribe C programs using pointers and to allocate memory using dynamic memory management functions	

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Course: Data Structure(SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: 1. Abstract Data Type 2. Linked Structures 3. Stacks 4. Queues 5. Etiquette and Mannerism 6. Ethical Values	**Upon completion of this unit, participants will:** 1. Have a deep understanding of various data types and their applications. 1. Recognize different data structures and classify them based on organizational principles. 2. Understand Abstract Data Types (ADT) and create user-specific ADTs. 3. Demonstrate proficiency in operations related to linked structures, stacks, and queues. 4. Analyze the advantages and disadvantages of linked structures, stacks, and queues.	1. Students will have acquired a well-rounded skill set in data types, data structures, graph theory, and hashing. 2. They will be equipped with the knowledge and practical experience necessary for effective problem-solving and algorithmic thinking in both academic and professional contexts

	5. Apply these data structures to real-world problems, such as polynomial equations, balanced delimiters, postfix notation conversion, and job scheduling.	
UNIT 2: 1. Doubly Linked list 2. Trees 3. Priority Queues & Heap	Upon completion of this unit, participants will: 1. Have a deep understanding of various data types and their applications. 2. Recognize different data structures and classify them based on organizational principles. 3. Understand Abstract Data Types (ADT) and create user-specific ADTs. 4. Demonstrate proficiency in operations related to linked structures, stacks, and queues. 5. Analyze the advantages and disadvantages of linked structures, stacks, and queues. 6. Apply these data structures to real-world problems, such as polynomial	

	equations, balanced delimiters, postfix notation conversion, and job scheduling.	
UNIT 3: 1. Graph 2. Hashing	Upon completion of this unit, participants will: 1. Understand the fundamentals of graphs, including their structure and terminology. 2. Comprehend the Abstract Data Type (ADT) for graphs and perform operations like insertion and deletion. 3. Demonstrate proficiency in graph representation using adjacency matrix and adjacency list. 4. Conduct graph traversals using Breadth-First Search (BFS) and Depth-First Search (DFS). 5. Explore practical applications of graphs, specifically in the context of shortest path algorithms. 6. Understand the Hash Table ADT, its advantages, and the concept of hashing. 7. Analyze collision issues in hashing and explore collision avoidance techniques.	

	8. Recognize the applications of hashing in various contexts, including efficient data storage and retrieval.	

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Course: Web Technologies (SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1 1. HTML5 2. CSS	**Upon completion of this unit, participants will have acquired:** 1.The knowledge and skills to effectively structure and style web content using HTML5 and CSS. 2.They will be able to create visually appealing and interactive web pages, incorporating multimedia elements and applying design principles for a seamless user experience.	1.Students will possess a comprehensive skill set in web development, from structuring and styling web content to implementing dynamic and interactive features using various technologies. 2.The course prepares participants to design and build effective web applications that meet modern standards and user expectations.
UNIT 2 1. JavaScript 2. XML	1.proficiency in using JavaScript for web development, including programming fundamentals, functions, and interactions with browser objects. 2.Additionally, participants will understand the basics of XML, its structure, and how to work with	

	XML documents, along with the transformation. 3.capabilities provided by XSLT. These skills will enable participants to enhance the interactivity and data representation of web applications.	
UNIT 3 1. Graph 2. Hashing	1.well-rounded set of skills in web development. 2.They will understand the AJAX model, be proficient in handling asynchronous requests using the XML Http Request object, and possess practical experience in PHP for variables, operators, program flow, arrays, file operations, database interactions, and working with cookies, sessions, and headers. 3. Additionally, participants will have a solid introduction to jQuery, gaining knowledge in its fundamentals, selectors, attribute	

	manipulation, DOM traversal, and event handling. 4. These skills collectively prepare participants for building dynamic and interactive web applications.	

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Course: Advanced Data Base(SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Overview of PL/SQL: Advantages of PL/SQL, Main Features of PL/SQL, Architecture of PL/SQL Fundamentals of PL/SQL: Character Sets, Lexical Units, Declarations, References to Identifiers, Scope and Visibility of Identifiers, Assigning Values to Variables, Expressions, Error-Reporting Functions, Data Types. Control Statements: Conditional Selection Statements, LOOP Statements, Sequential Control Statements, GOTO, and NULL Statements. Sequences: creating sequences, referencing, altering, and dropping a sequence. Stored Procedures and Functions: Procedures: Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures. Functions: Calling function and recursion function.	1. develop understanding of concepts and techniques for data management and learn 2. learn out widely used systems for implementation and usage.	1. Students will learn about what are the concepts of Master concepts of stored procedure, functions, cursors and triggers and its use are implements and helpful in real life. 2. Students will also Learn about using PL/SQL for data management. 3. Also they will learn about Use Efficiently Collections and records. 4. Also students will Understand concepts and implementations of transaction management and crash recovery When any failure occurs.

UNIT 2: Collections and Records: Associative Arrays, Varra (Variable-Size Arrays), Nested Tables, Collecti Constructors, Assigning Values to Collection Variable Multidimensional Collections, Collection Comparisor Collection Methods, Collection Types Defined in Packa Specifications, Record Variables, Assigning Values Record Variables. Error Handling: Compile-Tir Warnings, Overview of Exception Handling, Internal Defined Exceptions, Predefined Exceptions, User Defin Exceptions, Declared Predefined Exceptions, Raisi Exceptions Explicitly, Exception Propagation, Unhandl Exceptions. Cursors: Overview of Cursor, Types cursors, Invalid cursor Exception. Static and Dynam SQL: Static SQL: Description of Static SQL, Cursc Overview, Processing Query Result Sets, Cursor Variable CURSOR Expressions, Transaction Processing a Control, Autonomous Transactions. Dynamic SQL: Nati Dynamic SQL, DBMS_SQL Package, SQL Injection.	1. To develop understanding of Transaction management and crash recovery	

UNIT 3: Triggers: Overview of Triggers, implementing triggers – creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting, and modifying triggers, and enforcing data integrity through triggers. Packages: Overview of a Package. Need of Packages, Package Specification, Package Body, Package Instantiation and Initialization. Transaction Management: ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem, Read-Write Locks, Deadlocks Handling, Two Phase Locking protocol. Crash Recovery: ARIES algorithm. The log-based recovery, recovery related structures like transaction and dirty page table, Write-ahead log protocol, check points, recovery from a system crash, Redo and Undo phases	1.To develop concepts of programming concepts of database	

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Course: Green Technologies. (SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Green IT Fundamentals: Information Technology and Environment, Business, Environment, and Green Enterprise Characteristics, Green Vision and Strategic Points, Green Value, Green IT Opportunity, Challenges of a Carbon Economy, Environmental Intelligence, Envisioning the Green Future Green IT Strategies: Green strategic alignment, Green IT Drivers-Cost, Regulatory and Legal, Sociocultural and Political, Business ecosystem, New market opportunities, Green IT Business Dimensions, KPIs in Green Strategies Environmentally Responsible Business: Developing ERBS, Policies, Practices, and Metrics, Mobility and Environment, Green It Metrics and Measurements, Green IT Readiness and CMM, Context Sensitivity and Automation in Green IT Measures Green Assets: Introduction, Green Assets, Green IT Hardware, Green Data Centers and ICT Equipment, Server and Data Strategy	1. Student should be able to learn about Green IT Fundamentals: Business, IT, and the Environment. 2. Student should be able to understand Green IT Strategies. 3. Student should be able to understand Environmentally Responsible Business.	1.Student should be able to learn about Explain drivers and dimensions of change for Green Technology. 2.Student should be able to learn about the learner will be able to appreciate Virtualization; smart meters and optimization in achieving green IT. 3.Student should be able to learn about the learner will be able to develop Gain knowledge about green assets, green processes, and green enterprise architecture. 4.Student should be able to learn about the learner will be able to ISO 14001 and related standards for Audit for Green Compliance.
UNIT 2: Green Assets and emerging Trends: Data Servers Optimization and Virtualization, Physical Data Server Organization and Cooling, Cloud Computing and Data	1.Students come to know Green Assets and emerging Trends.	

Centers, Networking and Communications Infrastructure, End-User Devices, Smart Meters in Real-Time, Managing Devices for Central Green Services, Devices and Organizational Boundaries for Measurements, Mobile Devices, and Sustainability Green Business Process Management: Introduction, Green Reengineering, Green Process, Green BPM and standards, Green Business Analysis, Green Requirements Modelling, Green IT Governance, Green Business Process and Applications, QoS, Achieving green BPM, Green Mobile Business Process, Digital Library Green Enterprise Architecture: Green IT and organizational Systems, Aspects of Green Solutions Architecture, Contents and Integration with Service-Oriented Architecture, Green Supply Chain Management, Green Portals in Green Enterprise Architecture, Environmental Intelligence.	2.Students come to know how to implement Green Business Process Management. 3.Students come to know Green Enterprise Architecture	
UNIT 3: Green Information Systems(GIS): Design and Development Models: Describing GIS, GIS Requirements Sociocultural Aspects of Green IT: Green IT's Social Impact, Learning Organization, Green Social Stakeholders, Role-Based View of Green IT, Green User Practices, Attitude and Subjectivity in Green IT, Green IT Ethics and Code of Conduct, Privacy and Security of Green Information, Green Washing, Communications in Green Transformation Projects, Green HR and Changing Organizational Structures, Green-Collar Workers: Roles and Skill Sets, Green Virtual Communities Green	1.Come to know implementation of Green Information Systems(GIS): Design and Development Models. 2.To know implementation of Sociocultural Aspects of Green IT. 3.Student Come to know implementation of Green Compliance: Protocols, Standards, and Audits.	

Compliance: Protocols, Standards, and Audits: Protocols and Standards, ISO 14000-2004 Standard, Various initiatives by stakeholders, Green Audits and types, Audit and use of Carbon emission management software Emerging Carbon Issues: Technologies and Future: Future Carbon Landscape, Green ICT and Technology Trends, Cloud Computing, Nanotechnology, Quantum computing, Renewable energies, eco-design, Collaborative environmental intelligence.		

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Course: Java based Application Development(SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction: History, Features of Java, Java Development Kit, Java Application Programming Interface, Java Virtual Machine Java Program Structure, Java Tokens. OOPS: Introduction, Class, Object, Static Keywords, Constructors, this keyword, Inheritance, Inner class, Anonymous Inner class, super keyword, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes, Interfaces Packages: Introduction to predefined packages, User Defined Packages, Access specifiers Exception Handling: Introduction, Pre-Defined Exceptions, try-catch-finally, throws, throw, User Defined Exceptions Multithreading: Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, wait() notify() notify all() methods	1.Student should be able to learn about java virtual machine and java awt program. 2.Student should be able to understand Event handling in java. 3.Student should be able to understand thread concept	1. Student should be able to learn about design basic application in java using Graphical User Interface. 2.Student should be able to learn about the learner will be able to develop applications using swings 3.Student should be able to learn about the learner will be able to develop web based applications using servlet and jsp. 4.Student should be able to learn about the learner will be able to connect databases with java through.
UNIT 2: **Collection Framework**: Introduction, java. until Package interfaces, List, Set, Map, List interface & its classes, Set interface & its classes, Map interface & its classes.	1.Students come to know how to design interface. 2.Students come to know how to implement application using Swing.	

Introduction to JFC and Swing- Features of the Java Foundation Classes, Swing API Components, Component Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Toolbars, Implementing Action interface, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components, Colors and File Choosers, Tables and Trees, Printing with 2D API and Java Print Service API. **Event Handling:** Delegation Event Model, Events, Event classes, Event listener interfaces, Using delegation event model, adapter classes. **JDBC:** Introduction, JDBC Architecture, JDBC Drivers, JDBC Connectivity Model, java.sql package, Using Statement, Prepared Statement, Callable Statement, Result Set, Scrollable and Updatable Result Set, Navigating and manipulating data, Result Set Meta Data, Managing Transactions in JDBC, JDBC Exception classes, BLOB & CLOB		5.Student should be able to learn about the learner will be able to perform programs using JSON objects.
<u>UNIT 3:</u> **Servlets:** Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, working with Servlet Context and Servlet Config Object, Attributes in Servlet, Response and Redirection using Request Dispatcher and using send Redirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTP Session, Hidden Form Fields and URL Rewriting,	1.Come to know implementation of servlet. 2.To know implementation of jsp app. Come to know implementation of Jason app.	

Types of Servlet Event: Context Level and Session Level. **Java Server Pages (JSP)**: Introduction to JSP, Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, JSP CRUD Applications **JSON:** Overview, Synta		

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Course: Operating System(SEM-III)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
Unit 1: Introduction and Operating-Systems Structures: Definition of Operating system, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments Operating-System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure Processes: Process Concept, Process Scheduling, Operations on Processes, Interposes Communication Threads: Overview, Multicore Programming, Multithreading Models	1.To learn the fundamentals of Operating Systems and its types. 2.Analyse the structure of OS and basic architectural components involved in OS design	1. To provide an understanding of operating system, its structures and functioning. 2.Develop and master understanding of algorithms used by operating systems for various purposes.
Unit 2: Process Synchronization: General structure of a typical process, race condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling), Thread Scheduling	1. To learn the mechanisms of OS to handle processes and threads and their communication. 2. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.	

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	3. Analyse and design the applications to run in parallel either using process or thread models of different OS. 4. Understand the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system	
Unit 3: Main Memory: Background, Logical address space, Physical address space, MMU, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table Virtual Memory: Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing Mass-Storage Structure: Overview, Disk Structure, Disk Scheduling, Disk Management File-System Interface: File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing File-System Implementation: File-System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.	1.To learn the mechanisms involved in memory management in contemporary OS. 2. Analyse the various device and resource management techniques for timesharing and distributed systems.	

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Course: IoT Technologies(SEM-IV)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Fundamentals of IoT System on Chip Different types of IoT/SoC Platforms	**Upon completion of this unit, participants will:** 1.These unit outcomes are designed to ensure that students gain a comprehensive understanding of IoT fundamentals, SoC principles, and different platforms, with an emphasis on practical applications, problem-solving, critical analysis, and effective communication. 2.Assessment methods may include exams, hands-on projects, presentations, and practical demonstrations to evaluate students' achievement of these outcomes.	1.students will be well-equipped with the knowledge and practical skills needed to design, implement, and secure IoT systems, ensuring effective communication, efficient data management, and robust interfacing with various platforms. 2.The course outcomes emphasize not only theoretical understanding but also the ability to apply concepts in real-world scenarios and address advanced challenges in the IoT domain.
UNIT 2: 1. Interfacing with IoT Platforms 2. Using Sensor & Actuators 3. IoT and Protocols IoT Security	**Upon completion of this unit, participants will:** 1.These unit outcomes aim to demonstrate that students not only acquire practical skills but also	

	exhibit advanced proficiency in interfacing with IoT platforms, utilizing sensors and actuators effectively, and implementing robust security measures in IoT systems. 2.Assessment methods may include advanced hands-on projects, in-depth performance analysis reports, advanced security audits, and comprehensive documentation evaluations to gauge students' achievement of these outcomes.	
UNIT 3: 1. IoT & Web 2. IoT Applications 3. Edge Computing	**Upon completion of this unit, participants will:** 1.These unit outcomes are designed to ensure that students gain a holistic understanding of integrating IoT with web technologies, developing diverse IoT applications, and implementing edge computing solutions. 2.Assessment methods aim to measure students' theoretical	

	knowledge, practical skills, and the ability to apply these concepts in real-world scenarios.	

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Course: Advanced Application Development(SEM-IV)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
Unit 1: Node.js (N): Introduction to Node.js. Installing Node.js. The package. js on File. The Node.js Event Loop. The I/O Cycle. The Anatomy of a Node.js Module. Creating Node Modules. Exploring the Node.js HTTP Module. Creating an HTTP Webserver with Node.js. Responding to HTTP Requests. Routing in Node.js. Creating a Sample Node.js Application. MongoDB(M): Introduction to MongoDB. Installing MongoDB. Using MongoDB Compass. Using Mongo Shell Interface. Connecting to MongoDB. Creating Schemas and Models. Querying Documents Using find (). Inserting Documents Using create (). Updating Documents Using Find One and Update (). Deleting Documents Using Find One and Delete () & delete Many ()	1. understand all the necessary and important technologies such as MongoDB, Express. 2.Define Node.js and its role in server-side development. 3.Build a basic HTTP server using Node.js.Insert, update, delete, display data using Mongodb No Sql Concept.	1.Store the data in NoSQL, document-oriented MongoDB database that brings performance and scalability. 2.Use Node.js and Express Framework for building fast, scalable network applications. 3.Use AngularJS framework that offers declarative, two-way data binding for web applications. 4.Integrate the front-end and back-end components of the MEAN stack. 5.Develop robust mobile applications using Flutter.
Unit 2: Server-Side Development with Express (E): Introduction to the Express Framework. Installing and Testing Express. Creating a Node.js Express App. Restructuring an Express App. Creating Templates. Using Express Middleware Functions. Creating the List Page. Creating the Details Page. Creating the Edit Page. Creating the Add Page. Deleting	1.To understand all the necessary and important technologies such as AngularJS, and Node.js	

Data. REST API Basics. Testing REST APIs. Refactoring APIs. Understanding Angular.JS(A): Getting Started with Angular. Creating an Angular Application. Angular Project File Structure. Anatomy of an Angular Component. One-way Data Binding. Two-way Data Binding. Using Nglf Directive. Using Ng for of Directive. Angular Modules. Creating Ng Modules Using Angular Router. Configuring Templates. Creating Navigations. Working with Template-driven Forms. Working with Reactive Forms. Validating Form Data. Services Dependency Injection (DI). Reading Data from Database. Inserting Data into Database. Updating Data in the Database. Delete Data from Database.		
Unit3: Understanding Flutter: Importance of Flutter, Flutter Framework, Android Studio, Flutter SDK, Installing and Configuring Flutter SDK. Dart Programming: main () function, Dart Variables, Dart Data Types, Dart Conditional Operators, Control Flow & Loops. Dart Functions - Functions, Function Structure, creating a Function, Function Returning Expression. Object-Oriented Programming (OOP) - Creating a Class, Adding Methods to Classes, Class — Getters and Setters, Class Inheritance, Abstract Class. Flutter Widgets Fundamentals: Scaffold Widget, Image Widget, Container Widget, Column and Row Widgets, Icon Widget, Layouts in Flutter, Card Widget, Hot Reload and Hot Restart, tasteful and Stateless Widgets Navigation and Routing: Button Widget, App Structure and	1.To understand modern app development (like mobile and web development) using Flutter	

Navigation, navigate to a New Screen and Back, navigate with Named Routes, Send and Return Data among Screens, Animate a Widget across Screens, Web View Widget in Flutter.		

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Course: Android Application Development(SEM-IV)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to Kotlin: Basics of Kotlin, type conversions, comments, Kotlin operators, variables in Kotlin, packages, visibility modifiers, control flow statements, Concept of OOPS in Kotlin, classes in Kotlin, delegation and extension functions, the companion object, Advanced Concepts in Kotlin: declaring and calling functions, parameters, and arguments in Kotlin, default argument, variable number of arguments, unit-returning function, explicit return type, lambda expression, coroutines, Collections in Kotlin, Mutable and Immutable Collections, Ranges, type Checks, casting concept, this expression, Null safety, exception handling, annotations App Development with Android Studio: Android Architecture, Android Application Framework, Android Virtual Device, Creating and running First Android Application, working with Physical Android Device, Adding Kotlin Files in Android Studio Basics Of Android- Application Components: Activities, Intent, and Broadcast Receiver, Services, Fragment, Activity Life Cycle, Content Provider, Widgets, and Notifications.	1. Student should be able to learn about Kotlin language program. 2. Student should be able to understand how to use android studio with kotlin. 3. Student should be able to understand basics of android.	1.Student should be able to learn about how to Build useful mobile applications using Kotlin language on Android. 2.Students should be able to learn about the learner and will be able to Install and configure Android Studio for application development. 3.Students should be able to learn about Master basic to intermediate concepts of Kotlin required for mobile application development. 4.Students should be able to learn about Use built-in widgets and components, work with the database to store data. 5. Students should be able to learn about Master key Android

UNIT 2: Designing Android UI: User Interface (UI), Layout and Its Types, Layout Attribute, working with Views, Android UI Controls, Styles and Themes, Event Handler, setting up themes in Manifest and from the application, dialog in activity, using intents, fragments Handle Images, Listview And Menu: ImageView, ImageSwitcher, ListView, Menu, and its types, Designing menu in XML, Option menu, Context menu, popup menu, Screen Navigation, RecyclerView, Interaction of Views Data binding in Android-AdapterView, Spinner, Gallery view, AutotextCompleteView, screen orientation, Design the view dynamically Implementing Data Persistence: Data Storage-Shared Preference, Internal And External Storage Storing Data Using SQLite Databases, Content Provider, Firebase Real-Time Data	1.Students come to know how to design android UI. 2.Students come to know how to handle images, List view and Menu. 3.Students come to know how to handle Data binding in Android. Students come to know how to Implementing Data Persistence.	programming concepts and deploy the application on Google Play
UNIT 3: Graphics, Animations, and Integrating Media in Android: Draw able Class, Animation in Android, Media Player API and in Android, Media player and Audio Manger Class, Interacting With Camera and input gestures: Android Camera, Input gestures-multiple touch, swipe, drag, scroll, zoom, Recording Gathering	1.Students come to know Graphics, Animations, and Integrating Media in Android. 2.Students come to know Interacting with Camera and input gestures. 3.Students come to know Gathering Location Data.	

Location Data: Managing Background Tasks: Broad caste Receivers, Services, Threads and Process, A sync Task, Job Scheduler, Manage device Awake State Deploying Android applications on Google Play-Publishing/Deploy the application, Versioning, signing Application.		

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Course: Fundamentals of Algorithms(SEM-IV)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
Unit 1: Introduction to algorithm, why to analysis algorithm, running time analysis, how to Compare Algorithms, Rate of Growth, Commonly Used Rates of Growth, Types of Analysis, Asymptotic Notation, Big-O Notation, Omega-Ω Notation, Theta-Θ Notation, Asymptotic Analysis, Properties of Notations, Commonly used Logarithms and Summations, Performance characteristics of algorithms, Master Theorem for Divide and Conquer, Divide and Conquer Master Theorem: Problems & Solutions, Master Theorem for Subtract and Conquer Recurrences, Method of Guessing and Confirming	1.Able to Argue the correctness of algorithms using inductive proofs and Analyse worst-case running times of algorithms using asymptotic analysis.	1.Understand the concepts of algorithms for designing good program. 2. Implement algorithms using Python.
Unit 2: Tree algorithms: What is a Tree? Glossary, Binary Trees, Types of Binary Trees, Properties of Binary Trees, Binary Tree Traversals, Generic Trees (N-ary Trees), Threaded Binary Tree Traversals, Expression Trees, Binary Search Trees (BSTs), Balanced Binary Search Trees, AVL (Adelson-Velskii and Landis) Trees Graph Algorithms: Introduction, Glossary, Applications of Graphs, Graph Representation, Graph Traversals, Topological Sort, Shortest Path Algorithms,	1.Analyze the asymptotic performance of algorithms. 2. Ability to analyze asymptotic runtime complexity of algorithms including formulating recurrence relations.	

Minimal Spanning Tree Selection Algorithms: What are Selection Algorithms? Selection by Sorting, Partition-based Selection Algorithm, Linear Selection Algorithm - Median of Medians Algorithm, Finding the K Smallest Elements in Sorted Order.		
Unit 3: Algorithms Design Techniques: Introduction, Classification, Classification by Implementation Method, Classification by Design Method Greedy Algorithms: Introduction, Greedy Strategy, Elements of Greedy Algorithms, Advantages and Disadvantages of Greedy Method, Greedy Applications, Understanding Greedy Technique Divide and Conquer Algorithms: Introduction, what is Divide and Conquer Strategy? Divide and Conquer Visualization, Understanding Divide and Conquer, Advantages of Divide and Conquer, Disadvantages of Divide and Conquer, Master Theorem, Divide and Conquer Applications Dynamic Programming: Introduction, what is Dynamic Programming Strategy? Properties of Dynamic Programming Strategy, Problems which can be solved using Dynamic Programming, Dynamic Programming Approaches, Examples of Dynamic Programming Algorithms, Understanding Dynamic Programming, Longest Common Subsequence	1. Use greedy approach to solve an appropriate problem for optimal solution. 2. Apply dynamic programming approach to solve suitable problems 3. Understand the limitations of algorithm power and study how to cope with the limitations of algorithm power for various problems Coordinator Computer Science Department Government of Maharashtra's Ismail Yusuf College of Arts, Science & Commerce, Jogeshwari (East), Mumbai - 400 060.	

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Course: Theory of Computation(SEM-IV)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Automata Theory: Defining Automaton, Finite Automaton, Transitions and Its properties, Acceptability by Finite Automaton, Nondeterministic Finite State Machines, DFA and NDFA equivalence, Mealy and Moore Machines, Minimizing Automata. Formal Languages: Defining Grammar, Derivations, Languages generated by Grammar, Chomsky Classification of Grammar and Languages, Recursive Enumerable Sets, Operations on Languages, Languages and Automata.	1.Student should be able to learn about Automata Theory. 2.Student should be able to understand how to use Formal Languages.	1.Student should be able to learn about how to understand Grammar and Languages. 2.Students should be able to learn about Automata theory and its application in Language Design. 3.Learn about Turing Machines and Pushdown Automata. 4.Students should be able to learn about Understand Linear Bound Automata and its applications.
UNIT 2: Regular Sets and Regular Grammar: Regular Grammar, Regular Expressions, Finite automata and Regular Expressions, Pumping Lemma and its Applications, Closure Properties, Regular Sets and Regular Grammar Context Free Languages: Context-free Languages, Derivation Tree, Ambiguity of Grammar, CFG simplification, Normal Forms, Pumping Lemma for CFG Pushdown Automata: Definitions, Acceptance by PDA, PDA and CFG.	1.Students come to know how to design Regular Sets and Regular Grammar. 2.Students come to know how to use Context Free Languages. 3.Students come to know how to do Pushdown Automata	
UNIT 3: Linear Bound Automata: The Linear Bound Automata Model, Linear Bound Automata and Languages. Turing	1.Students come to know Linear Bound Automata.	

Machines: Turing Machine Definition, Representations, Acceptability by Turing Machines, Designing and Description of Turing Machines, Turing Machine Construction, Variants of Turing Machine, Undesirability: The Church-Turing thesis, Universal Turing Machine, Halting Problem, Introduction to Unsolvable Problems.	2.Students come to know Turing Machines 3.Students come to know Undesirability.	

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Course: Artificial Intelligent(SEM-V)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction to AI and Intelligent Agents What Is AI: Foundations, History and State of the Art of AI Intelligent Agents: Agents and Environments, Nature of Environments, Structure of Agents. Problem Solving by searching: Problem-Solving Agents, Uninformed Search Strategies, Informed (Heuristic) Search Strategies	1.Understand the foundations, history, and state of the art of AI. 2.Learn about intelligent agents, their environments, and the structure of agents.	1) Demonstrate knowledge of the foundations and key. concepts in the field of AI. 2) Analyze and design intelligent agents for specific environments. 3)Apply problem-solving techniques and algorithms to find solutions to different types of problems. 4) Construct knowledge representation models and use reasoning 5)techniques to derive new knowledge. Implement machine-learning algorithms and evaluate their performance for classification and regression tasks.
UNIT 2: Knowledge Representation, Reasoning, and Machine Learning 15 Page 6 of 63 Knowledge Representation and Reasoning: Knowledge Representation and different forms, Reasoning, Planning, Uncertainty in Knowledge Fuzzy Logic & Russification Machine Learning: Forms of Learning, Parametric & Non-Parametric Models, Classification, Regression, Regularization, Decision Trees, SVM, Artificial Neural Networks, Ensemble Learning, Boosting, K-NN, Gradient Descent	1.Explore different problem-solving strategies, including uninformed and informed search techniques. 2. Gain knowledge of knowledge representation and reasoning methods, and apply them to solve complex problems	
UNIT 3: Probabilistic Models, Unsupervised Learning, and Reinforcement Learning Probabilistic models: Statistical	1.Develop an understanding of machine learning techniques,	

Learning, Learning with Complete Data, Naive Bayes Classifier, Learning with Hidden Variables: The EM Algorithm Unsupervised Learning: Concept of Unsupervised learning,, Association Rule Mining Reinforcement learning: Concept of Reinforcement learning, Q-Learning, Hidden Markov Model	including classification, regression, and ensemble learning	

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Course: Information & Network Security(SEM-V)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction: Security Trends, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Cipher Principles, The Data Encryption Standard, The Strength of DES, AES (round details not expected), Multiple Encryption and Triple DES, Block Cipher Modes of Operation, Stream Ciphers Public-Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm	1. Student should be able to learn about steganography. 2. Student should be able to understand types of security attack. 3. Student should be able to understand encryption and Decryption Process.	1. Student should be able to learn about analyze and evaluate security trends, attacks, and mechanisms, and propose effective security solutions based on the OSI security architecture. 2. Student should be able to learn about apply classical encryption techniques, such as substitution and transposition ciphers, to encrypt and decrypt messages and analyze their security implications. 3. Student should be able to learn about implement public-key cryptography
UNIT 2: Key Management: Public-Key Cryptosystems, Key Management, Diffie-Hellman Key Exchange Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and Macs, Secure Hash Algorithm, HMAC Digital Signatures and Authentication: Digital Signatures, Authentication Protocols, Digital Signature	1. Students come to know how to design key-exchange. 2. Students come to know how to implement message authentication code.	

Standard Authentication Applications: Kerberos, X.509 Authentication, Public-Key Infrastructure	3. Students come to know how to implement hash algorithm. 4. Students come to know how to implement security certificates.	algorithms, including RSA, and demonstrate the ability to securely exchange keys and establish secure communication channels.
UNIT 3: Electronic Mail Security: Pretty Good Privacy, S/MIME IP Security: Overview, Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management Web Security: Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction Intrusion: Intruders, Intrusion Techniques, Intrusion Detection Malicious Software: Viruses and Related Threats, Virus Countermeasures, DDOS Firewalls: Firewall Design Principles, Types of Firewalls	1. To know how to implement IP security. 2. Students come to know how to implement key management. 3. Students come to know how to working of firewall. 4. Students come to know how to understand Types of virus.	4. Student should be able to learn about Design and implement secure authentication mechanisms, including message authentication codes and digital signatures, to ensure data integrity and non-repudiation. 5. Student should be able to learn about Evaluate and implement various security measures, such as IP security, web security protocols (e.g., SSL/TLS), intrusion detection systems, and

		firewall configurations, to protect networks and systems from unauthorized access and attacks.

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Course: Project Management(SEM-V)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: 1. Introduction to Project Management 2. Introduction to Project Management 3. Project Selection, Initiation and scope Management 4. Project Time & Cost Management	1.participants will have acquired the knowledge and skills necessary for effective project management. 2.They will understand the key concepts of project selection, initiation, and scope management, as well as time and cost management. 3.Participants will be equipped to apply project management processes and tools. 4.to successfully plan, execute, and control projects.	Participants completing the entire course will have: 1. developed a comprehensive and advanced skill set in project management. They will be well-prepared to handle the challenges of diverse projects, demonstrating proficiency in both traditional and Agile. 2. project management methodologies. The course aims to empower participants to lead successful projects, navigate complex team. 3. dynamics, and adhere to ethical standards in project governance,
UNIT 2: 1. Project Execution and Control 2. Project Resource & Procurement Management 3. Project Integration Management	1.participants will have acquired comprehensive knowledge and skills in project quality and risk management, resource and procurement management, as well as project integration management. 2.They will be prepared to execute and control projects effectively, ensuring quality deliverables, managing risks,	

	optimizing team performance, and successfully closing out projects with valuable lessons learned.	contributing to their overall effectiveness as project managers in today's dynamic work environment. Expectations.
UNIT 3 1. Advanced Topics in Project Management 2. Agile Project & Management in the Digital Age 3. Project Governance and Ethics	1.participants will have acquired advanced knowledge and skills in Agile project management, effective people management, and project governance with a focus on ethics. 2.They will be equipped to lead projects in the digital age, foster a positive team environment, engage stakeholders effectively, and ensure governance structures align with ethical considerations and professional responsibility.	

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Course: Cyber Law (SEM-VI)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: 1. Introduction to Cyber Laws and Technology 2. Legal Framework and Regulations 3. Key Issues in Cyber Laws	1.These are designed to guide students in acquiring a comprehensive understanding of the legal aspects of cyberspace, from foundational. 2.principles to practical applications. Assessment methods, such as exams, case studies, and projects, can be aligned with these outcomes to gauge students' mastery of the material.	1.These course outcomes aim to provide students with a comprehensive skill set, including legal analysis, ethical considerations, and practical application of knowledge in the fields of cyber laws, enforcement, and intellectual property rights. 2. Assessment methods such as exams, case studies, projects, and presentations can be employed to measure students' attainment of these outcomes.
UNIT 2: 1. Cyber Crimes and Enforcement 2. Emerging Issues and Legal Considerations 3. Jurisdiction and Privacy	1.These unit outcomes are structured to provide students with a comprehensive understanding of cybercrime. 2.enforcement mechanisms, and the legal considerations associated with emerging threats. 3.The outcomes also address the challenges related to jurisdiction, privacy, and ethical considerations in	

	4.the context of cybercrime enforcement. Assessment methods, such as case studies, simulations, and research projects, can be used to evaluate students' proficiency in these areas.	
UNIT 3: 1. Intellectual Property Rights and Online Regulations 2. Intellectual Property Rights (IPRs), Copyrights & Patents 3. Disputes and Resolution	1.These unit outcomes are designed to provide students with a comprehensive understanding of intellectual property rights, online regulations, and the resolution of disputes in the digital domain. 2.They encompass legal principles, practical applications, and emerging issues related to copyrights, patents, and other forms of intellectual property. Assessment methods may include case analyses, research projects, and discussions to evaluate students' mastery of the material.	

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Course: Fundamentals of Algorithms(SEM-VI)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
Unit 1: Introduction to algorithm, why to analysis algorithm, Running time analysis, How to Compare Algorithms, Rate of Growth, Commonly Used Rates of Growth, Types of Analysis, Asymptotic Notation, Big-O Notation, Omega-Ω Notation, Theta-Θ Notation, Asymptotic Analysis, Properties of Notations, Commonly used Logarithms and Summations, Performance characteristics of algorithms, Master Theorem for Divide and Conquer, Divide and Conquer Master Theorem: Problems & Solutions, Master Theorem for Subtract and Conquer Recurrences, Method of Guessing and Confirming	1.Able to Argue the correctness of algorithms using inductive proofs and Analyze worst-case running times of algorithms using asymptotic analysis.	1. Understand the concepts of algorithms for designing good program. 2. Implement algorithms using Python
Unit 2: Tree algorithms: What is a Tree? Glossary, Binary Trees, Types of Binary Trees, Properties of Binary Trees, Binary Tree Traversals, Generic Trees (N-ary Trees), Threaded Binary Tree Traversals, Expression Trees, Binary Search Trees. (BSTs), Balanced Binary Search Trees, AVL (Adelson-Velskii and Landis) Trees Graph Algorithms: Introduction, Glossary, Applications of Graphs, Graph Representation, Graph Traversals, Topological Sort, Shortest Path Algorithms, Minimal Spanning Tree Selection Algorithms: What are Selection Algorithms? Selection by	1.Analyze the asymptotic performance of algorithms. 2. Ability to analyze asymptotic runtime complexity of algorithms including formulating recurrence relations.	

Sorting, Partition-based Selection Algorithm, Linear Selection Algorithm - Median of Medians Algorithm, Finding the K Smallest Elements in Sorted Order.		
Unit 3: Algorithms Design Techniques: Introduction, Classification, Classification by Implementation Method, Classification by Design Method Greedy Algorithms: Introduction, Greedy Strategy, Elements of Greedy Algorithms, Advantages and Disadvantages of Greedy Method, Greedy Applications, Understanding Greedy Technique Divide and Conquer Algorithms: Introduction, what is Divide and Conquer Strategy? Divide and Conquer Visualization, Understanding Divide and Conquer, Advantages of Divide and Conquer, Disadvantages of Divide and Conquer, Master Theorem, Divide and Conquer Applications Dynamic Programming: Introduction, what is Dynamic Programming Strategy? Properties of Dynamic Programming Strategy, Problems which can be solved using Dynamic Programming, Dynamic Programming Approaches, Examples of Dynamic Programming Algorithms, Understanding Dynamic Programming, Longest Common Subsequence	1. Use greedy approach to solve an appropriate problem for optimal solution. 2. Apply dynamic programming approach to solve suitable problems. 3. Understand the limitations of algorithm power and study how to cope with the limitations of algorithm power for various problem.	

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Course: Ethical Hacking.(SEM-VI)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Introduction: Terminology, Hacking Technology Types, Ethical Hacking Phases, Hacktivism, Hacker Classes, Skills Required for an Ethical Hacker, Vulnerability Research, Ways to Conduct Ethical Hacking Foot printing: Definition, Information Gathering Methodology, Competitive Intelligence, DNS Enumeration, Who is and ARIN Lookups, Types of DNS Records, Traceroute in Foot printing, E-Mail Tracking Social Engineering: Common Types Of Attacks Scanning and Enumeration: Port Scanning, Network Scanning, Vulnerability Scanning, CEH Scanning Methodology, Ping Sweep Techniques, Nap Command Switches, SYN, Stealth, XMAS, NULL, IDLE, FIN Scans, Anonymizers, HTTP Tunneling Techniques, IP Spoofing Techniques, SNMP Enumeration, Steps Involved in Enumeration.	1.Student should be able to learn about Introduction of ethical hacking. 2.Student should be able to understand Foot printing. 3.Student should be able to understand Scanning and Enumeration.	1. Students should be able to learn about, analyze and evaluate how to apply ethical hacking methodologies to conduct comprehensive security assessments and penetration tests. 2. Students should be able to learn about Perform effective foot printing and reconnaissance techniques to gather critical information about target systems 3. Students should be able to learn about Identify and exploit vulnerabilities in various network and system components using appropriate tools and techniques. 4. Students should be able to learn about Design and implement, evaluate the security posture of web servers, web applications, and wireless networks, and recommend appropriate countermeasures.
UNIT 2: System Hacking: Password-Cracking Techniques, Types of Passwords, Key loggers and Other Spyware Technologies, Escalating Privileges.	1.Students come to know System Hacking. 2.Students come to know Sniffers, Denial of Service.	

Rootkits Sniffers: Protocols Susceptible to Sniffing, Active and Passive Sniffing, ARP Poisoning, MAC Flooding, DNS Spoofing Techniques, Sniffing Countermeasures Denial of Service: Types of DoS Attacks, Working of DoS Attacks, BOTs/BOTNETs, "Smurf" Attack, "SYN" Flooding, DoS/DDoS Countermeasures Session Hijacking: Spoofing vs. Hijacking, Types, Sequence Prediction, Steps, Prevention Hacking Web Servers: Web Server Vulnerabilities, Attacks against Web Servers, Patch Management Techniques, Web Server Hardening.	3.Students come to know how to implement Session Hijacking. 4.Students come to know how to implement Hacking Web Servers.	5. Students should be able to demonstrate an understanding of ethical and legal considerations in conducting ethical hacking activities and adhere to professional codes of conduct.
UNIT 3: Web Application Vulnerabilities: Web Application Hacking, Web Application Threats, Google Hacking, Countermeasures Web-Based Password Cracking Techniques: Authentication Types, Password Crackers, Countermeasures SQL Injection: Steps, SQL Server Vulnerabilities, Countermeasures Buffer Overflows: Types, Stack-Based Buffer Overflows, Mutation Techniques Wireless Hacking: WEP, WPA Authentication Mechanisms, and Cracking Techniques, Wireless Sniffers, Rogue Access Points, Wireless Hacking Techniques, Securing Wireless Networks Penetration Testing Methodologies: Methodologies, Steps, Automated Tools, Pen-Test Deliverables.	1. Students come to know Web Application Vulnerabilities. 2. Students come to know Web-Based Password Cracking Techniques. 3. Students come to know Buffer Overflows. 4. Students come to know about Wireless Hacking.	Coordinator Computer Science Department Government of Maharashtra's Ismail Yusuf College of Arts, Science & Commerce, Jogeshwari (East), Mumbai - 400 060.

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Course: Information Retrieval (SEM-VI)

UNIT NO & NAME	UNIT OUTCOMES	COURSE OUTCOMES
UNIT 1: Foundations of Information Retrieval Introduction to Information Retrieval (IR) systems: Definition and goals of information retrieval, Components of an IR system, Challenges and applications of IR Document Indexing, Storage, and Compression: Inverted index construction and compression techniques, Document representation and term weighting, Storage and retrieval of indexed documents, Retrieval Models: Boolean model: Boolean operators, query processing, Vector space model: TF-IDF, cosine similarity, query-document matching, Probabilistic model: Bayesian retrieval, relevance feedback Spelling Correction in IR Systems: Challenges of spelling errors in queries and documents, Edit distance and string similarity measures. **Performance Evaluation:** Evaluation metrics: precision, recall, F-measure, average precision, Test collections and relevance judgments, Experimental design and significance testing	1.To understand the fundamental principles and components of information retrieval systems. 2.To explore various techniques for document indexing, storage, and retrieval.	1.Explain the key components and principles of information retrieval systems. 2.Apply indexing, storage, and retrieval techniques to efficiently retrieve relevant documents. 3.Compare and contrast different retrieval models and select appropriate models for specific search scenarios. 4.Develop practical skills in implementing and evaluating information retrieval systems. 5. Demonstrate an understanding of advanced topics in information retrieval, including web search and machine learning techniques.
UNIT 2:	1.To analyze and compare different retrieval models and	

Advanced Topics in Information Retrieval Text Categorization and Filtering: Text classification algorithms: Naïve Bayes, Support Vector Machines, Feature selection and dimensionality reduction, Applications of text categorization and filtering. Text Clustering for Information Retrieval: Clustering techniques: K means, hierarchical clustering, Evaluation of clustering results, clustering for query expansion and result grouping Web Information Retrieval: Web search architecture and challenges, Crawling and indexing web pages, Link analysis and PageRank algorithm Learning to Rank: Algorithms and Techniques, Supervised learning for ranking: Rank SVM, Rank Boost, Pairwise and list wise learning to rank approaches Evaluation metrics for learning to rank Link Analysis and its Role in IR Systems: Web graph representation and link analysis algorithms, HITS and PageRank algorithms, Applications of link analysis in IR systems	understand their strengths and limitations. 2.To gain practical experience in implementing and evaluating information retrieval systems.	
UNIT 3: Advanced Topics in Information Retrieval Crawling and Near-Duplicate Page Detection: Web page crawling techniques: breadth-first, depth-first, focused crawling, Near-duplicate page detection algorithms, Handling dynamic web content during crawling.	1.To explore advanced topics in information retrieval, such as web information retrieval and machine learning techniques.	

Advanced Topics in IR: Text Summarization: extractive and abstractive methods, Question Answering: approaches for finding precise answers, Recommender Systems: collaborative filtering, content-based filtering Cross-Lingual and Multilingual Retrieval: Challenges and techniques for cross-lingual retrieval, Machine translation for IR, Multilingual document representations and query translation, Evaluation Techniques for IR Systems User-based evaluation: user studies, surveys, Test collections and benchmarking, Online evaluation methods: A/B testing, interleaving experiments		

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