

KUMARAGURU COLLEGE OF TECHNOLOGY

An autonomous Institution affiliated to Anna University, Chennai.

COIMBATORE – 641 049

Master of Computer Applications REGULATION 2024A



I to II Semesters

(Applicable to the students admitted from the academic year 2026 – 27 onwards)

Department of Computer Applications

VISION

- To be a leader in computing education and research, equipping students with the skills to thrive in the technology field and contribute to the growth of society and the economy.

MISSION

- Deliver high-quality education and practical skills in computing and technology, preparing students to meet industry demands and excel in their careers.
- Encourage innovation, critical thinking, and research in computing, enabling students to solve real-world problems and contribute to technological advancements.
- Nurture socially responsible and ethical professionals who can lead with integrity and contribute to the sustainable development of society and the economy.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of Master of Computer Applications Program are to:

PEO1: Equip with strong computing skills and innovation of software products to meet industry needs.

PEO2: Provide exposure to cutting edge technologies and training to work on multidisciplinary projects in a team.

PEO3: Prepare for life-long learning through professional activities; adapt themselves with ease to new technologies, while exhibiting ethical and professional standards.

PROGRAM OUTCOMES (POs)

On successful completion of the program:

PO1: Foundation Knowledge - Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO2: Problem Analysis- Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.

PO3: Development of Solutions - Design, develop and investigate problems with an innovative approach for solutions incorporating ESG/SDG goals.


Signature of the BOS Chairman

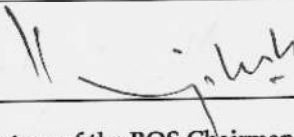
PO4: Modern Tool Usage - Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO5: Individual and Teamwork- Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO6: Project Management and Finance - Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

PO7: Ethics - Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware

PO8: Life-long learning - Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

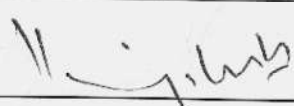

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KUMARAGURU COLLEGE OF TECHNOLOGY
DEPARTMENT OF COMPUTER APPLICATIONS
REGULATION 2024A

Master of Computer Applications – Curriculum

(Applicable to students admitted from 2026 – 27 onwards)

Semester I									
S. No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24CAI501	Data Structures and Algorithms	Embedded	PC	3	0	2	0	4
2	24CAI502	Database Management Systems	Embedded	PC	3	0	2	0	4
3	24CAI511	Object Oriented Programming with Java	Embedded	PC	1	0	4	0	3
4	24CAT504	Operating Systems	Theory	PC	3	0	0	0	3
5	24CAI512	Python for Computational Problem Solving	Embedded	PC	1	0	4	0	3
6	24MAI504	Probability and Statistics for Data Analysis	Embedded	BS	3	0	2	0	4
7	24HST506	Professional Communication Strategies	Theory	HS	2	0	0	0	2
Total Credits									23
Total Contact Hours/week									29
Semester II									
S. No.	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24CAT505	Cloud Computing	Theory	PC	3	0	0	0	3
2	24CAT506	Cyber Security	Theory	PC	3	0	0	0	3
3	24CAI507	Automation and Artificial Intelligence	Embedded	PC	2	0	2	0	3
4	24CAI508	Full Stack Application Development	Embedded	PC	3	0	2	0	4
5	24CAI509	Data Analysis and Visualization	Embedded	PC	3	0	2	0	4
6	24CAC0--	Professional Elective I	Embedded	PE	2	0	2	0	3
7	24CAE0--	Professional Elective II	Theory	PE	3	0	0	0	3
Total Credits									23
Total Contact Hours/week									27


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SEMESTER I

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Signature of the BOS Chairman

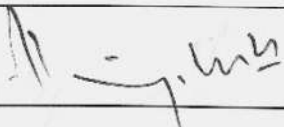
24CAI501	DATA STRUCTURES AND ALGORITHMS	L	T	P	J	C
		3	0	2	0	4
PC		SDG		4,9,11		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Develop a strong foundation in basic data structures.
2	Learn to analyze the efficiency of algorithms using time and space complexity.
3	Implement data structures in both static and dynamic environments.
4	Gain proficiency in implementing and analyzing searching, sorting and hashing techniques.
5	Apply data structures and algorithms to solve complex real-world problems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Analyze algorithmic efficiency using fundamental concepts and analysis techniques.	An
CO2	Apply linear data structures and their static and dynamic implementations in practical programming contexts.	Ap
CO3	Apply the representation and operations of hierarchical data structures to implement them for effective data management.	Ap
CO4	Apply graph traversal techniques and algorithms to solve network-related problems efficiently.	Ap
CO5	Develop programs applying sorting, searching, and hashing techniques to optimize data organization and retrieval	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3		2	2				
2		3	3					2
3		2						
4		3	2					
5							3	



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Course Content	
ALGORITHM ANALYSIS Fundamentals of Algorithm Problem Solving - Fundamentals of Analysis of Algorithm - Efficiency- Analysis Framework - Asymptotic Notations-Mathematical Analysis of Recursive and Non-recursive Algorithms-Analysis of Algorithm-Time Complexities.	9 Hours
ARRAYS AND DYNAMIC MEMORY IMPLEMENTATION Arrays: Representation-Operations on Arrays-Linked List: Basic Concepts and Operations-Types of Linked List: Singly Linked List - Doubly List - Stack: Definition-Operations on Stack-Static and Dynamic Implementation of a Stack-Recursion using Stack - Queue: Definition-Operations on Queue-Static and Dynamic Implementation of a Queue.	9 Hours
Practical Component Experiments related to Arrays, Linked lists, Stacks and Queues.	8 Hours
TREES Trees: Terminologies-Sequential and Linked Representation-Implementation- Binary Tree- Properties-Binary Tree Traversals-Binary Search Tree: Operations- B-trees: Definition, Operations-Applications of Trees.	9 Hours
Practical Component Experiments related to Trees and Binary Trees.	6 Hours
GRAPHS Graphs: Introduction -Terminology-Representation of Graph-Graph Traversals: Depth-First and Breadth-First Traversal-Applications of Graphs-Transitive Closure: Warshall's Algorithm-Shortest Path Algorithms: Dijkstra's Algorithm-Floyd's Algorithm-Minimum Spanning Tree: Prim's and Kruskal's Algorithms.	9 Hours
Practical Component Experiments related to Graph traversals, Transitive Closure, Shortest Path and Minimum Spanning Trees.	8 Hours
SORTING AND HASHING Sorting: Insertion Sort, Quick Sort, Merge Sort, Heap Sort - Searching: Linear and Binary Search-Analysis - Hashing: Operations-Hash Table: Hash Functions, Implementation, Collision Resolution and Overflow Handling Techniques, Linear Open Addressing, Chaining.	9 Hours
Practical Component Implementation of Sorting, Searching and Hashing Techniques.	8 Hours

Theory	Tutorial	Practical	Project	Total
Hours:45	Hours: 0	Hours:30	Hours: 0	Hours:75

Learning Resources	
Textbooks	
1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2017. 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 2006.	
Reference books/ Web Links	
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", The MIT Press, Third Edition, 2009.	


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2. Jean Paul Trembly, Paul G Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw Hill, 2017.
3. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", University Press, 2012.

Online Resources

1. <https://nptel.ac.in/courses/106102064>

Assessment (Embedded course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by		
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	Dr. V. Vijilesh, Dr.V.Geetha Dept. of Computer Applications
Recommended by BoS on	16/08/2024	
Academic Council Approval	No.27	Date 24/08/2024



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24CAI502	DATABASE MANAGEMENT SYSTEMS	L	T	P	J	C
		3	0	2	0	4
PC		SDG		4,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Understand database architecture, relational structures, ER model, and SQL operations.
2	Learn efficient database design, normalization (1NF to BCNF), and MySQL integration.
3	Master physical design, transaction concepts, concurrency control, and recovery mechanisms.
4	Explore distributed, multimedia, blockchain, and cloud databases, focusing on mobile applications.
5	Study NoSQL databases like MongoDB, focusing on key-value and document-based models.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand fundamental database concepts and architecture, including relational and NoSQL systems, to support data management needs in various applications.	U
CO2	Apply relational database design principles, including normalization and SQL operations, to effectively structure and query databases.	Ap
CO3	Analyze different database technologies to select appropriate solutions for diverse organizational needs.	An
CO4	Implement concurrency control techniques and recovery mechanisms to achieve fault tolerance in database management systems.	Ap
CO5	Develop database systems using SQL and NoSQL technologies, ensuring efficient data storage, retrieval, and transaction management across various platforms.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3	2						2	
2			3						
3		2		2					
4			2			2			
5	3							3	


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Course Content

INTRODUCTION TO DATABASES		9 Hours
Introduction – Database Architecture – Structure of Relational Databases – Database Schema – Schema Diagrams – Relational Query Languages – Keys – Basic Structure of Queries and SQL Operations – Integrity Constraints – ER Model.		
Practical Component		8 Hours
- Execute Data Definition Language (DDL) and Data Manipulation Language (DML) commands. - Implement Data Query Language (DQL). - Implement Join Operations.		
DATABASE DESIGN		9 Hours
Relational Database Design – First Normal Form – Second Normal Form – Third Normal Form – Boyce - Codd Normal Form – Case Study: Normalization Process – Front end and Back end – MySQL – Connectivity using ODBC/JDBC.		
Practical Component		7 Hours
- Create Database Objects - Execute Complex and Sub Queries		
DATABASE IMPLEMENTATION		9 Hours
Physical Database Design and Tuning – Database Transaction: Transaction Concept and State – Concurrency Control: Two-Phase Locking Protocol – Recovery: Failure Classification – Log Based Recovery – Shadow Paging.		
Practical Component		8 Hours
- Demonstrate Data Control Language (DCL) and Transaction Control Language (TCL) commands - Execution of PL/SQL Commands - Record Management using Cursors and Functions		
EMERGING TECHNOLOGIES AND APPLICATIONS		9 Hours
Distributed Databases: Concepts – Database Design and Types – Database Applications in Mobile Communication – Multimedia Databases – Blockchain Databases – Cloud Databases.		
NoSQL		9 Hours
Introduction – Aggregate Data Model – Distribution Model – NoSQL Implementation: Key Value Database – Document Database – Graph based Database - MongoDB.		
Practical Component		7 Hours
- CRUD Operations in NoSQL - Indexing and Aggregation Framework in NoSQL		

Theory	Tutorial	Practical	Project	Total
Hours: 45	Hours: 0	Hours: 30	Hours: 0	Hours: 75

Learning Resources

Textbooks

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan, "Database System Concepts", 7th Edition, Tata McGraw Hill International Edition, 2019.
2. Pramod Kumar J. Sadalage and Martin Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", 1st Edition, Addison Wesley Professional, 2012.


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Reference books/ Web Links

1. R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2016.
2. Batra, Shashank., Dang, Sachin., "NoSQL Database for Beginners", BPB Publications, New Delhi ,2016.

Online Resources

1. Database Management Essentials - <https://www.coursera.org/learn/database-management>
2. Oracle Database Concepts-
<https://docs.oracle.com/en/database/oracle/oracledatabase/index.html>

Assessment (Embedded course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
-	-	Dr. M. Manikantan, Dept. of Computer Applications
Recommended by BoS on	16/08/2024	
Academic Council Approval	No.27	Date 24/082024



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24CAI511	OBJECT ORIENTED PROGRAMMING WITH JAVA	L	T	P	J	C
PC		1	0	4	0	3
		SDG 4,9				

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:		The purpose of taking this course is to:
1.	Understand the fundamentals of Java programming including program structure, data types, methods, and control statements.	
2.	Learn object-oriented programming concepts such as classes, inheritance, polymorphism, abstraction, and interfaces.	
3.	Develop skills in handling errors and working with strings and wrapper classes for efficient program development.	
4.	Understand multithreading, synchronization, and file handling concepts using Java I/O techniques.	
5.	Enable students to work with collections, database connectivity, and application development using Java technologies.	

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply fundamental programming and object-oriented principles to develop programs using basic programming constructs.	Ap
CO2	Implement object-oriented features such as inheritance, polymorphism, abstraction, interfaces, and packages to develop reusable programs.	Ap
CO3	Apply exception handling and string processing techniques to develop reliable and robust programs.	Ap
CO4	Construct multithreaded programs and utilize input/output techniques for file handling and data processing.	Ap
CO5	Develop database-integrated applications using collection frameworks, modern programming features, and database connectivity techniques.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3	2	2						
2	2		3	2					
3		3	2	2					
4	2		3	2					
5		2	3	2					


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Course Content

JAVA FUNDAMENTALS Overview of Java – History, Features, and Program Structure – Compilation and Execution – Data Types, Variables, Operators, and Type Casting – Introduction to OOP Concepts: Class, Object, Constructor, Encapsulation.	3 Hours
Practical Component: • Develop Java programs using data types, variables, operators, type casting, and input/output statements to solve basic computational and logical problems. • Construct Java programs using conditional statements and looping constructs to solve number-based problems, logical problems, and iterative computations. • Implement Java programs to generate various star, number, and alphabet patterns using nested loops and conditional statements. • Design Java programs using one-dimensional and two-dimensional arrays, methods, parameters, and return values to implement searching, sorting, and matrix operations. • Create Java applications using classes, objects, constructors, constructor overloading, and the 'this' keyword to model real-world entities. • Develop Java applications by implementing encapsulation using private data members, getter and setter methods, and constructors to build simple object-oriented systems.	12 Hours
OBJECT-ORIENTED PROGRAMMING Types of Inheritance – 'super' keyword and Constructor Chaining – Method Overriding and Runtime Polymorphism – Abstract Classes and Abstract Methods – Interfaces and Multiple Inheritance – Packages and Access Modifiers.	3 Hours
Practical Component: • Develop Java programs to demonstrate different types of inheritance, constructor chaining, and the use of the super keyword for accessing parent class members and constructors. • Implement Java programs to demonstrate method overriding, dynamic method dispatch, and runtime polymorphism using inheritance. • Design Java applications using abstract classes and abstract methods to achieve abstraction and code reusability. • Create Java programs using interfaces to implement abstraction and demonstrate multiple inheritance through interfaces. • Develop Java applications by creating user-defined packages and applying different access modifiers to control accessibility of classes, methods, and variables. • Design and implement a menu-driven Java application that integrates inheritance, polymorphism, abstraction, interfaces, packages, and access modifiers to model a real-world problem.	12 Hours
EXCEPTION HANDLING, STRINGS AND WRAPPER CLASSES Checked vs Unchecked Exceptions – Exception Hierarchy – try, catch, finally, throw, throws – Built-in and User-defined Exceptions – String Immutability – StringBuffer vs StringBuilder – Wrapper Classes overview – Autoboxing and Unboxing.	3 Hours
Practical Component: • Develop Java programs to demonstrate exception handling using try, catch, finally, throw, and throws statements with built-in exceptions. • Design Java applications that create and handle user-defined exceptions for validating input and implementing application-specific error handling. • Implement Java programs using String, StringBuffer, and StringBuilder classes to perform string manipulation, comparison, searching, modification, and performance analysis. • Develop Java programs using wrapper classes, autoboxing, unboxing, parsing methods, and type conversion to process different data types. • Design and implement a menu-driven Java application that integrates exception handling, user-defined exceptions, string manipulation, and wrapper classes to solve a real-world problem with robust input validation. • Design Java programs to perform structured file processing, including text manipulation, data validation, buffering, and efficient file handling using appropriate stream classes.	12 Hours


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MULTITHREADING, I/O AND FILE HANDLING		3 Hours
Process vs Thread – Thread Life Cycle and States – Thread Model – Synchronization concepts – I/O Stream Hierarchy – Byte Streams vs Character Streams – File Handling overview.		
Practical Component:		12 Hours
- Develop Java programs to create threads using the Thread class and Runnable interface, demonstrating thread creation, execution, priorities, and life cycle states. - Design Java applications to demonstrate multithreading concepts, synchronization, and coordination of shared resources using synchronized methods and blocks. - Implement Java programs using byte streams and character streams to perform input and output operations on files and standard input/output devices. - Develop Java applications to create, read, write, append, and manage files using Java File I/O classes. - Design Java programs to perform file and directory operations such as creating, deleting, renaming, copying, and retrieving file properties using Java file handling classes		
COLLECTIONS, GUI OVERVIEW AND DATABASE CONNECTIVITY		3 Hours
Collection Framework Hierarchy – List, Set, Queue, Map interfaces overview – Generic Collections – Introduction to Lambda Expressions and Stream API – GUI Programming overview (Swing and JavaFX) – JDBC Architecture and Driver types.		
Practical Component:		12 Hours
- Develop Java programs using the Collection Framework, including List, Set, Queue, Map, and generic collections, to perform data storage, retrieval, searching, sorting, and manipulation operations. - Design Java programs using lambda expressions and the Stream API to perform filtering, mapping, sorting, aggregation, and other functional operations on collections. - Design and develop interactive graphical user interfaces using JavaFX by creating layouts, controls, event handling mechanisms, and scene management for desktop applications. - Develop Java applications to establish database connectivity using JDBC, perform CRUD (Create, Read, Update, Delete) operations, and execute SQL queries using appropriate JDBC classes.		

Theory	Tutorial	Practical	Project	Total
Hours: 15	Hours: 0	Hours: 60	Hours: 0	Hours: 75

Learning Resources

Textbooks

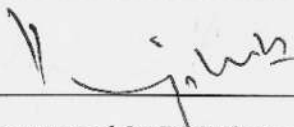
1. Cay S. Horstmann, Core Java Volume I – Fundamentals, 13th Edition, Pearson, 2025.
2. Herbert Schildt, Java: The Complete Reference, 13th Edition, McGraw-Hill Education, 2024.
3. Kathy Sierra, Bert Bates, and Trisha Gee, Head First Java, 3rd Edition, O'Reilly Media, 2022.

Reference books/ Web Links

1. Paul Deitel and Harvey Deitel, Java How to Program, 11th Edition, Pearson, 2019.
2. E. Balagurusamy, Programming with Java: A Primer, 7th Edition, McGraw-Hill Education, 2024.
3. Barry Burd, Beginning Programming with Java For Dummies, 6th Edition, Wiley, 2021. Paul Deitel and Harvey Deitel, Java How to Program, 11th Edition, Pearson, 2017.

Online Resources

1. <https://www.coursera.org/specializations/java-programming>
2. <https://www.edx.org/learn/java>
3. <https://www.codecademy.com/learn/learn-java>
4. <https://docs.oracle.com/en/java/javase/>


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Assessment (Embedded Course)

SA-II, MCQ, Assignments, Model-1, Model-2 and End Semester Examination (Lab)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Ms. P. Anitha, AP/CSE Ms. G. Shobana, AP/IT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No. 30	Date 19.06.2026



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24CAT504	OPERATING SYSTEMS	L	T	P	J	C
		3	0	0	0	3
PC		SDG		4,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Understand the structure, operations, and management principles of operating systems, with a focus on Linux and open-source OS concepts.
2	Introduce process management techniques, including process scheduling, inter-process communication, and threading in Linux.
3	Explore process coordination mechanisms, such as synchronization, deadlock prevention, and classic synchronization problems.
4	Examine memory and I/O management strategies, disk scheduling algorithms, and file systems, with real-world case studies like the Linux kernel and Android OS.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand the fundamental concepts of operating systems, including process management, memory management, file systems, and Operating system architecture.	U
CO2	Apply process management techniques, CPU scheduling algorithms, inter-process communication, and multithreading models in modern operating systems.	Ap
CO3	Examine process synchronization mechanisms, deadlock handling methods, and coordination techniques for efficient resource sharing in operating systems.	An
CO4	Analyze memory management strategies, virtual memory concepts, paging, segmentation, and page replacement algorithms. (An)	An
CO5	Apply I/O management, disk scheduling algorithms, file management techniques, and the features of mobile operating systems in real-world applications	Ap


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3							
2	3	2						
3	3	3	3					
4	3	3	3					
5								2

Course Content

INTRODUCTION Operating Systems – Structure – Operations – Process Management – Memory Management – Secondary Storage Management – Protection and Security – Operating System Services – Linux OS – Open-Source OS-Shell-Kernel – File System – Case Study: Evolution of Linux OS.	8 Hours
PROCESS MANAGEMENT Process Concepts – Process Scheduling – Operations on Processes – Inter Process Communication in Linux – Pipes – Shared Memory – Message Queues – Threads – Multi-threading Model – Libraries – Issues – CPU Scheduling – Basic Concepts – Scheduling Criteria – Scheduling Algorithms – Problems – Case Study: Process Scheduling in the Linux Kernel.	8 Hours
PROCESS COORDINATION Process Synchronization – Critical Section Problem – Peterson's Solution - Synchronization Hardware – Semaphores – Classic Problem of Synchronization – Monitors – Deadlock – Deadlock Characterization – Handling Deadlocks – Deadlock Prevention – Avoidance – Detection – Recovery.	8 Hours
MEMORY MANAGEMENT Background – Swapping – Contiguous Memory Allocation – Paging - Segmentation- Virtual Memory Management – Demand Paging – Page Replacement – Thrashing – Working Set - Case Study: Memory Management in the Linux Kernel.	8 Hours
I/O MANAGEMENT, DISK SCHEDULING AND FILE MANAGEMENT Evolution of I/O Function – Types of I/O devices – Logical Structure of I/O Functions – I/O Buffering – Disk I/O - Disk Scheduling Algorithms – Disk Cache: Access Methods – Free Space management – Case Study: Ext4 File System in Linux.	8 Hours
CASE STUDIES Android OS – Key Features – Use Cases – Android in Mobile Devices – Use in Wearables and Automotive Systems – iOS – Key Features – Use Cases – iOS in Mobile Devices – Use in Wearables and Integration with other Products.	5 Hours

Theory Hours:45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours:45
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Learning Resources	
Textbooks	
1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne," Operating System Concepts", 10th Edition, John Wiley & Sons, Inc., 2018.	
Reference books/ Web Links	
1. P.C.Bhatt, "An Introduction to Operating Systems – Concepts and Practice", 4th Edition, Prentice Hall of India., 2013.	
2. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Prentice Hall of India, 2018.	
3. D.M.Dhamdhare, "Operating Systems: A Concept based Approach", 3rd Edition, Tata McGraw Hill, 2017.	
Online Resources	
1. https://archive.nptel.ac.in/courses/106/105/106105214/	

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by		
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr. P. Parameswari, Dept. of Computer Applications
Recommended by BoS on	16/08/2024	
Academic Council Approval	No.27	Date 24/08/2024


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24CAI512	PYTHON FOR COMPUTATIONAL PROBLEM SOLVING	L	T	P	J	C
		1	0	4	0	3
		SDG	9			

Pre-requisite courses	NIL	Data Book / Code book (If any)	NIL
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Course Objectives:

The purpose of taking this course is to:

1	Introduce the basics of Python, including data types, operators, and control structures, with a focus on practical implementation.
2	Develop proficiency in iterative statements, string handling, and fundamental data structures like lists, tuples, and dictionaries through extensive lab work.
3	Provide foundational knowledge on modules, functions, object-oriented programming (OOP) concepts, and file handling.
4	Familiarize students with exception handling and Python's standard libraries like NumPy and Pandas for data manipulation.
5	Enable students to apply Python concepts to solve real-world problems through practical, hands-on experiments.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand Python syntax, data types, operators, and basic control structures.	U
CO2	Apply conditional and iterative constructs for solving logical problems.	Ap
CO3	Implement modular programming concepts, handle strings, and utilize data structures efficiently	Ap
CO4	Demonstrate object-oriented programming, file handling, and exception handling in Python.	Ap
CO5	Utilize libraries like NumPy and Pandas for data analysis and manipulation.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3							
2	3							
3		2						
4			2					
5			3	3	2	3		


 Signature of the BOS Chairman

Course Content

PYTHON BASICS AND CONTROL STRUCTURES Python Basics: Python syntax – Variables - Data Types - Type Casting - Arithmetic & Logical Operators. Conditional Branching Statements: if, if-else, if-elif-else, nested conditions. Iterative Statements: for loop, while loop, Loop Control Statements. Practical Component: Implement basic Python programs to demonstrate data types, operators, and input/output operations. Develop programs using all forms of conditional statements. Write extensive Python scripts using for and while loops to generate complex patterns, various series like Fibonacci, arithmetic progression, and solve simple mathematical/logical problems.	3 Hours 12 Hours
PYTHON FUNCTIONS, STRINGS, AND DATA STRUCTURES Defining functions, Function arguments - Return values - Anonymous Lambda Functions. Modules - built-in and user-defined modules - String Handling: String slicing, concatenation, formatting, and methods-List: Creating lists- List indexing- List methods- List comprehension. Tuple - Characteristics of tuples- Tuple indexing, Tuple methods. Dictionary: Key-value pairs, Dictionary methods. Sets in Python: Create, Add, Remove with Examples. Python Regular Expressions (RegEx) basics. Practical Component: Create Python scripts to demonstrate advanced string manipulation techniques, including RegEx for basic pattern matching. Perform complex operations on lists, tuples, sets, dictionaries, and combinations of all datatypes using various methods. Develop and utilise user-defined modules.	3 Hours 12 Hours
OBJECT-ORIENTED PROGRAMMING OOP concepts - Creating classes and objects - Self parameter - init_method. Inheritance & Polymorphism: Types of inheritance, Method Overriding - Concept of Method Overloading in Python. Practical Component: Develop a robust OOP-based application to practically demonstrate the core concepts: creating multiple classes and objects, implementing all major types of inheritance, and showcasing polymorphism through method overriding. Implement a solution to simulate method overloading using variable arguments or default parameters.	3 Hours 12 Hours
FILE HANDLING AND EXCEPTION HANDLING File Handling: Reading and writing files, File modes - Working with text and CSV files. Exception Handling: Understanding exceptions - Handling exceptions using try-except-finally - Raising custom exceptions. Practical Component: Read and write large amounts of data to text and CSV files using different Python file handling modes. Create a practical utility that processes data from a file, writes results to another file, and is fully protected using robust exception handling. Implement and raise meaningful custom exceptions for validation or specific error conditions.	3 Hours 12 Hours


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PYTHON LIBRARIES - NUMPY AND PANDAS		3 Hours
NumPy Library: Introduction to NumPy, Arrays, Array creation and manipulation, Array operations. Analysing different pipeline structures involving storage - processing, ML components based on requirements. Pandas Library: Series: Creating Series Indexing - Operations on Series. DataFrames: Creating DataFrames, Data Manipulation. Handling Missing Data: dropna(), fillna(), isnull() functions.		
Practical Component: Perform an extensive array creation, manipulation, and mathematical operations on NumPy arrays. Manipulate real-world or mock datasets using Pandas Series and DataFrames, including data cleaning, filtering, sorting, and handling missing values using appropriate functions.		12 Hours

Theory Hours:15	Tutorial Hours: 0	Practical Hours: 60	Project Hours: 0	Total Hours:75
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Learning Resources	
Textbooks:	
1. Mark Lutz, "Learning Python," O'Reilly Media, 6th Edition, 2025. 2. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 1st Edition, 2017.	
References:	
1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist," Green Tea Press, 2nd Edition, 2015. 2. Zed A. Shaw, "Learn Python the Hard Way," Addison-Wesley, 5th Edition, 2024.	
Online Educational Resources:	
1. https://docs.python.org/3/tutorial/index.html 2. https://learn.microsoft.com/en-us/shows/intro-to-python-development/ 3. https://www.udacity.com/course/introduction-to-python--ud1110 4. https://www.geeksforgeeks.org/courses/python-course-certification-free 5. https://onlinecourses.nptel.ac.in/noc24_cs57/preview 6. https://www.coursera.org/projects/python-for-data-analysis-numpy	

Assessment (Embedded course)
MCQ, Experimental Cycle tests and End Semester Examination (Lab)

Course Curated by		
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
-	-	Ms. Ruphashini Department of Artificial Intelligence and Data Science
Recommended by BoS on	06.06.2026	
Academic Council Approval	No. 30	Date 19.06.2026


Signature of the BOS Chairman

24MAI504 BS	PROBABILITY AND STATISTICS FOR DATA ANALYSIS	L	T	P	J	C
		3	0	2	0	4
		SDG		3,8,9,13		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Statistical Tables
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Course Objectives:	The purpose of taking this course is to:
1	Equip students with the ability to summarize and interpret data using descriptive statistics, central tendency measures, and graphical tools for effective data visualization.
2	Develop skills in correlation and regression techniques to understand relationships between variables and build predictive models for discrete data.
3	Familiarize students with probability distributions and statistical methods for solving real-world problems involving random variables and hypothesis testing.
4	Enhance students' knowledge of experimental design and variance analysis to assess the effectiveness of statistical techniques and interpret results in data-driven conclusions.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Summarize data using appropriate collection methods, central tendency measures, variation metrics, and graphical tools such as charts and box plots.	Ap
CO2	Determine the relationship between two variables using correlation techniques (Karl Pearson's and Spearman's) to develop regression models for discrete data to predict outcomes.	Ap
CO3	Apply the concept of probability distributions for random variables, expectation and normal distribution to solve real-world problems.	Ap
CO4	Perform hypothesis testing using statistical methods such as large sample tests and chi-square tests to make data-driven conclusions	Ap
CO5	Analyse the effectiveness of experimental designs, including Completely Randomized Design (CRD), Randomized Block Design (RBD), and Latin Square Design (LSD), through Analysis of Variance (ANOVA).	An
CO6	Implement statistical methods in R programming to analyze, interpret, and draw insights from data.	Ap


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2	2		2				
2	2			2				
3	2	2		2				
4	3			2				
5	2		3	2				
6	2			3				

Course Content

DESCRIPTIVE STATISTICS

Collection of Data-Classification-Tabulation-Graphical Representation – Simple Bar Chart – Pie Chart -Measures of Central Tendency: Arithmetic Mean, Median and Mode – Measures of Variation: Range, Quartile Deviation - Standard Deviation and Coefficient of Variation – Five Number Summary – Box Plot Technique.

13 Hours

Practical Component

- Introduction of R, Basic data representation.
- Importing data from MS-Excel.
- Data presentation methods - Bar Chart, Pie Chart.
- Mean, median, mode.
- Standard deviation, five number summary, box plot.

8 Hours

CORRELATION AND REGRESSION

Correlation (Discrete Data) – Scatter Diagram - Karl Pearson's Correlation Coefficient – Spearman's Rank Correlation – Regression Lines (Discrete Data).

8 Hours

Practical Component

- Scatter diagram, correlation and Regression.

4 Hours

RANDOM VARIABLES

Random Variable – Distribution Function – Properties – Probability Mass Function – Probability Density Function – Expectation - Normal Distribution.

9 Hours

Practical Component

- Normal distribution.

4 Hours


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TESTING OF HYPOTHESIS Testing of Hypothesis for Large Samples (Single Mean, Difference of Means, Single Proportion, Difference of Proportions) - Chi-Square Test for Independence of Attributes.		9 Hours
Practical Component - Large sample test. - Chi square test-independence of attributes.		8 Hours
ANALYSIS OF VARIANCE Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).		6 Hours
Practical Component Analysis of Variance (ANOVA).		6 Hours

Theory Hours: 45	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 75
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Learning Resources	
Textbooks	
- Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, 2020. - Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", Duxbury Press, 9th Edition, 2018. - Sharma J. K., "Operations Research", Macmillan India Ltd, Delhi, 5th Edition, 2019. - Veerarajan. T., "Probability, Statistics and Random Process", Tata McGraw Hill, 4th Edition, 2021.	
Reference books/ Web Links	
- Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury, 9th Edition, 2021. - Freund, J.E., "Mathematical Statistics", Prentice Hall of India, 7th Edition, 2017. - Gupta S.C. and Kapur J.N., "Fundamentals of Mathematical Statistics", 11th Edition, 2019, Sultan & Chand, Publishers, New Delhi. - Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", 6th Edition, Pearson Education, Asia, 2019. - Johnson, R. A., "Miller & Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, 2017. - Spiegel, M.R. and Stephens, L.J., "Schaum's Outlines: Statistics", Tata McGraw-Hill, 5th Edition, 2020.	
Online Resources	
- NPTEL – Probability and Statistics - https://nptel.ac.in/courses/111105090 - Coursera – Data Analysis with R - https://www.coursera.org/learn/data-analysis-r - edX – Introduction to Probability - https://www.edx.org/course/introduction-to-probability - Stack Overflow – R Programming - https://stackoverflow.com/questions/tagged/r	

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, Viva-voce.


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Course Curated by					
Expert(s) from Industry		Expert(s) from Higher Education Institution		Internal Expert(s)	
1. Mr. Ramesh V.S., STEPS Knowledge Services Private Limited, Coimbatore. 2. Mr.Jayakumar Venkatesan, Valles Marineris International Private Limited- Chennai. 3. Mr. Imran Khan, GE Transportation Company, Bangalore.		1. Dr.T.Govindan, Government College of Engineering, Srirangam, Trichy. 2. Dr.C.Porkodi, PSG College of Technology, Coimbatore. 3. Dr.P.Paramanathan, Amrita Vishwa Vidyapeetham, Coimbatore.		1. Dr. Vijeta Iyer, Mathematics Dr. K.Meena, Mathematics	
Recommended by BoS on		16/08/2024			
Academic Council Approval		No.27		Date	24/08/2024


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24HST506	PROFESSIONAL COMMUNICATION STRATEGIES	L	T	P	J	C
		2	0	0	0	2
HS		SDG		4,8		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Demonstrate mastery in using digital tools and software to produce well-structured and effective business documents, aligned with industry standards.
2	Communicate ideas clearly and effectively in written and verbal formats, tailoring messages to fit diverse professional settings, audiences, and cultural contexts.
3	Establish and maintain a professional digital presence on networking platforms such as LinkedIn, portfolios, and personal websites.
4	Exhibit thorough preparation for professional interactions such as meetings, presentations, and interviews by researching relevant topics and aligning personal goals with career opportunities.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Show expertise in creating, revising, and organizing various types of professional documents.	Ap
CO2	Communicate clearly and effectively in both written and verbal forms across different professional settings, adjusting to diverse audiences and cultural environments.	An
CO3	Establish and maintain a professional presence online, utilizing digital platforms to enhance networking and career progression.	U
CO4	Demonstrate thorough preparation and active engagement in professional interactions, aligning personal objectives with career opportunities and overcoming communication challenges.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1		1	2		3			3	
2		2	2		3		3	3	
3		2	2		3		2	3	
4		2	2		3		3	3	


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Course Content	
TECHNICAL CORRESPONDENCE Proof Reading (Subject – Verb Agreement - Articles and Preposition - Use of Conjunctions) Paragraph Writing Techniques - Transcoding Graphical Representations - Writing Technical Instructions- Framing Prompts for AI Tools.	6 Hours
TECHNICAL READING Reading Strategies for Technical Texts – Subskills - Reading & Summarizing -Reading Comprehension Exercises (Task Types from International Language Exams).	6 Hours
BUSINESS CORRESPONDENCE Email Writing (Email Etiquette, Email Structure and Tone, Crafting Clear Subject Lines and Messages, Responding to Emails Professionally) - Formal Letters (Structure and Format, Tone and Language in Business Correspondence) –Drafting Meeting Agenda and Minutes.	6 Hours
GROUP DYNAMICS AND LEADERSHIP SKILLS Group Discussion Types of GD – Key Skills for Effective Group Discussions -Roles and Responsibilities - Overcoming Communication Barriers – Leadership Skills - Role of Communication in Leadership - Developing Emotional Intelligence (Self-Regulation, Empathy, Social Skills) – Decision Making and Problem Solving.	6 Hours
GOAL SETTING & INTERVIEW SKILLS Types of Goals: Short-Term, Long-Term, Personal, and Professional – SMART Goals - SWOT Analysis – Aligning Personal Goals with Organizational Objectives - Developing a Comprehensive Goal Setting Plan - Job application and Digital Profile - Types of Interviews – Preparing for interview – Answering Common Interview Questions - Handling Difficult Interview Scenarios -Mock Interview.	6 Hours

Theory Hours:30	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours:30
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Learning Resources
Textbooks
-
Reference books/ Web Links
1. Mahesh Kumar, Dr.Soma. "Soft Skills: Enhancing Personal and Professional Success", McGraw Hill, 2023. 2. Maxwell, John C., "Developing the Leader within You", HarperCollins, 2018. 3. Dr. K.Alex, "Soft Skills Know Yourself & Know The World", Generic, 2011. 4. Burnard, Philip., "Interpersonal Skills Training", Viva Books Private Limited, Feb 2011.
Online Resources
1. https://www.glassdoor.co.in/Interview/index.htm 2. https://www.coursera.org/learn/successful-interviewing 3. https://www.mindtools.com/a5ykiuq/personal-goal-setting 4. https://www.exed.hbs.edu/senior-executive-leadership-program-

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)


 Signature of the BOS Chairman

Course Curated by			
Expert(s) from Industry		Expert(s) from Higher Education Institution	Internal Expert(s)
Mr.Vijayan Ramanathan, Project Manager, Toppan Merrill. Technologies, Coimbatore.		Dr. Aninditha Sahoo, IIT, Madras Dr.P.R. Sujatha Priyadharshini, Anna University Chennai Dr. E. Justin Ruben, CIT, Coimbatore.	Dr. Arokia Lawrence Vijay Dr. A S Mythili
Recommended by BoS on		16/08/2024	
Academic Council Approval		No.27	Date 24/08/2024


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SEMESTER II



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24CAT505	CLOUD COMPUTING	L	T	P	J	C
		3	0	0	0	3
PC		SDG		8, 9, 12		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Understand core concepts, service models (SaaS, PaaS, IaaS), and deployment types (public, private, hybrid).
2	Understand virtualization techniques, hypervisors, and their practical applications.
3	Design scalable cloud applications with auto-scaling, load balancing, and database management.
4	Implement cloud security measures, including encryption, firewalls, and identity management.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand the evolution, characteristics, architecture, and design challenges of cloud computing environments.	U
CO2	Apply cloud service and deployment models to select appropriate cloud solutions for different application requirements.	Ap
CO3	Analyse virtualization techniques, hypervisors, and virtual machine management approaches in cloud platforms.	An
CO4	Evaluate cloud scalability mechanisms, load balancing strategies, cloud storage models, and database management solutions.	E
CO5	Design secure cloud computing environments using encryption, firewall mechanisms, identity management, and access control techniques.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2	2				2	
2	2	3		3				
3	2	2						3
4	2			2				2
5		2	2					


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Course Content	
INTRODUCTION TO CLOUD COMPUTING Introduction to Cloud Computing - Evolution of Cloud Computing – Cloud Characteristics - Elasticity in Cloud - On-demand Provisioning – NIST Cloud Computing Reference Architecture – Architectural Design Challenges.	8 Hours
CLOUD COMPUTING: SERVICE AND DEPLOYMENT MODEL Cloud Service Models: Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Service Providers, Challenges and Risks in Cloud Adoption. Cloud Deployment Model: Public Clouds – Private Clouds – Community Clouds – Hybrid Clouds – Advantages of Cloud Computing.	8 Hours
VIRTUALIZATION Virtualization: Definition – Benefits of Virtualization – Types of Virtualizations – Hypervisors-based: Paravirtualization – Full Virtualization – Virtual Machine Monitor – Hypervisors: Xen, KVM, VMWare, Virtual Box and Hyper-V - Pros and Cons of Virtualization.	9 Hours
CLOUD SCALABILITY AND DATA MANAGEMENT Scaling in the Cloud - Auto-Scaling in Cloud - Use of Load Balancers to Enhance Scalability - Elastic Compute Cloud - Cloud Storage - Database in Cloud - Relational DBMS in Cloud - Non-relational DBMS in Cloud – Private and Public Cloud Platforms.	10 Hours
SECURITY DESIGN IN THE CLOUD Challenges with Cloud Data - Challenges with Data Security - Security-as-a-Service- Data Confidentiality and Encryption - Data Availability - Data Integrity - Cloud Data Management Interface - Cloud Storage Gateways – Cloud Firewall - Virtual Firewall - Security Monitoring – Identity Management and Access Control.	10 Hours

Theory	Tutorial	Practical	Project	Total
Hours:45	Hours: 0	Hours: 0	Hours: 0	Hours:45

Learning Resources
Textbooks
1. Sandeep Bhowmik "Cloud Computing", Cambridge University Press, 2017. 2. Kailash Jayaswal, Jagannath Kallakurch, Donald J. Houde, Deven Shah "Cloud Computing Black Book", Wiley India, 2014.
Reference books/ Web Links
1. Michael J. Kavis "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" John Wiley & Michel Kavis, 2014. 2. Mehul Mahrishi Kamal Kant Hiran, Ruchi Doshi and Dr.Fagbola Temitayo, "Cloud Computing", BPB Publications, First Edition, 2019. 3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", McGraw-Hill Education, First Edition, 2017. 4. Shailendra Singh, "Cloud Computing", Oxford University Press, First Edition, 2018. 5. Ted Hunter, Steven Porter and Legorie Rajan P.S, "Building Google Cloud Platform Solutions: Develop Scalable applications from scratch and make them globally available in almost any language", Packt Publishing Limited, 2019.
Online Resources
1. https://explore.skillbuilder.aws/learn/course/external/view/elearning/134/aws-cloud-practitioner-essentials 2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138433310243799043616_2_shared/overview


 Signature of the BOS Chairman

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)	
-	-	Dr. C. Rajankrupa, Dept. of Computer Applications	
Recommended by BoS on	16/08/2024		
Academic Council Approval	No.27	Date	24/08/2024


Signature of the BOS Chairman

24CAT506	CYBER SECURITY	L	T	P	J	C
		3	0	0	0	3
PC		SDG		4,9,16		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Understand fundamental security concepts and principles to recognize the importance of protecting information and systems from various threats.
2	Apply cryptographic methods to enhance data confidentiality and integrity, ensuring secure communication across networks.
3	Analyze security vulnerabilities and risks in computer systems and applications to identify potential weaknesses and develop mitigation strategies.
4	Evaluate security solutions and practices by testing and assessing systems for effectiveness in preventing and responding to cyber threats.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand the fundamental security goals, the need for security, and various security approaches.	U
CO2	Apply symmetric and asymmetric cryptography techniques to secure data.	Ap
CO3	Analyze penetration testing methodologies and tools to identify potential vulnerabilities in systems.	An
CO4	Evaluate the effectiveness of various methods for exploiting and securing application vulnerabilities, and insecure coding practices.	E
CO5	Apply digital forensic techniques and incident response strategies to manage and investigate cyber incidents effectively.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2	2				2	
2	2	3		3				
3	2			3				
4		2		2				2
5	2		2					3


 Signature of the BOS Chairman

Course Content	
INTRODUCTION TO THE CONCEPTS OF SECURITY Security Goals - The Need for Security – Security Approaches -Principles of Security – Attacks - Types of attacks - Sniffing and Spoofing: Packet sniffing - Packet spoofing – Phishing - Pharming.	8 Hours
CRYPTOGRAPHY TECHNIQUES Introduction - Plain Text and Cipher Text - Substitution Techniques - Transposition Techniques - Encryption and Decryption - Symmetric and Asymmetric Key Cryptography - Data Encryption Standard (DES) - The RSA Algorithm.	8 Hours
PENETRATION TESTING Benefits of Penetration Testing - Attacking and Exploiting - Information Gathering: Open-Source Intelligence Gathering - Port Scanning, Ping Sweeps - Vulnerability Scanning: Nmap Version Scan to Potential Vulnerability - Web Application Scanning- Penetration Testing Tools: Nikto, OpenVAS, Nessus and Nmap.	10 Hours
EXPLOITING APPLICATION VULNERABILITIES Exploiting Injection Vulnerabilities: Input Validation - Web Application Firewalls - SQL Injection Attacks - Code Injection Attacks - Exploiting Authentication Vulnerabilities: Password Authentication - Session Attacks - Kerberos Exploits - Exploiting Web Application Vulnerabilities: Cross-Site Scripting (XSS) - Unsecure Coding Practices.	10 Hours
DIGITAL FORENSICS Introduction - Forensic Science - Digital Forensics - Fundamentals of Digital Forensics - Uses of Digital Forensics - The Digital Forensics Process - Understanding Incident Response - Managing Cyber Incidents.	9 Hours

Theory Hours:45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours:45
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Learning Resources	
Textbooks	
1. Atul Kahate "Cryptography and Network Security", McGraw Hill Education (India) Private Limited, 2013. 2. Mike Chapple David Seidl, "CompTIA PenTest+ Study Guide" Wiley, 2019. 3. John Sammons, "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics", Elsevier Inc, 2015.	
Reference books/ Web Links	
1. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", William Pollock, 2014. 2. Ric Messier, "CEH v12 Certified Ethical Hacker Study Guide", John Wiley & Sons, 2023. 3. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", John Wiley, 2011. 4. Gerard Johansen "Digital Forensics and Incident Response", Packt Publishing, 2017. 5. Behrouz A. Forouzan, "Introduction to Cryptography and Network Security", McGraw-Hill, Inc., 2015.	
Online Resources	
1. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944176014540801893_shared/overview 2. https://www.mygreatlearning.com/blog/introduction-to-penetration-testing/ 3. https://www.mygreatlearning.com/academy/learn-for-free/courses/cyber-security-threats	


Signature of the BOS Chairman

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)	
-	-	Dr.C.Rajankrupa, Dept. of Computer Applications	
Recommended by BoS on	16/08/2024		
Academic Council Approval	No.27	Date	24/08/2024


Signature of the BOS Chairman

24CAI507	AUTOMATION AND ARTIFICIAL INTELLIGENCE	L	T	P	J	C
		2	0	2	0	3
		SDG		4,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:		The purpose of taking this course is to:
1	Understand the principles, strategies, and components of automation systems and their applications in production.	
2	Introduce the role of Industry 4.0 and explore the integration of Robotic Process Automation (RPA) with AI technologies.	
3	Gain knowledge of artificial intelligence concepts, including intelligent agents and AI programming techniques.	
4	Explore machine learning methods and their applications in intelligent automation across various industries.	

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand the fundamentals of automation, Industry 4.0, robotic process automation (RPA), and the components of automated systems.	U
CO2	Apply UI Path tools, recording modes, and screen scraping techniques to automate tasks involving text extraction and document processing.	Ap
CO3	Analyze the role of intelligent agents, artificial intelligence techniques, and their applications in solving real-world problems.	An
CO4	Implement machine learning techniques for data analysis, classification, prediction, and pattern recognition tasks.	Ap
CO5	Examine the applications of intelligent automation and artificial intelligence in industries including automotive, healthcare, insurance, and life sciences using NLP, computer vision, and speech recognition technologies.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3		2	3		2		
2	3	2						
3	3	3	3					
4			3	2			2	
5			3					2


 Signature of the BOS Chairman

<u>Course Content</u>	
INTRODUCTION TO AUTOMATION Introduction to Automation-Automation in Production System-Automation Principles and Strategies-Basic Elements of an Automated System-Advanced Automation Functions-Levels of Automation-Hardware Components for Automation-Sensors and Actuators- Benefits of Automation - Limitations to Automation. Industry 4.0 -Introduction to Robotic Process Automation (RPA) - Benefits of RPA- Overview of Industries Best-Suited for RPA-Advancements in RPA and its Integration with AI Components of RPA- RPA Platforms-About UI Path- The Future of Automation.	7 Hours
Practical Component • Study on UI path Tool • Recording Modes • Notepad/Word Automation • Screen Scrapping Techniques to extract text from Images/Web/Document	10 Hours
ARTIFICIAL INTELLIGENCE Introduction to Artificial Intelligence -Intelligent Agents: Agents and Environment- Reactive Agent- Deliberative- Goal Driven- Utility Driven and Learning Agents - Artificial Intelligence Programming Techniques and Applications.	9 Hours
MACHINE LEARNING Forms of Learning -Supervised Learning - Unsupervised Learning - Artificial Neural Networks- Non-parametric Models - Support Vector Machines -Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- Introduction to Expectation Maximization Algorithm – Overview of Reinforcement Learning.	9 Hours
Practical Component • Implement various pre-processing techniques in the dataset. • Split the dataset into Training and Testing data. Fit the data into the model and calculate the performance measures using Decision Tree. • Implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets. • Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. • Implement support vector machine for the given data set. • Implement the K-Means algorithm for the given data set. Evaluate the performance using various K values.	20 Hours
APPLICATIONS OF INTELLIGENT AUTOMATION Applications of Intelligent Automation- Automotive- Life Sciences- Healthcare- Insurance - AI Applications in Industry - Automation using Natural Language Processing, Computer Vision, Speech Recognition-The Future of Intelligent Automation.	5 Hours

Theory	Tutorial	Practical	Project	Total
Hours:30	Hours: 0	Hours:30	Hours: 0	Hours:60

W. G. L.

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Learning Resources	
Textbooks	
1.	Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson, 4th Edition, 2020.
2.	Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", (electronic): 978-1-4842-5729-6", A press, 2020.
Reference books/ Web Links	
1.	M.P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 5th Edition, Pearson Education, 2009.
2.	Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing Release Date: March 2018.
Online Resources	
1.	https://www.coursera.org/specializations/roboticprocessautomation
2.	https://www.coursera.org/professional-certificates/google-it-automation

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)	
-	-	Dr.P.Parameswari, Dept. of Computer Applications	
Recommended by BoS on	16/08/2024		
Academic Council Approval	No.27	Date	24/08/2024


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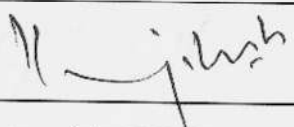
24CAI508	FULL STACK APPLICATION DEVELOPMENT	L	T	P	J	C
PC		3	0	2	0	4
		SDG		4,8,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Learn front-end technologies (HTML, CSS, JavaScript, Bootstrap) and explore web development stacks like MERN, MEAN, and LAMP.
2	Develop routing, middleware, authentication, and REST APIs using the Express framework.
3	Master Node.js for building server-side applications, managing asynchronous I/O, and using modules.
4	Integrate MongoDB, design schemas, and deploy full-stack applications with Node.js.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply the basics of HTML, CSS, JavaScript, and Git to create and manage web projects using version control.	Ap
CO2	Analyse the concepts of Node.js to develop and manage server-side JavaScript applications.	An
CO3	Analyze asynchronous I/O patterns and callback functions in Node.js to handle events, errors, and JSON data efficiently.	An
CO4	Evaluate the use of Express framework to implement robust back-end web applications with middleware and routing.	E
CO5	Design MongoDB schemas and integrate them with Node.js applications to ensure data management and deployment.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium-2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3								
2					2				
3		3						2	
4				2					
5			3			2			


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Course Content	
INTRODUCTION TO FULL STACK DEVELOPMENT & VERSION CONTROL Overview of HTML, CSS, JavaScript, and Bootstrap. Web Development Stack - Full Stack – Introduction – Types: MERN, MEAN, MEVN, LAMP, Ruby on Rails, Django, .NET, JAMSTACK - Version Control – Need - Popular version control tools like Git - Create a GitHub Account - Use the GitHub Web Interface to Create a Repository - Add a File to Git and Commit the Changes – Git Commands.	9 Hours
Practical Component Create your own Node.js module and import and use modules in your web server application.	3 Hours
INTRODUCTION TO NODE.JS Introduction to Node.js - Server-Side JavaScript and Node.js - Creating a Web Server with Node.js - Working with Node.js Modules - Overview of Node Package Manager.	9 Hours
Practical Component Develop asynchronous functions with callbacks, error handling, and control flow using callbacks.	3 Hours
SERVER-SIDE JAVASCRIPT Asynchronous I/O with Callback Programming - Creating Callback Functions - Using Anonymous Callback Functions in Node.js - Issues with Callbacks - Working with JSON - Handling Errors and Debugging Node.js Applications.	9 Hours
Practical Component - Demonstrate JSON file data read and write using Node.js. - Create a RESTful API to serve JSON data. - Demonstrate RESTful endpoints using Express and HTTP methods to handle GET, POST, PUT, and DELETE requests.	9 Hours
EXPRESS WEB APPLICATION FRAMEWORK Extending Node.js - Working with Third Party Node.js Extensions - Introduction to Web Frameworks - Express Web Application Framework - Working with Back-end JavaScript Frameworks and Express - Routing, Middleware, and Templating - Authentication in Node JS - Middleware & Routers - HTTP Methods and Rest APIs.	9 Hours
Practical Component - Integrate a template engine (e.g., EJS or Pug) with Express and render dynamic HTML views using templates. - Implement user authentication in your Express application. - Explore and integrate third-party Node.js extensions into your Express app. - Create a multi-page web application with authentication, routing, and RESTful APIs.	12 Hours
MONGODB AND DEPLOYMENT OF NODE.JS APPLICATIONS NoSQL databases and MongoDB - Setting up a MongoDB Development Environment - Building MongoDB Schema and Models with Mongoose – Connecting Node.js Application with MongoDB – Testing and Deploying Node.js Applications with Server Configurations.	9 Hours
Practical Component Create a simple Employee Management Application with MongoDB and Node.js.	3 Hours


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Theory Hours:45	Tutorial Hours: 0	Practical Hours:30	Project Hours: 0	Total Hours:75
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Learning Resources

Textbooks

1. Laura Lemay, Rafe Colburn and Jennifer Kyrnin, "Mastering HTML, CSS & JavaScript Web Publishing", BPB Publications, 2016.
2. David Herron, "Node.js Web Development: Server-side Web Development", Packt Publishing Limited, 5th Edition, 2020.
3. Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich, "Node.js in Action" Manning, 2nd Edition, 2017.

Reference books

1. Luciano Mammino and Mario Casciaro, "Node.js Design Patterns", Packt Publishing Limited, 3rd Edition, 2022.
2. Mithun Satheesh, Bruno Joseph D'mello and Jason Krol "Web Development with MongoDB and Node JS", Packt Publishing Limited; 2nd edition, 2015.
3. Ethan Brown, "Web Development with Node and Express", O'Reilly Media, Inc. 2nd Edition, 2019.

Online Resources

1. <https://www.coursera.org/learn/introduction-to-web-development-with-html-css-javascript?specialization=ibm-full-stack-cloud>
2. <https://www.coursera.org/learn/getting-started-with-git-and-github?specialization=ibm-full-stack-cloud-developer>
3. <https://www.coursera.org/learn/developing-backend-apps-with-nodejs-and-express?specialization=ibm-full-stack-cloud-developer>
4. <https://www.coursera.org/learn/introduction-to-mongodb>
5. <https://www.coursera.org/projects/showcase-build-a-crud-nodejs-and-mongodb-employee-management-web-app>

Assessment (Embedded course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr.M.Manikantan, Dept. of Computer Applications
Recommended by BoS on	16/08/2024	
Academic Council Approval	No.27	Date 24/08/2024


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24CAI509	DATA ANALYSIS AND VISUALIZATION	L	T	P	J	C
		3	0	2	0	4
PC		SDG		4,8,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil
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Course Objectives:	The purpose of taking this course is to:
1	Introduce the core concepts and significance of Exploratory Data Analysis (EDA) to enhance students' ability to interpret and make sense of complex datasets.
2	Equip students with practical skills to apply data wrangling and transformation techniques for preparing datasets for analysis and visualization.
3	Develop proficiency in utilizing advanced visualization tools such as Matplotlib and Seaborn to communicate data-driven insights effectively.
4	Encourage analytical thinking by examining relationships and patterns within datasets through univariate, bivariate, and multivariate analysis techniques.
5	Guide students in evaluating various data analysis and visualization strategies to address complex data challenges and provide actionable insights

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand key data analysis and visualization techniques to effectively interpret and communicate insights from complex datasets	U
CO2	Apply various tools and methods for data wrangling and transformation to prepare datasets for detailed analysis and visualization.	Ap
CO3	Apply advanced visualization tools to present data insights and support informed decision making across various contexts.	Ap
CO4	Analyze data patterns and model performance using standard evaluation techniques to support informed decision-making.	An
CO5	Evaluate univariate, bivariate, and multivariate data relationships to derive meaningful insights from complex and time-based datasets.	An



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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	3	3					
2	3	3						
3			2	2				
4	3	3						
5			2	2				

Course Content

EXPLORATORY DATA ANALYSIS FUNDAMENTALS		6 Hours
Overview – Significance of Exploratory Data Analysis (EDA) – Making Sense of Data – Comparing EDA with Classical and Bayesian Analysis – Software tools for EDA - Visual Aids for EDA- Data Transformation Techniques-Merging Database, Reshaping and Pivoting, Transformation Techniques - Grouping Datasets - Data Aggregation – Pivot Tables and Cross-tabulations.		
Practical Component		5 Hours
Experiments on data transformation, merging and reshaping datasets, pivot tables, univariate, bivariate, and multivariate analysis, handling missing values, outliers, and developing dashboards.		
VISUALIZING USING MATPLOTLIB		6 Hours
Importing Matplotlib – Simple Line Plots – Simple Scatter Plots – Visualizing Errors – Density and Contour Plots – Histograms – Legends – Colors – Subplots – Text and Annotation – Customization – Three-dimensional Plotting - Geographic Data with Basemap - Visualization with Seaborn.		
Practical Component		5 Hours
Experiments online and scatter plots, visualizing errors, density and contour plots, histograms, adding legends, colors, subplots, text, annotations, 3D plotting, and visualizing geographic data with Basemap and Seaborn.		
DATA WRANGLING AND DATA VISUALIZATION		8 Hours
Group By Mechanics-Data Aggregation-General Split-Apply-Combine, Pivot Tables and Cross Tabulation. Time Series Data Analysis: Date and Time Data Types and Tools-Time Series Basics, -Date Ranges, Frequencies and Shifting-Time Zone Handling-Periods and Periods Arithmetic-Resampling and Frequency Conversion-Moving Window Functions.		
Practical Component		5 Hours
Experiments online plots, scatter plots, histograms, subplots, 3D plotting, and visualizing data with Basemap and Seaborn.		


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DASHBOARD CREATION Metrics for Evaluating Classifier Performance - Holdout Method and Random Sub Sampling - Cross- Validation –ROC Curves - Techniques to Improve Classification Accuracy: Bagging – Boosting –Random Forest. Practical Component Experiments on evaluating classifier performance, cross-validation, ROC curves, and improving classification accuracy using bagging, boosting, and random forest techniques.	8 Hours
	5 Hours
UNIVARIATE & BIVARIATE ANALYSIS Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series-Relationships Between Two Variables - Percentage Tables - Analysing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations. Practical Component Experiments on distributions, numerical summaries, scaling, time series smoothing, analysing relationships between variables, scatterplots, and contingency tables.	9 Hours
	5 Hours
MULTIVARIATE AND TIME SERIES ANALYSIS Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of Time Series Data (TSA) – Characteristics of TSA – Data Cleaning – Time-based Indexing – Visualizing – Grouping – Resampling. Practical Component Experiments on three-variable contingency tables, time series data analysis, data cleaning, time-based indexing, visualization, grouping, and resampling.	8 Hours
	5 Hours

Theory Hours:45	Tutorial Hours: 0	Practical Hours:30	Project Hours: 0	Total Hours:75
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Learning Resources	
Textbooks	
1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing Ltd., 2020. 2. Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers (Elsevier), 2012.	
Reference books/ Web Links	
1. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. 2. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.	
Online Resources	
1. https://www.datacamp.com/tutorial/exploratory-data-analysis-python 2. https://www.enjoyalgorithms.com/blog/univariate-bivariate-multivariate-analysis	

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce.


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Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)	
-	-	Dr. N. Jayakanthan, Dept. of Computer Applications	
Recommended by BoS on	16/08/2024		
Academic Council Approval	No.27	Date	24/08/2024


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MCA R24A – LIST OF ELECTIVES OFFERED BY MCA DEPARTMENT
(For the students admitted from 2026 onwards)

S.No.	Course Code	Course Title	Course Mode	Course Type	L	T	P	J	C
Web and Software Development Cohort									
1	24CAC636	UI and UX Design	Embedded	PE	2	0	2	0	3
2	24CAC637	Software Testing and Automation	Embedded	PE	2	0	2	0	3
3	24CAC638	DevOps Mastery	Embedded	PE	1	0	0	4	3
4	24CAC639	Software Project Management	Embedded	PE	2	0	2	0	3
Cyber Security and Block Chain Cohort									
5	24CAC640	Secure Software Development	Embedded	PE	2	0	2	0	3
6	24CAC641	Network Security Administration	Embedded	PE	2	0	2	0	3
7	24CAC642	Ethical Hacking and Cyber Laws	Embedded	PE	2	0	2	0	3
8	24CAE643	Web Application Security	Theory	PE	3	0	0	0	3
9	24CAE644	Database Security	Theory	PE	3	0	0	0	3
10	24CAE645	Foundations of Blockchain Technology	Theory	PE	3	0	0	0	3
11	24CAE646	Cryptocurrency and Bitcoins	Theory	PE	3	0	0	0	3
Networking and IoT Cohort									
12	24CAC647	IOT System Design	Embedded	PE	2	0	2	0	3
13	24CAC648	IOT Application Development	Embedded	PE	2	0	2	0	3
Cloud Computing Cohort									
14	24CAC649	Cloud Application Development	Embedded	PE	2	0	2	0	3
15	24CAC650	Cloud Infrastructure and Architecture	Embedded	PE	2	0	2	0	3
16	24CAC651	Cloud Storage Management	Embedded	PE	2	0	2	0	3
17	24CAC652	Virtualization and Resource Management	Embedded	PE	2	0	2	0	3
18	24CAC653	Cloud Security	Embedded	PE	2	0	2	0	3
19	24CAC654	Cloud Automation	Embedded	PE	2	0	2	0	3
Artificial Intelligence & Data Science Cohort									
20	24CAC655	Business Intelligence for Decision Making	Embedded	PE	2	0	2	0	3
21	24CAC656	Deep Learning Applications	Embedded	PE	2	0	2	0	3
22	24CAE657	Responsible AI	Theory	PE	3	0	0	0	3


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23	24CAC658	Generative AI	Embedded	PE	2	0	2	0	3
24	24CAC659	Social Network Analytics	Embedded	PE	2	0	2	0	3
25	24CAC660	Agentic AI	Embedded	PE	1	0	0	4	3



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WEB AND SOFTWARE DEVELOPMENT COHORT



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24CAC636	UI AND UX DESIGN	L	T	P	J	C
		2	0	2	0	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Apply UI/UX design concepts and empathy techniques to identify user needs and develop user-centered solutions.
2	Understand design thinking methods for solving user experience problems.
3	Gain skills in visual design and UI component creation.
4	Practice wireframing, prototyping, and usability testing.
5	Use tools like Figma to build interactive user interfaces.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply UI and UX design concepts along with empathy techniques to identify user needs and proposes suitable user-centered design solutions.	Ap
CO2	Apply UI design principles to implement visual design standards and UI components to enhance user interaction.	Ap
CO3	Conduct UX research using at least two industry-relevant techniques to align user goals with business objectives.	Ap
CO4	Create and evaluate responsive wireframes and prototypes using iterative testing methods for a given user scenario.	An
CO5	Design an interactive, user-centered interface using essential Figma tools and techniques.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2							
2			3					
3			3					
4				2				
5				2				


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Course Content	
INDUSTRY-RELEVANT DESIGN THINKING Understanding UI vs. UX Design, Design Thinking Framework, Innovative Thinking Methods, Empathy Techniques for User Insights. Practical Component : 1. Create User Personas and Empathy Maps for a selected product idea. 2. Apply Design Thinking methodology to identify and solve a user problem. 3. Design a project board and visual theme using Canva.	6 Hours 6 Hours
UI DESIGN PRINCIPLES FOR INDUSTRY Visual Design Standards, UI Components and Design Patterns, User Interaction and Engagement, Branding Integration and Style Guides. Practical Component : 1. Explore and analyze common UI components and interaction patterns. 2. Design a responsive user interface layout using Figma. 3. Create a UI Style Guide with colors, typography, and components.	6 Hours 6 Hours
UX RESEARCH AND STRATEGY IN THE INDUSTRY UX Fundamentals for Business Impact Design Process, Industry Research Techniques, Aligning User and Business Goals. Practical Component : 1. Perform competitor analysis and user research for a digital product. 2. Develop user journey maps aligning user and business goals. 3. Create a pattern library including fonts, colors, and reusable assets.	6 Hours 6 Hours
WIREFRAMING, PROTOTYPING AND TESTING Sketching Principles - Sketching Red Routes - Responsive Design - Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings -Prototype Iteration. Practical Component : 1. Design low-fidelity wireframes and wireflow diagrams for an application. 2. Develop an interactive prototype using Figma 3. Conduct usability testing and refine the prototype based on feedback.	6 Hours 6 Hours
LOW CODE -NO CODE TOOLS Low code- No code Design Tools -Essential Concepts of Figma - Setup and Configure Figma - Images, Shapes, and Tools - Working with Figma - Figma Components - Styles and Libraries in Figma - Cards and Layout Grids in Figma. Practical Component : 1. Configure a Figma workspace and create basic UI screens. 2. Create and manage layout grids and Auto Layout features in Figma. 3. Design reusable components and build a shared design library.	6 Hours 6 Hours

Theory Hours:	30	Tutorial Hours:	30	Project Hours:	60	Total Hours:
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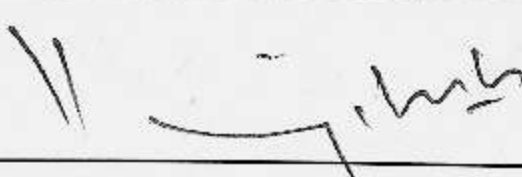
Learning Resources	
Textbooks	
1. Jon Yablonski, Laws of UX: Using Psychology to Design Better Products & Services, O'Reilly, 2021.	


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Reference books/ Web Links	
1.	Joel Marsh, UX for Beginners, O'Reilly, 2022.
2.	Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, 2013.
3.	Steve Krug, Don't Make Me Think: A Commonsense Approach to Web Usability, New Riders, 2014.
4.	Jeffrey Zeldman and Ethan Marcotte, Responsive Web Design, A Book Apart, 2011.
5.	Jenifer Tidwell, Charles Brewer and Aynne Valencia, Designing Interfaces: Patterns for Effective Interaction Design, 3rd Edition, O'Reilly Media, 2020.
Online Resources	
1.	https://www.coursera.org/learn/designing-user-interfaces-and-experiences-uiux

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Nivetha R AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No:30	Date	19.06.2026


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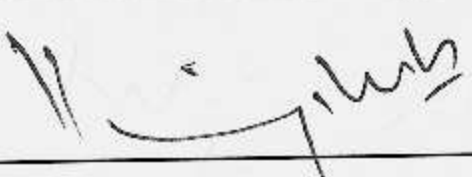
24CAC637	SOFTWARE TESTING AND AUTOMATION	L	T	P	J	C
		2	0	2	0	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Apply software testing concepts and techniques to ensure software quality and reliability.
2	Learn how to do the testing and planning effectively
3	Build test cases and execute them
4	Focus on wide aspects of testing and understanding multiple facets of testing
5	Get an insight about test automation and the tools used for test automation

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply fundamental software testing concepts and techniques to evaluate and ensure quality in software systems	Ap
CO2	Apply test planning techniques to effectively organize, prioritize, and schedule testing tasks in a structured test strategy.	Ap
CO3	Design and execute test cases using manual and automated methods to validate functional requirements in software systems.	Ap
CO4	Analyze various testing types and levels to determine their appropriateness in given scenarios.	An
CO5	Evaluate and utilize software test automation tools to improve testing efficiency and coverage.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3								
2	3								
3		2							
4			2						
5				2					


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TEST AUTOMATION AND TOOLS Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.	6 Hours
Practical Component : • Configure Selenium WebDriver and automate basic browser operations. • Automate form validation and navigation test cases using Selenium. • Develop and execute TestNG test suites and generate automated test reports. • Automate end-to-end testing of a web application and generate execution reports.	6 Hours

Theory Hours: 30	Tutorial Hours: -	Practical Hours: 30	Project Hours: -	Total Hours: 60
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Learning Resources
Textbooks
1. Yogesh Singh, Software Testing, Cambridge University Press, 2013. 2. Unmesh Gundecha, Satya Avasarala, Selenium WebDriver 3 Practical Guide, Second Edition, Packt Publishing, 2018.
Reference books/ Web Links
1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, John Wiley & Sons, Inc., 2015. 2. Ron Patton, Software Testing, 2nd Edition, Sams Publishing, 2006. 3. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, 5th Edition, Taylor & Francis Group, 2021. 4. Carl Cocchiaro, Selenium Framework Design in Data-Driven Testing, Packt Publishing, 2018. 5. Elfriede Dustin, Thom Garrett, Bernie Gauf, Implementing Automated Software Testing, Addison-Wesley Professional, 2009. 6. Satya Avasarala, Selenium WebDriver Practical Guide, Packt Publishing, 2014. 7. Varun Menon, TestNG Beginner's Guide, Packt Publishing, 2013.

Online Resources
1. https://www.coursera.org/specializations/software-testing-automation 2. https://onlinecourses.nptel.ac.in/noc22_cs61/preview

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By		
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Nivetha R & Arthi J AP/CSE
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date: 19.06.2026


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24CAC638	DEVOPS MASTERY	L	T	P	J	C
PE		1	0	4	0	3
		SDG		9		

Pre-requisite courses	NA	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Apply DevOps concepts, Linux, and networking fundamentals to create and manage system environments effectively.
2	Apply version control and continuous integration techniques to streamline development Workflows.
3	Implement containerization and orchestration using Docker and Kubernetes.
4	Automate configuration management and infrastructure deployment using Ansible and Terraform.
5	Integrate end-to-end DevOps toolchains for efficient deployment and monitoring in real-world projects.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply foundational DevOps concepts, Linux, and networking essentials to create and manage system environments effectively.	Ap
CO2	Implement version control using Git and develop CI/CD pipelines with Jenkins to automate build and deployment processes.	Ap
CO3	Design and deploy containerized applications using Docker and manage orchestration through Kubernetes clusters.	An
CO4	Automate configuration and infrastructure provisioning using Ansible and Terraform to ensure scalability and reproducibility.	Ap
CO5	Integrate multiple DevOps tools into a cohesive workflow to deliver reliable, continuous, and monitored software solutions.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1			3					
2			3					
3			3					
4			3					
5			3	3		2		


 Signature of the BOS Chairman

Practical Component : 1. Integrate Git, Jenkins, and Docker to implement a Continuous Integration workflow. 2. Implement Continuous Deployment using Docker, Kubernetes, and Jenkins. 3. Configure Prometheus and Grafana to monitor application and infrastructure performance. 4. Develop and demonstrate an end-to-end DevOps pipeline integrating Git, Jenkins, Docker, Kubernetes, Ansible, Terraform, and monitoring tools.	12 hours
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Theory Hours: 15	Tutorial Hours: 0	Practical Hours: 60	Project Hours: 0	Total Hours: 75
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Learning Resources
Textbooks
1. Gene Kim, Jez Humble, Patrick Debois, John Willis, The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations, Second Edition, 2021 2. Rafal Leszko, Continuous Delivery with Docker and Jenkins, Third Edition, 2023
Reference books/ Web Links
1. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015. 2. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016. 3. Sricharan Vadapalli, Modern DevOps Practices: Implement, Secure, and Manage DevOps Processes, 2024. 4. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019.

Online Resources
1. https://www.coursera.org/specializations/devops-mastery 2. https://www.coursera.org/professional-certificates/devops-and-software-engineering 3. https://www.coursera.org/learn/intro-to-devops?specialization=devops-and-softwareengineering 4. https://www.jenkins.io/doc/book

Assessment (Embedded Course)
MCQ, Experimental Cycle tests and End Semester Examination (Lab)

Course Curated By		
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Ms. Nivetha R, AP/CSE
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date: 19.06.2026


Signature of the BOS Chairman

24CAC639	SOFTWARE PROJECT MANAGEMENT	L	T	P	J	C
PE		2	0	2	0	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Explore software project management principles and Agile project execution practices.
2	Apply estimation, planning, scheduling, and collaboration techniques for software projects.
3	Analyze project risks, software quality assurance practices, and AI-assisted workflow management strategies.
4	Utilize Agile and project management tools for monitoring and team coordination.
5	Develop practical skills in managing software projects using modern collaborative and AI-supported approaches.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Analyse software project management principles, Agile lifecycles, AI-assisted collaborative workflows, and project communication practices in software industries.	An
CO2	Apply project planning, estimation, scheduling, and resource management techniques using collaborative project management platforms.	Ap
CO3	Develop Agile requirements, sprint plans, and workflow strategies using AI-assisted project coordination and documentation tools.	Ap
CO4	Apply risk management, software quality assurance, version control, and software delivery practices in project execution environments.	Ap
CO5	Evaluate software project performance using Agile metrics, dashboards, project monitoring strategies, and retrospective practices.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1		3		2	2			
2		3	2	3		3		
3		3	3	3	3	2		
4		2	2	3		3	2	
5		3		2	2	3		


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Course Content	
SOFTWARE PROJECT MANAGEMENT FUNDAMENTALS Characteristics of software projects - Responsibilities of software project managers - Traditional vs Agile project lifecycles - Stakeholders and team organization - Project scope and feasibility analysis - Project communication workflows - Introduction to AI-assisted collaborative project environments. Practical Component : 1. Identify project goals, stakeholders, and scope for a simple software application. 2. Prepare a Project Charter using Notion AI. 3. Conduct Technical, Economic, and Operational Feasibility Analysis and prepare a feasibility report. 4. Generate a Software Requirement Summary and Requirement Specification document using Notion AI.	6 Hours 6 Hours
PROJECT PLANNING, ESTIMATION AND SCHEDULING Project planning activities - Work Breakdown Structure (WBS) - Resource allocation and team coordination - Cost and effort estimation techniques - Function point analysis - COCOMO model - Project scheduling - Gantt charts - PERT and CPM - Milestones, deliverables, and task dependencies. Practical Component : 1. Develop a Work Breakdown Structure (WBS) for the selected software project 2. Create a Gantt Chart showing project activities, dependencies, and milestones. 3. Perform effort and cost estimation for the software project using suitable estimation techniques. 4. Create a project schedule in Jira by defining tasks, timelines, priorities, and resource assignments.	6 Hours 6 Hours
AGILE PROJECT MANAGEMENT AND ITERATION PLANNING Agile manifesto and Scrum framework - Scrum roles, events, and artifacts - Kanban methodology - Product backlog and sprint backlog management - User stories and acceptance criteria - Sprint planning, review, and retrospectives - AI-assisted requirement generation and collaborative reporting workflows - Iterative development and release planning. Practical Component : 1. Develop Epics, User Stories, and Acceptance Criteria for the selected software project. 2. Create a Product Backlog and Sprint Backlog using Jira. 3. Configure a Sprint Board in Jira by organizing user stories, assigning tasks, and estimating story points. 4. Generate Sprint Review and Sprint Retrospective reports for a given project scenario using Notion AI.	6 Hours 6 Hours
RISK MANAGEMENT AND SOFTWARE DELIVERY Software risks and challenges - Risk identification and mitigation strategies - AI-assisted risk prediction and issue analysis - Issue tracking and change management - Software quality assurance practices - Defect tracking - Version control and collaborative repositories. Practical Component : 1. Identify project risks and prepare a Risk Register. 2. Develop Risk Mitigation and Contingency Plans using Notion AI. 3. Create and manage issue tickets, bug reports, labels, and workflows using GitHub Projects. 4. Configure Jira dashboards and generate project progress reports using sample project data.	6 Hours 6 Hours


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PROJECT MONITORING, REPORTING AND ANALYTICS Project progress monitoring and reporting - Project progress tracking and reporting dashboards - Team coordination and project communication - AI-assisted project reporting - Project closure and retrospective analysis - Case studies in software project management. Practical Component : 1. Create project performance dashboards and analyze project metrics. 2. Generate project status reports and analytics summaries using Notion AI. 3. Prepare project closure documentation including lessons learned and project outcomes. 4. Develop and present the final mini software project report and presentation.	6 Hours
	6 Hours

Theory Hours: 30	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours: 60
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Learning Resources	
Textbooks	
1. Hughes, Bob., Cotterell, Mike., and Mall, Rajib., Software Project Management, 6th Edition, 2017, McGraw Hill Education. 2. Schwalbe, Kathy., Information Technology Project Management, 9th Edition, Cengage Learning, 2019. 3. Jonathan Rasmusson., The Agile Samurai: How Agile Masters Deliver Great Software, Pragmatic Bookshelf, 2021.	
Reference books/ Web Links	
1. PMI., A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, 7th Edition, 2021. 2. Rubin, Kenneth S., Essential Scrum: A Practical Guide to the Most Popular Agile Process, Addison-Wesley, 2013. 3. Joachim Rossberg, Agile Project Management with Azure DevOps: Concepts, Templates, and Metrics, 2019, Apress.	
Online Resources	
1. https://www.coursera.org/learn/software-processes-and-agile-practices 2. https://www.coursera.org/learn/project-management-principles-and-practices 3. https://www.atlassian.com/agile 4. https://www.scrum.org/resources 5. https://www.notion.so/product/ai	

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) ,Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Ms. Arthi.J, AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

CYBERSECURITY AND BLOCKCHAIN COHORT



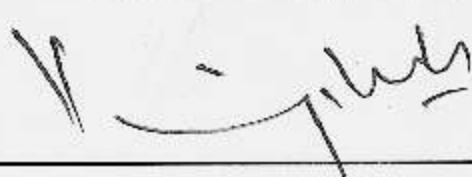
Signature of the BOS Chairman

24CAC640	SECURE SOFTWARE DEVELOPMENT			L	T	P	J	C
				2	0	2	0	3
PE				SDG		4,9		
Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)			NIL			

Course Objectives:	The purpose of taking this course is to:
1	Know the importance and need for software security
2	Learn about secure software design
3	Understand risk management in secure software development
4	Know the working of tools related to software security

Course Outcomes:	After successful completion of this course, the students shall be able to:	Bloom's Taxonomy Level (BTL)
CO1	Demonstrate memory-based vulnerabilities by simulating attacks and applying mitigation techniques	U
CO2	Develop secure software components by integrating security principles into the SDLC and documenting threat models.	Ap
CO3	Examine risks in a software project using profiling tools and propose mitigation strategies aligned with industry standards.	An
CO4	Apply penetration testing tools to identify security flaws in software and generate security assessment reports.	Ap
CO5	Apply security frameworks to implement a secure web application and justify the selected security design choices.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						
2	3	2		3				
3	3	2		2				
4	3	2		2				
5	3			3				


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Course Content	
NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS Introduction - Software Assurance and Software Security –Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Secure SDLC- Memory-Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks. Practical Component : 1. Studying and Installing Kali Linux	6 Hours 4 Hours
SECURE SOFTWARE DESIGN Requirements Engineering for secure software - SQUARE process Model – Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles Practical Component : 1. Implementation of the Buffer Overflow attack 2. Implementation of the SQL injection attack 3. Implementation of Cross Site Scripting and Prevention of XSS	7 Hours 6 Hours
SECURITY RISK MANAGEMENT Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management. Practical Component : 1. Basic risk profiling and assessment of a known software vulnerability	5 Hours 4 Hours
SECURITY TESTING Traditional Software Testing – Comparison - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing. Practical Component : 1. Penetration testing on a web application to gather information about the system 2. Initiate XSS and SQL injection attacks using tools like Kali Linux 3. Developing and testing the secure test cases	8 Hours 8 Hours
SECURE PROJECT MANAGEMENT Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice. Practical Component : 1. Implementation of secured web application	4 Hours 8 Hours

Theory	Tutorial	Practical	Project	Total
Hours: 30	Hours:0	Hours: 30	Hours: 0	Hours:60

Learning Resources
Textbooks
1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2009.
Reference books/ Web Links
1. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011.


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2. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison-Wesley Professional, 2006.
3. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
4. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
5. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012.
6. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012.
7. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing, 2012.
8. Gary McGraw, "Software Security: Building Security In", Addison-Wesley Professional (Pearson Education), 2006.
9. Jim Manico and August Detlefsen, Engineering Secure Software and Systems, Wiley, First Edition, 2024.

Online Resources

1. <https://www.us-cert.gov/bsi/articles/best-practices/project-management/software-security-engineering-guide-project-managers>

MOOCS:

1. <https://nptel.ac.in/courses/106106199/>
2. <https://www.mooc-list.com/course/software-security-coursera>
3. <https://www.coursera.org/specializations/requirements-engineering-secure-software>
4. <https://pe.gatech.edu/courses/secure-software-development>
5. <https://www.my-mooc.com/en/mooc/software-security/>
6. <https://www.coursera.org/learn/requirements-elicitation?specialization=requirements-engineering-secure-software>

Assessment (Embedded Course)

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr.V.Vanitha, Professor/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026

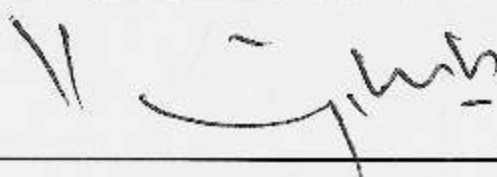
Signature of the BOS Chairman

24CAC641	NETWORK SECURITY ADMINISTRATION	L	T	P	J	C
		2	0	2	0	3
PE		SDG		4,9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Understand fundamental concepts of network security, including threats, vulnerabilities, and countermeasures.
2	Explore the architecture and functionality of firewalls, VPNs, IDS/IPS, and other network security components.
3	Configure and manage firewalls to control traffic flow and enforce network security policies.
4	Administer secure network services and monitor network activity to detect and respond to security incidents.
5	Evaluate network security risks and design security solutions to meet organizational requirements. Apply the symmetric cryptographic concepts and block cipher techniques for secure data transmission.

Course Outcomes:	After successful completion of this course, the students shall be able to:	Bloom's Taxonomy Level (BTL)
CO1	Apply symmetric cryptographic concepts and block cipher techniques to ensure secure data transmission.	Ap
CO2	Apply public-key cryptography and hash algorithms to enhance data security.	Ap
CO3	Apply secure communication protocols to organize and safeguard data payloads at the Internet and Transport layers.	Ap
CO4	Apply the principles of Three-Tier Architecture to organize and secure network components in a firewall environment.	Ap
CO5	Apply firewall rules to secure communication and manage network traffic routing.	Ap
CO6	Analyse network and system security from an administrative perspective to identify and mitigate cyber threats.	An


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	3					2	
2	3	3						
3	3	3						
4	3			3				2
5	3			3			2	
6		3		3			3	

Course Content	
NETWORK SECURITY BASICS Overview of Network Security, Internet Standards and RFCs, Conventional Encryption Principles and block ciphers, Advanced Encryption standards, AES Implementation, Block Cipher operation: cipher block modes of operation, location of encryption devices. Practical Component : 1. Implementation of Advanced Encryption Standard (AES) algorithm 2. Designing of a secure network and identify optimal encryption device placement	6 Hours
ASYMMETRIC CIPHERS AND DATA INTEGRITY ALGORITHM Public key cryptography, RSA Algorithm, Diffie Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Cryptography, Pseudorandom number generation, Cryptographic Hash Functions: Requirements and Secure Hash algorithm (SHA), Message Authentication Codes: HMAC, Key Management and Distribution. Practical Component : 1. Implementation of RSA algorithm 2. Implementation of secure hash algorithm	6 Hours
INTERNET SECURITY Transport Layer Security: Web security considerations, HTTPS, secure shell (SSH), Email privacy: Good Privacy (PGP) and S/MIME. IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management. Practical Component : 1. Analysing of FTP, Telnet and HTTP packets using Wireshark 2. Implementation of Image Sniffing using Wireshark	6 Hours


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NETWORK SECURITY MANAGEMENT		6 Hours
Deploying Smart Console - Security Management Server - Security Gateway - Configuring Objects in Smart Console-Establishing Secure Internal Communication - Managing Administrator Access - Managing Licenses - Creating a Security Policy - Configuring Order Layers.		
Practical Component :		6 Hours
1. Configuring objects in smart console 2. Managing administrator access for an operating system 3. Elevating Security with Autonomous Threat Prevention		
NETWORK SECURITY CONFIGURATION		6 Hours
Configuring a Shared Inline Layer - Configuring NAT - Integrating Security with a Unified Policy - Elevating Security with Autonomous -Threat Prevention - Configuring a Locally Managed Site-to-Site VPN - Elevating Traffic View - Monitoring System States - Maintaining the Security Environment.		
Practical Component :		6 Hours
1. Configuring NAT to use a private IP address 2. Creating a security policy and integrating it with a unified policy 3. Monitoring System States and Maintaining the Security Environment.		

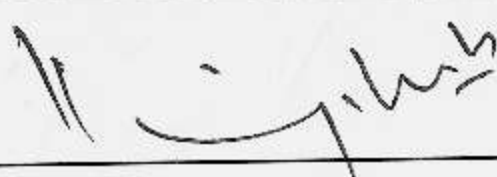
Theory Hours: 30	Tutorial Hours:0	Practical Hours: 30	Project Hours: 0	Total Hours:60
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Learning Resources	
Textbooks	
1. William Stallings, Network Security Essentials (Applications and Standards), Pearson Education 2018. 2. William Stallings, Cryptography and Network Security, Seventh edition, Stallings, PHI/Pearson 4, 2017. 3. Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeah, Hack Proofing your Network, Wiley Dreamtech Published by Syngress, 2002.	
Reference books/ Web Links	
1. Bernard Menezes, Network Security and Cryptography: CENGAGE Learning, 2010. 2. Charlien Kaufman, Radia Perlman and Mike Speciner, Network Security – Private Communication in a Public World by, Pearson/PHI 2002. 3. https://www.checkpoint.com/downloads/professional-services/AdministratorStudyGuide.pdf. 4. https://sc1.checkpoint.com/documents/R81/WebAdminGuides/EN/CP_R81_SecurityManagement_AdminGuide/Topics-SECMG/Understanding-SmartConsole.htm.	
Online Resources	
1. https://www.classcentral.com/course/cybersecurity-rochester-institute-of-technology-c-7844. 2. https://www.classcentral.com/course/network-security-rochester-institute-of-technolog-7858. 3. https://www.classcentral.com/course/coursera-advanced-network-security-and-analysis-397836. 4. https://www.coursera.org/specializations/fortinet-network-security.	

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce


Signature of the BOS Chairman

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr.A.Roshini,AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

24CAC642	ETHICAL HACKING AND CYBER LAWS	L	T	P	J	C
PE		2	0	2	0	3
		SDG		4,9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Introduce core concepts of ethical hacking, including threats, vulnerabilities, and attack methodologies.
2	Develop skills in reconnaissance, footprinting, and enumeration using ethical hacking tools.
3	Simulate real-world attacks such as password cracking, sniffing, and wireless exploitation.
4	Provide knowledge of cyber laws, ethical practices, and digital rights frameworks.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Identify and describe the key concepts and terminologies of ethical hacking, including phases of hacking, threat types, vulnerabilities, and exploits	U
CO2	Demonstrate the use of reconnaissance tools for footprinting and port scanning, and script-based enumeration of Windows and Linux systems,	Ap
CO3	Apply password cracking techniques, implement keyloggers and sniffers, and analyze remote system vulnerabilities to simulate system hacking attacks	Ap
CO4	Execute wireless network attacks and demonstrate secure configuration practices using wireless hacking tools.	Ap
CO5	Apply national and international cyber laws and ethical principles to address legal and ethical issues in real-world cyber case studies.	Ap

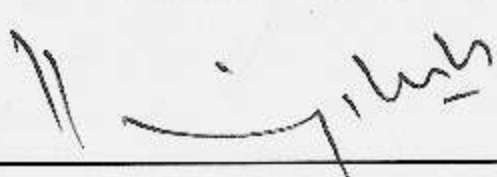
Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						2
2	3	2		2				
3	3	2	2					
4	3			2				
5							2	2


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Course Content	
ETHICAL HACKING OVERVIEW & VULNERABILITIES Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking. Practical Component : 1. Installation of Kali or Backtrack Linux / Metasploitable/ Windows XP 2 2. Basics of reconnaissance.	6 Hours 6 Hours
FOOTPRINTING & PORT SCANNING Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting enumeration-Introduction, enumerating windows OS & Linux OS. Practical Component : 1. Passive Footprinting Using OSINT Tools 2. Active Footprinting and Network Mapping 3. Enumeration of Windows and Linux Systems	6 Hours 8 Hours
SYSTEM HACKING Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Side-channel Attacks on Cryptographic Hardware: Basic Idea, Current-measurement based Side-channel Attacks. Hardware Trojans. Practical Component : 1. Password Guessing and Password Cracking 2. Understanding Data Packet Sniffers 3. Working with Trojans, Backdoors	6 Hours 10 Hours
HACKING WIRELESS NETWORKS Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks. Practical. Component 1. Cracking WEP Encryption 2. Wireless Sniffing and DoS Attack Simulation	6 Hours 6 Hours
CYBER LAW AND ETHICAL FRAMEWORKS The legal and ethical aspects of cyber activities, covering fundamental cyber laws in India and internationally, digital evidence handling, data protection regulations, intellectual property rights, and ethical responsibilities of IT professionals.	6 Hours

Theory	30	Tutorial	0	Practical	30	Project	0	Total	60
Hours:		Hours:		Hours:		Hours:		Hours:	

Learning Resources
Textbooks
1. Ric Messier, CEH v11: Certified Ethical Hacker Study Guide, Wiley , 2021. 2. Vivek Sood, Cyber Law Simplified, Tata McGraw-Hill , 2017.
Reference books/ Web Links


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1. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010.
2. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006.
3. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packet Publishing, 2011.
4. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003.

Online Resources

1. <https://www.coursera.org/specializations/cybersecurity-attack-and-defense>
2. <https://www.netacad.com/courses/ethical-hacker?courseLang=en-US>

Assessment (Embedded Course)

SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr N.Suganthi, Prof / CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


 Signature of the BOS Chairman

24CAE643	WEB APPLICATION SECURITY	L	T	P	J	C
		3	0	0	0	3
PE		SDG		4, 9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Provide foundational knowledge of web application security concepts
2	Analyze and identify common web vulnerabilities
3	Familiarize students with browser security policies and encryption practices
4	Introduce tools and techniques for vulnerability assessment and penetration testing
5	Enable students to design and develop secure web applications

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Understand the fundamentals of web application security to identify and explain common security threats.	U
CO2	Apply browser security principles to demonstrate methods for mitigating attacks.	Ap
CO3	Understand the process of vulnerability assessment in conducting penetration testing on web applications.	Ap
CO4	Apply secure design techniques to organize and implement security measures in web application development.	Ap
CO5	Understand about Hacking techniques and Tools	U

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2							
2				3				
3		3						
4			3					
5		3					3	


 Signature of the BOS Chairman

Course Content	
FUNDAMENTALS OF WEB APPLICATION SECURITY The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation.	9 Hours
BROWSER SECURITY PRINCIPLES AND WEB APPLICATION VULNERABILITIES Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection. Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie-based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery	9 Hours
VULNERABILITY ASSESSMENT AND PENETRATION TESTING Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.	9 Hours
SECURE WEB DESIGN Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines, Forms and validity, technical implementation.	9 Hours
HACKING TECHNIQUES AND TOOLS Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc. probing, Double hashing and rehashing, Hashing Applications. Memory Management: Garbage Collection.	9 Hours

Learning Resources
Textbooks
1.Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc. 2.Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGraw-Hill Companies. 3.Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA 4.Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Professional, 2011. 5.Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011.
Reference books/ Web Links
1. Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Paperback, ISBN: 978-0-470-17077-9 , October 2007. 2. Malcolm McDonald, Web Security for Developers: Real Threats, Practical Defense, No Starch Press,2020.


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Online Resources	
1.	https://www.offsec.com/cyberiversity/web-application-security/
2.	https://web.stanford.edu/class/cs253/
3.	https://owasp.org/www-project-top-ten/
4.	https://www.hackthebox.com/blog/vulnerability-assessments-vs-pentesting
5.	https://developer.mozilla.org/en-US/docs/Learn_web_development/Extensions/Server-side/First_steps/Website_security
6.	https://www.hackerone.com/knowledge-center/white-hat-hacker

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr.G.Kanagaraj, AP-II/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

24CAE644	DATABASE SECURITY	L	T	P	J	C
		3	0	0	0	3
PE		SDG		4,9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	
1	To understand the principles, policies, models, and mechanisms of access control and database security.
2	To apply role-based access control models, security techniques, and tools to mitigate database vulnerabilities and attacks.
3	To explore current and emerging trends in database security and implement practical solutions for access control in evolving digital environments.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Explain fundamental concepts of database security including threats, vulnerabilities, and basic security models.	U
CO2	Analyze and compare access control mechanisms (DAC, MAC, RBAC) and their limitations through policy enforcement.	An
CO3	Apply various security models in enterprise IT infrastructure scenarios.	Ap
CO4	Apply Virtual Private Database techniques and SQL injection countermeasures to enhance database security.	Ap
CO5	Apply emerging trends in database security to implement suitable access control solutions in practical scenarios.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						2
2	3	3						
3	3		3					2
4	3		3					
5	3							3

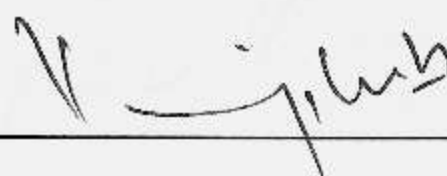

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Course Content	
FOUNDATIONS OF DATABASE SECURITY Database security – Introduction includes threats, vulnerabilities and breaches, Basics of database design, DB security – concepts, approaches and challenges,	7 Hours
ACCESS CONTROL AND POLICY ENFORCEMENT Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.	10 Hours
SECURITY MODELS Biba's integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructure: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi-line Insurance Company	9 Hours
VIRTUAL PRIVATE DATABASE AND SQL INJECTION Necessity of VPD –implementing VPD- Problems of VPD -. Launch SQL injection attacks – Countermeasures-, Security Re-engineering for Databases: Concepts and Techniques, Database Watermarking – Basic Watermarking Process - Discrete Data, Multimedia, and Relational Data – Attacks on Watermarking - Single Bit Watermarking, Multi bit Watermarking	10 Hours
FUTURE TRENDS IN DATABASE SECURITY A Bayesian Perspective, Privacy-enhanced Location based Access Control, Efficiently Enforcing the Security and Privacy Policies in a Mobile Environment	9 Hours

Theory	45	Tutorial	0	Practical	0	Project	0	Total	45
Hours:		Hours:		Hours:		Hours:		Hours:	

Learning Resources	
Textbooks	
1. Danturthi, R. S. Database and Application Security: A Practitioner's Guide. Pearson Education, Boston ,2024. 2. Pfleeger, Charles P., and Shari Lawrence Pfleeger., "Access Control Policies and Models.", Security in Computing., Prentice Hall, Upper Saddle River ,2015, pp. 55–88. 3. Michael Gertz and Sushil Jajodia, "Handbook of Database Security— Applications and Trends", Springer, 2008.	
Reference books/ Web Links	
1. Ben-Natan, Ron. How to Secure and Audit Oracle 10g and 11g. Auerbach Publications, Boca Raton, 2009. 2. Thuraisingham, Bhavani. Database and Applications Security: Integrating Information Security and Data Management. Auerbach Publications, Boca Raton ,2005.	
Online Resources	
1. https://www.coursera.org/learn/access-control-concepts	

Assessment (Theory course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)


Signature of the BOS Chairman

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr.N.Rajathi P/ IT	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

24CAE645	FOUNDATIONS OF BLOCKCHAIN TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Introduce the fundamental principles of blockchain systems and the cryptographic techniques that enable secure decentralized computing.
2	Explain the structure, components, and functioning of blockchain networks including blocks, transactions, and consensus mechanisms.
3	Expose students to a variety of blockchain applications across sectors like finance, healthcare, governance, and supply chain.
4	Develop an understanding of blockchain-related security challenges, privacy mechanisms, and regulatory considerations.
5	Familiarize students with recent innovations, scalability solutions, and future trends in blockchain and decentralized technologies.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Illustrate the foundational elements of blockchain and cryptographic techniques to demonstrate how decentralized systems maintain trust.	Ap
CO2	Apply the structural components of blockchain architecture and transaction flow to organize how data is validated and stored securely.	Ap
CO3	Analyze blockchain applications across various domains to distinguish the suitability of blockchain features for specific sector needs.	An
CO4	Analyze common blockchain security threats and privacy measures to interpret how system vulnerabilities can be identified and addressed.	An
CO5	Apply emerging blockchain trends and governance models to illustrate how evolving mechanisms influence decentralized innovation.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3						2		
2	3	2					2		
3	2	3					2		
4	2	3					2		
5	2						3		


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Course Content	
BLOCKCHAIN FUNDAMENTALS AND CRYPTOGRAPHIC BUILDING BLOCKS Introduction to Distributed Systems and Blockchain Evolution - Principles of Cryptography for Blockchain: Hash Functions, Merkle Trees, Digital Signatures - Public Key Infrastructure in Blockchain - Blockchain Classifications: Public, Private, Consortium, Hybrid - Blockchain Trilemma: Scalability, Security, Decentralization - Consensus Mechanisms Overview: PoW, PoS, and Variants - Case Study: Blockchain vs Traditional Distributed Databases.	9 Hours
BLOCKCHAIN ARCHITECTURE AND TRANSACTION PROCESSING Structure of a Block: Block Header, Block Body - Anatomy of a Blockchain Network: Nodes, Miners, Validators - Transaction Lifecycle: Creation, Propagation, Validation, Finality - Blockchain Forks and Chain Reorganizations - Incentives, Gas Mechanisms, and Fees in Public Blockchains - Smart Contracts: Concept and Deployment Cycle - Case Study: Comparing Bitcoin and Ethereum Architectures.	9 Hours
BLOCKCHAIN APPLICATIONS IN INDUSTRY SECTORS Blockchain in Finance: Cryptocurrencies, DeFi Basics, CBDCs - Blockchain in Healthcare: Health Records, Interoperability, Privacy - Blockchain in Governance: Digital Identity Systems, Land Registries, E-Voting - Blockchain in Supply Chain: Provenance Tracking, Logistics Management - Blockchain for IoT Integration: Secure Data Sharing and Automation - Challenges in Blockchain Adoption: Energy Efficiency, Legal Frameworks - Case Study: Blockchain-based E-Governance Initiatives (India and Global).	9 Hours
BLOCKCHAIN SECURITY, PRIVACY, AND CHALLENGES Common Threats: Sybil Attack, 51% Attack, Replay Attack - Privacy Enhancements: Zero-Knowledge Proofs, Mixers - Identity Management and Access Control - Regulatory Landscape: GDPR, Data Sovereignty in Blockchain - Blockchain Interoperability Solutions: Cross-Chain Bridges, Sidechains - Emerging Threats and Security Trends in Multi-chain Ecosystems - Case Study: Security Audit of a Public Smart Contract.	9 Hours
FUTURE TRENDS AND INNOVATIONS IN BLOCKCHAIN Layer 2 Scaling Techniques: Optimistic Rollups, ZkRollups, State Channels - Decentralized Autonomous Organizations (DAOs) and Governance Models - Tokenization and NFTs: Standards and Applications Blockchain in Metaverse, Digital Assets, and Web3.	9 Hours

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	0	Total Hours:	45
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Learning Resources
Textbooks 1. M. Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015. 2. Dhillon, V., Metcalf, D., and Hooper, M, Blockchain enabled applications, 2017, 1st, Edition, CA: Apress, Berkeley. 3. A. Narayanan et al., Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016. 4. P. Franco, Understanding Bitcoin: Cryptography, Engineering and Economics, Wiley, 2014. 5. G. Wood, Ethereum: A Secure Decentralised Generalised Transaction Ledger, Ethereum Foundation, 2014.
Reference books/ Web Links


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Books:

1. Diedrich, H., Ethereum: Blockchains, digital assets, smart contracts, decentralized autonomous organizations, 2016, 1st Edition, Wildfire publishing, Sydney.
2. Wattenhofer, R. P, Distributed Ledger Technology: The Science of the Blockchain (Inverted Forest Publishing), 2017, 2nd Edition, CreateSpace Independent Pub, Scotts Valley, California, US.
3. Bashir, I. (2020). Mastering Blockchain: A Deep Dive into Distributed Ledgers, Consensus Protocols, Smart Contracts, DApps, Cryptocurrencies, Ethereum, and More - Third Edition. United Kingdom: Packt Publishing.

Web References:

1. Ethereum Whitepaper: <https://ethereum.org/en/whitepaper/>
2. Hyperledger Fabric Documentation: <https://hyperledger-fabric.readthedocs.io/>
3. Blockchain Beyond the Hype (World Economic Forum):
<https://www.weforum.org/reports/blockchain-beyond-the-hype>
4. <https://www.investopedia.com/terms/b/blockchain.asp>
5. <https://www.debutinfotech.com/blockchain-technology>

Online Resources (Mooc References)

1. <https://www.coursera.org/specializations/blockchain>.
2. <https://nptel.ac.in/courses/106105184/>
3. https://swayam.gov.in/nd1_noc20_cs01/preview
4. Blockchain Technology: <https://www.edx.org/learn/blockchain/university-of-california-berkeley-blockchain-technology>

Assessment (Theory course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
		Dr. V. Sujitha, AP/IT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date 19.06.2026



Signature of the BOS Chairman

24CAE646	CRYPTOCURRENCY AND BITCOINS	L	T	P	J	C
PE		3	0	0	0	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Understand the origin, architecture, and cryptographic foundations of Bitcoin and its blockchain system.
2	Develop the ability to construct and validate Bitcoin transactions using blockchain data structures and scripting mechanisms.
3	Apply cryptocurrency trading concepts and strategies to simulate dynamic market environments and assess performance using market indicators.
4	Evaluate the economic, legal, and regulatory implications of cryptocurrencies and explore the future potential of altcoins and blockchain innovations.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Illustrate Bitcoin principles and cryptographic foundations to demonstrate secure transaction validation.	Ap
CO2	Apply Bitcoin network and wallet structures to organize transaction flow and privacy techniques.	Ap
CO3	Analyze trading models and market behavior to interpret pricing trends and strategy outcomes.	An
CO4	Analyze economic and legal aspects of cryptocurrency to examine their influence on adoption and compliance.	An
CO5	Apply concepts of altcoins and consensus methods to illustrate improvements in blockchain performance.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2					2	
2	2	2					2	
3	2	3					2	
4	2	3					2	
5	2						3	


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Course Content	
FUNDAMENTALS OF BITCOIN AND CRYPTOGRAPHY Origin and evolution of Bitcoin - Blockchain structure and Proof-of-Work consensus - Cryptographic techniques: Hashing, Digital Signatures, Merkle Trees - Bitcoin mining: Mining pools and incentives - Bitcoin scripting language and transaction verification - Case Study: Genesis Block and Satoshi Nakamoto's Whitepaper.	9 Hours
BITCOIN ECOSYSTEM AND WALLETS Bitcoin network architecture: Nodes, wallets, mempool - Types of wallets: Hot vs Cold, Hardware wallets, Hierarchical Deterministic wallets - Bitcoin transactions and UTXO model - SegWit, Lightning Network, and scalability - improvements - Privacy techniques: CoinJoin, Mixing services - Case Study: Real-world Bitcoin transaction tracing.	9 Hours
CRYPTOCURRENCY TRADING AND MARKET DYNAMICS Crypto trading concepts: Order types, Exchanges, Order Books - Centralized vs Decentralized Exchanges (CEX vs DEX) - Trading strategies: Spot, Margin, Arbitrage, HODLing - Stablecoins and algorithmic currencies - Market indicators and volatility analysis - Case Study: Historical Bitcoin price fluctuations and crashes.	9 Hours
ECONOMIC, LEGAL, AND REGULATORY ASPECTS Cryptocurrency and global financial systems - Merits and demerits of cryptocurrency adoption - Regulatory frameworks across the globe (USA, EU, India) - Taxation and anti-money laundering (AML) concerns - Legal status of Bitcoin: Security or commodity? - Case Study: FTX, Mt. Gox, and Terra - UNA collapses.	9 Hours
ALTERNATIVE CRYPTOCURRENCIES AND FUTURE TRENDS Overview of altcoins: Ethereum, Litecoin, Monero, Ripple - Crypto forks: Hard vs Soft - Proof-of-Stake and energy-efficient consensus - DAOs, DeFi, and NFTs - Case Study: Bitcoin vs Ethereum vs New-gen coins.	9 Hours

Theory Hours:	45	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	0	Total Hours:	45
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Learning Resources	
Textbooks	
1. A. Narayanan, J. Bonneau, E. Felten, A. Miller, & S. Goldfeder, Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016. 2. M. Swan, Blockchain: Blueprint for a New Economy, O'Reilly Media, 2015. 3. P. Franco, Understanding Bitcoin: Cryptography, Engineering and Economics, Wiley, 2014. 4. C. Dannen, Introducing Ethereum and Solidity: Foundations of Cryptocurrency and Blockchain Programming for Beginners, Apress, 2017.	
Reference books/ Web Links	



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Reference Books:

1. Antonopoulos, A. M. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, 2017, 2nd edition, O'Reilly Media, Inc, United States.
2. Lewis, Antony, The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and The Technology That Powers Them., 2018, 1st edition, Mango Media Inc., United States.
3. Bitcoin: Programming the Open Blockchain, Andreas M. Antonopoulos, Mastering, Second edition, 2017, O'Reilly Media.

Web Links:

1. Ripple Labs Documentation: <https://ripple.com/build/>
2. Bitcoin Whitepaper: <https://bitcoin.org/bitcoin.pdf>
3. Bitcoin Core Documentation: <https://bitcoin.org/en/developer-documentation>
4. CoinMarketCap (for Cryptocurrency Market Analysis): <https://coinmarketcap.com/>
5. CoinGecko (for Market Trends and Trading Data): <https://www.coingecko.com/>

Online Resources

1. <https://www.coursera.org/learn/cryptocurrency>
2. <https://www.edx.org/learn/bitcoin/university-of-california-berkeley-bitcoin-and-cryptocurrencies>
3. <https://nptel.ac.in/courses/106106175>

Assessment (Theory Course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
		Dr. J. Cynthia, Professor, CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026



Signature of the BOS Chairman

Networking and IoT Cohort



Signature of the BOS Chairman

24CAC647	IOT SYSTEM DESIGN	L	T	P	J	C
		2	0	2	0	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	
The purpose of taking this course is to:	
1	Understand the fundamentals of IoT, its role in improving quality of life, and the major challenges such as energy constraints, data explosion, and security issues.
2	Explain the architecture of IoT systems including hardware components like power supply, processor, memory, sensor interface, and wireless communication technologies.
3	Familiarize students with IoT system design and various wireless communication interfaces such as BLE, Wi-Fi, RFID, and LPWAN technologies like LoRa, LTE-M, Sigfox, and NB-IoT.
4	Understand power management techniques and energy harvesting methods including solar, RF, kinetic, and thermal energy systems for IoT devices.
5	Study IoT communication protocols and real-world applications through case studies and cloud-based IoT systems.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Explain the core concepts, challenges, and opportunities in the design and deployment of Internet of Things (IoT) systems.	U
CO2	Develop IoT applications using relevant communication protocols such as MQTT, CoAP, and AMQP for efficient data transmission.	Ap
CO3	Apply suitable power management and energy harvesting techniques to improve the energy efficiency and operational lifetime of IoT devices.	Ap
CO4	Analyse suitable hardware components such as sensors, microcontrollers, and power sources for specific IoT applications.	An
CO5	Analyse IoT system performance in terms of scalability, reliability, and security through case studies and prototype demonstrations.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2	2						2
2	2							
3			2	2				
4			2	2		2		
5		2						


 Signature of the BOS Chairman

Course Content	
FUNDAMENTALS OF IOT AND CHALLENGES Introduction to IOTs - Improving Quality of Life. Challenges to solve in IOTs - Energy / Power, Data Explosion, Security AI Tools: IBM Watson IoT, Google Cloud IoT, Microsoft Azure IoT, ThingSpeak, AWS IoT Core, MATLAB	6 Hours
IOT SYSTEM ARCHITECTURE AND DESIGN System design of an IOT System - Power supply, Processor, Memory Sensor Interface. Wireless Interfaces - LAN - BLE, Wi-Fi, RFID, LP WAN - LORA, LTE-M, Sigfox, NB-IOT. AI Tools: Arduino IDE, Raspberry Pi OS, Proteus Design Suite, Node-RED, Cisco Packet Tracer, Fritzing	6 Hours
POWER MANAGEMENT AND ENERGY HARVESTING Power supply design - LDOs, Switching regulators - BuckBoost Converters, Energy Measurements. Energy harvesting and battery life calculation - PV, RF, Kinetic Energy, TEGs, aeroelastic flutter, Harvesting ICs in silicon. AI Tools: MATLAB Simulink, ANSYS, LTspice, PLECS, COMSOL Multiphysics, LabVIEW	6 Hours
COMMUNICATION PROTOCOLS FOR IOT IOT Protocols - IoT MAC, REST based COAP, Publish subscribe- MQTT, AMQP, MDNS, Building an IOT System - Application based Microcontroller selection. AI Tools: Postman, Eclipse Mosquitto, Wireshark, Eclipse Paho, Node-RED, OMNeT++	6 Hours
IOT CASE STUDIES AND APPLICATIONS Joule Jotter, Cloud Based Systems AI Tools: ThingSpeak, AWS IoT Core, Microsoft Azure IoT, Google Cloud IoT, IBM Watson IoT, MATLAB Simulink	6 Hours
PROJECT COMPONENT: INTEGRATED IOT SYSTEM DESIGN To design and implement a complete IoT system addressing a real-world problem. It involves conceptualizing the architecture, selecting appropriate sensors, power sources, and wireless technologies, and ensuring efficient energy management and harvesting. To implement core IoT communication protocols and integrate the system with a cloud platform for data visualization and interaction. A functional prototype will be developed, emphasizing usability, scalability, and low-power design.	30 Hours

Theory	30	Tutorial	0	Practical	30	Project	0	Total	60
Hours:		Hours:		Hours:		Hours:		Hours:	

Learning Resources	
Textbooks	
1. James, A. , IoT system design: Project-based approach. Springer, 2020. 2. Agarwal, D., Verma, K., & Urooj, S., Energy harvesting: Enabling IoT transformations. CRC Press, 2022. 3. Shabaz, M., & Suhaib, M., Building IoT systems: Design scalable IoT systems from edge to cloud. Springer,2021.	
Reference books/ Web Links	
1. Madan, J., Yadav, D., & Gupta, A., IoT system design: Measurement, Instrumentation, and Smart Systems. Springer., 2023. 2. Vasseur, J.-P., & Dunkels, A., Interconnecting Smart Objects with IP: The next Internet. Morgan Kaufmann, 2010. 3. Rowland, C., Goodman, E., Charlier, M., Light, A., & Lui, A., Designing connected products: UX for the consumer Internet of Things. O'Reilly Media,2015.	
Web References:	
1. https://link.springer.com/book/10.1007/978-3-030-85863-6	


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2. [https://www.routledge.com/Energy-Harvesting-Enabling-IoT-ransformations/Agarwal Verma-Urooj/p/book/9781032349251](https://www.routledge.com/Energy-Harvesting-Enabling-IoT-ransformations/Agarwal-Verma-Urooj/p/book/9781032349251)
3. https://link.springer.com/book/10.1007/979-8-8688-1212-5?utm_
4. https://www.amazon.in/IoT-System-Design-Measurement-Instrumentation/dp/3030858626?utm_
5. <https://www.oreilly.com/library/view/designing-connected-products/9781491922197/>

MOOC References:

1. <https://nptel.ac.in/courses/108108098>
2. <https://www.coursera.org/learn/iot-architecture>
3. <https://www.coursera.org/learn/iot-communications>
4. <https://www.coursera.org/learn/iot-software-architecture>
5. <https://www.coursera.org/learn/advanced-iot-systems-and-industrial-applications-course-3>

Assessment (Embedded course)

SA - I, SA - II, Activity and Learning Task(s), MCQ, Project Presentation, Demo Presentation, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
		Dr. V. Sumathi, ASP / CSE
Recommended by BoS on	06.062026	
Academic Council Approval	No: 30	Date 19.06.2026


 Signature of the BOS Chairman

24CAC648	IOT APPLICATION DEVELOPMENT	L	T	P	J	C
PE		2	0	2	0	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
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1	To understand the fundamentals of IoT architecture, hardware components, and embedded system design using microcontrollers and data-encoding techniques.
2	To apply suitable communication, modulation, and networking techniques for developing efficient and connected IoT systems.
3	To gain proficiency in deploying and managing IoT applications on cloud platforms using SDKs, CLI tools, and IAM configurations.
4	To implement security practices for protecting IoT devices, networks, and cloud services, ensuring reliable and secure IoT operations.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply the fundamentals of IoT to design basic embedded systems using microcontrollers, circuit components, and data-encoding techniques.	Ap
CO2	Implement communication and modulation techniques for low-power IoT devices.	Ap
CO3	Configure wired and IP-based network architectures and device discovery protocols for IoT systems.	Ap
CO4	Implement cloud SDKs, CLI tools, IAM configurations to deploy and monitor IoT applications on Cloud.	Ap
CO5	Apply security mechanisms for IoT hardware, firmware, sensors, and cloud services to build secure end-to-end IoT systems.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2		1	1				
2		2	1	1				
3		2	1	1				
4	2		1	1				
5	2			1			1	


 Signature of the BOS Chairman

Course Content	
INTRODUCTION Overview of IOT Application Development - Introduction to Internet of Things -IoT Hardware-Circuit Design - IoT Device Architecture: Integrated Circuits- Data Encoding Challenges and approaches- Microcontrollers-Programmable Circuits-IoT Platform Design and Programming AI Tool: Tinker cad Circuits (Design IoT hardware Circuits), Edge Impulse (AI capabilities to sensors, microcontrollers, and embedded system)	6 Hours
IOT COMMUNICATION Radio Frequency Communications-Antenna Design-Signal Propagation- Attenuation-Spectrum Division-Modulation- Media Access protocol: Collision Detection and Resolution-Power Saving Algorithms-Power MAC Algorithms- routing-Service discovery.	6 Hours
IOT NETWORKING Wired Networking Overview-Reference Architectures for IoT-Layer 2 and Layer 3 Networking-L2 Switching vs L3 Routing- Ethernet Forwarding-Ethernet Learning Switches-Network Virtualization with VLANs-VLAN Configuration Encapsulation-Ethernet & IPv4 Headers, TCP header-Internet Addressing-Address Discovery Protocols-Dynamic Host Configuration Protocol-Networking Devices-Device Types. AI tool: Chatgpt, Claude (design system architecture, generate embedded code (Arduino/Python), and integrate communication)	6 Hours
DEPLOYING IOT IN CLOUD Cloud APIs -Google Cloud SDK-Google Cloud CLI-Cloud Client Libraries- Cloud Shell and Cloud Code-Cloud Storage and databases: Authorization with Cloud IAM-Authenticating Google APIs and service Accounts-authentication method-using Secret Manager- Overview of Machine Learning Models-Deploying -Monitoring and performance Tuning. AI Tool/ Platform: Google Cloud / Think speak	6 Hours
DEVELOPING SECURE IOT APPLICATION IoT security basics- Device security -Network security for IOT devices- IoT Application security -Secure hardware design for IoT devices- Firmware development -Secure sensors Integration and data Processing -Secure IoT Services and Cloud Platform AI Tool/ Platform: Google Cloud and firebase	6 Hours
Practical Component :: Create a real-time IoT application using IoT hardware programming, communication, network configuration, cloud deployment, and secure device integration. Deploy the IoT project to make it operational and accessible by users. Sample Experiments: - Interface and programming IoT hardware and circuits - Implement communication and MAC techniques - Configure wired and wireless IoT networks - Deploy IoT workloads using Google Cloud SDK and APIs - Apply secure design, authentication, and firmware security practices (e.g., Smart Home Control, smart framing)	30 Hours

Theory	30	Tutorial	0	Practical	30	Project	0	Total	60
Hours:		Hours:		Hours:		Hours:		Hours:	


Signature of the BOS Chairman

Learning Resources**Textbooks**

1. Kranz, M., Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry. Wiley, 2016.
2. Brown, R. G., IoT Deployment Handbook: A Practical Guide to Implementing Successful IoT Projects. 2022.
3. Bahga, A., & Madisetti, V., Internet of Things: A Hands-On Approach. Universities Press, 2016.
4. Hersent, O., Boswarthick, D., & Elloumi, O., The Internet of Things: Key Applications and Protocols. Wiley, 2012.
5. Kurose, J. F., & Ross, K. W., Computer Networking: A Top-Down Approach. Pearson, 2021.
6. Chattopadhyay, B., Google Cloud IoT: End-to-End Implementation Guide. Packt Publishing, 2021.

Reference books/ Web Links

1. Developing Applications with Google Cloud: Foundations | Coursera
2. Hands-on Internet of Things | Coursera
3. <https://www.coursera.org/learn/developing-secure-iot-applications?msockid=3de4fc32da0261e02866ef3ddbaf6034#modules>

Assessment (Embedded course)

SA - I, SA - II, Activity and Learning Task(s), MCQ, Project Presentation, Demo Presentation, End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert
		Mrs. G. Shobana, AP/IT
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date 19.06.2026


Signature of the BOS Chairman

Cloud Computing Cohort



Signature of the BOS Chairman

24CAC649	CLOUD APPLICATION DEVELOPMENT	L	T	P	J	C
		2	0	0	2	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Apply the concepts of cloud application design, service models, deployment models, and requirement analysis for developing cloud-based solutions.
2	Analyze cloud application development frameworks and cloud platforms for deploying scalable applications.
3	Apply cloud service delivery mechanisms, API integration, and architectural best practices in cloud ecosystems.
4	Analyze DevOps practices, CI/CD pipelines, monitoring techniques, and containerization technologies for cloud application management.
5	Apply modern cloud development and deployment practices to design scalable, reliable, and efficient cloud-based applications.

Course Outcomes	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Analyse cloud application requirements, service models, deployment types, and challenges such as scalability, security, and interoperability.	An
CO2	Apply cloud based application development frameworks to build scalable applications.	Ap
CO3	Analyse and compare commercial cloud platforms for application deployment	An
CO4	Apply agile application development and manage application life cycle using DevOps .	Ap
CO5	Apply integrated cloud application development and deployment strategies to build scalable, secure, and fault-tolerant cloud solutions.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1		3	3	2				
2	3	3				2		
3	2			3	2			
4		3		3		2		
5								


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Course Content	
INTRODUCTION TO APPLICATION DESIGN Business case for implementing cloud application, Requirements, collection for cloud application development, Cloud service models and deployment models, Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy.	6 Hours
APPLICATION DEVELOPMENT FRAMEWORK Accessing the clouds: Web application vs Cloud Application, Frameworks: Model View Controller (MVC), Struts, Spring. Cloud platforms in Industry – Google AppEngine, Microsoft Azure, Openshift, CloudFoundry.	8 Hours
CLOUD SERVICE DELIVERY ENVIRONMENT AND API Storing objects in the Cloud, Session management, Working with third party APIs: Overview of interconnectivity in Cloud ecosystems. Facebook API, Twitter API, Google API. Architecting for the Cloud: Best practices in architecture cloud applications in AWS cloud, Amazon Simple Queue Service (SQS), RabbitMQ, Amazon Simple Notification Service (Amazon SNS), multi-player online game hosting on cloud resources, Building content delivery networks using clouds.	8 Hours
DEVOPS IN CLOUD Continuous Integration/Continuous Deployment (CI/CD), collaboration among development, operations, and other stakeholders, Agile and lean principles: Embracing agile methodologies and lean practices to enable faster development and delivery cycles. Automating development pipelines, Monitoring and Logging, Implementing monitoring solutions for cloud applications, Containerization: Docker basics and container orchestration with Kubernetes.	8 Hours
PROJECT: Projects involving Google AppEngine, Microsoft Azure, Openshift, Cloud Foundry services will be done.	30 Hours

Theory	30	Tutorial	0	Practical	0	Project	30	Total	60
Hours:		Hours:		Hours:		Hours:		Hours:	

Learning Resources	
Textbooks	
1. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, Oreilly Publication, 2021. 2. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by Addison-Wesley Professional, 2020.	
Reference books/ Web Links	
-	
Online Resources	
1. https://www.coursera.org/specializations/ibm-cloud-application-development-foundations 2. https://www.udemy.com/course/cloud-computing-development-essentials/ 3. https://www.coursera.org/learn/cloud-native-devops-agile-nosql?specialization=ibm-cloud-application-development-foundations 4. https://www.edx.org/certificates/professional-certificate/ibm-cloud-and-application-development-foundations	


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Assessment (Embedded course)

SA I, SA II Activity and Learning Task(s), Assignments, MCQ, Project Demo, viva-voce , End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert	
		Dr.L.Dhanabal, AP/MCA	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026



Signature of the BOS Chairman

24CAC650	CLOUD INFRASTRUCTURE AND ARCHITECTURE	L	T	P	J	C
PE		2	0	2	0	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Providing a foundational understanding of OpenStack architecture, key components, workflow, and API functionalities used in cloud infrastructure.
2	Develop the skills required to configure, launch, and manage compute instances using the OpenStack Horizon dashboard and Command Line Interface (CLI).
3	Learn about object storage using Swift, including file uploads, permission management, and understanding of data lifecycle operations.
4	Explore the techniques to manage cloud-based virtual networks, including configuration of routers, floating IP addresses, and security groups using Neutron.
5	Enable students to aware about identity and access management principles in OpenStack and managing users, roles, and permissions using Keystone services.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply OpenStack architecture, components, workflows, and API functionalities to deploy and manage cloud infrastructure services.	Ap
CO2	Configure and manage compute resources using Command Line Interface.	Ap
CO3	Deploy and manage object storage services, configure access permissions, and apply data lifecycle policies in a cloud environment.	Ap
CO4	Configure and manage virtual networks, routers, and floating IPs with cloud networking services.	Ap
CO5	Implement identity and access management by configuring users, roles, and authentication services in a cloud environment.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	2		3		2			
2	2			3				
3		2		3	2			
4			2	3		2		
5		3		2		2		


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Course Content	
INTRODUCTION TO CLOUD INFRASTRUCTURE Introduction to cloud Infrastructure/virtual infrastructure, General Architecture of virtual infrastructure: Architecture of OpenStack, project, services, mode of deployment, workflow, Openstack Components: Nova, Swift, cinder, Neutron, Glance, Keystone, Horizon. Virtualization environment with KVM. OpenStack API. Practical Component : Single node private cloud setup using Devstack/Packstack	7 Hours 6 Hours
CLOUD COMPUTE ARCHITECTURE Configuring Horizon Dashboard, OpenStack CLI client - Create and manage flavors, compute instances, generate and manage SSH keys, accessing instances, configure an instance with a floating IP address, create instances with security groups, manage Nova host consoles, instance snapshots. Openstack image service: image repository, manage images, metadata, image types, bundling, exporting, migrating images. Practical Component : Configure NOVA compute Node - Build a horizon node – Monitor node	7 Hours 9 Hours
CLOUD STORAGE ARCHITECTURE Swift: features, architecture of swift, swift installation and configuration, data management lifecycle, backup and archival, media storage with swift. Use the command line client to upload and manage files to Swift containers, manage permissions on a container in object storage. Cinder: Architecture of cinder block storage, Volume provisioning and management- create and manage volumes, attach volumes to instances, manage volume quotas, backup and restore volumes, manage volume snapshots. Practical Component : Configure Swift object storage - Construct a cinder block node	8 Hours 7 Hours
CLOUD NETWORK ARCHITECTURE Software defined networking, Neutron Architecture, Manage network resources, create external/public networks, create project networks, create project routers, attach routers to public and project networks, manage network services for a virtual environment, manage network quotas, manage network interfaces on compute instances, create and manage project security groups and rules, assign security group to instance, create and manage floating IP addresses, assign floating IP address to instance, detach floating IP address from instance. Identity and access management- keystone: users, roles, groups. Practical Component : Launching an instance- Register an account at openstack, Create SSH Key, validate network - Sharing project environment among multiple users.	8 Hours 8 Hours

Theory	30	Tutorial	30	Project	60
Hours:		Hours:		Hours:	Hours:

Learning Resources	
Textbooks	
1. Ben Silverman., Michael Solberg., OpenStack for Architects :Design Production-ready Private Cloud Infrastructure., 2nd Edition, Packt Publishing ,2018. 2. Michael Solberg, Ben Silverman., OpenStack for Architects., Packt Publishing ,2017.	
Reference books/ Web Links	
1. Alok Shrivastwa., Sunil Sarat, Kevin Jackson, Cody Bunch, Egle Sigler, Tony Campbell., OpenStack: Building a Cloud Environment., Packt Publishing , 2016. 2. James Denton, Learning OpenStack Networking (Neutron), Packt Publishing , 2015.	
Online Resources	
1. https://www.coursera.org/learn/juniper-openstack-and-kubernetes?	

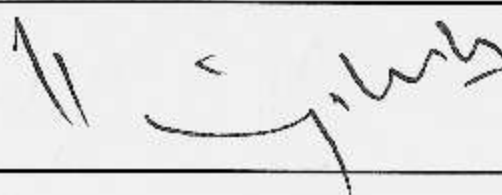

 Signature of the BOS Chairman

Assessment (Embedded Course)

SA I, SA II ,Activity and Learning Task(s), Assignments, MCQ, Project Review, viva-voce , End-Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert	
		Dr.R.Kalaiselvi, AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026



Signature of the BOS Chairman

24CAC651	CLOUD STORAGE MANAGEMENT	L	T	P	J	C
PE		2	0	2	0	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Learn the fundamental concepts of cloud computing and cloud-based storage systems.
2	Understand different types of cloud storage solutions and how they are used in modern computing environments.
3	Explain how data is stored, accessed, secured, and managed in the cloud.
4	Familiarize students with the tools and technologies used for backup, disaster recovery, and data lifecycle management in the cloud.
5	Develop practical skills in using cloud platforms for setting up and managing storage services effectively.

Course Outcomes	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply basic principles of cloud storage design and deployment methods to set up storage systems.	Ap
CO2	Analyze different cloud storage types and protocols to identify the best solutions for specific application needs.	Ap
CO3	Implement data protection strategies using cloud-native tools and services.	Ap
CO4	Analyze cloud storage strategies to optimize enterprise data management, scalability, security, and performance.	An
CO5	Analyze security and compliance issues in cloud storage for secure data handling.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3			3		2			
2	3	3		2					
3	3		3	3					
4		3							
5	3			3			2		


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Course Content	
INTRODUCTION TO CLOUD STORAGE AND INFRASTRUCTURE Basics of Cloud Storage - Evolution of data storage - Traditional vs. Cloud-based storage systems - Cloud storage benefits and limitations - Types of Cloud Storage - Block Storage - File Storage - Object Storage - Cloud Deployment Models - Public, Private, Hybrid, Multi-cloud models - Storage Infrastructure - Physical storage: HDD, SSD, Tape, NVMe - RAID: Levels 0, 1, 5, 6, 10 – purpose and configurations - Storage Architectures - NAS vs. SAN – architectures, use cases - Fibre Channel, iSCSI protocols - Virtual storage and storage pools. Practical Component : Set up AWS S3 and upload/download objects using console and CLI - Create and configure block storage (EBS) and attach to EC2.	6 Hours 6 Hours
CLOUD STORAGE ACCESS AND PROTOCOLS Cloud Storage Access Mechanisms - File-based access: NFS, SMB - Block-level access: iSCSI - Object-level access: REST APIs, HTTP/S3 commands - APIs and Command-line Access - RESTful interface: buckets, objects, metadata - Tools: AWS CLI, Azure CLI, AzCopy, Rclone - Software Defined Storage (SDS) - Introduction and platforms: Ceph, GlusterFS, vSAN - Use cases in cloud-native apps - Storage Provisioning and Automation - Dynamic provisioning - Infrastructure-as-code basics: Terraform, Ansible - Cloud Storage Gateways - Functionality and use in hybrid environments Practical Component : Create and deploy storage bucket policies and lifecycle rules (S3/Azure Blob)	10 Hours 4 Hours
DATA LIFECYCLE MANAGEMENT, BACKUP, AND COMPLIANCE Data Lifecycle and Tiering - Hot, cool, cold, archive storage tiers - Auto-tiering and cost optimization - Data Protection Mechanisms - Data replication: synchronous and asynchronous - Snapshots, cloning, checkpoints - Backup and Disaster Recovery (DR) - Backup types: full, incremental, differential - Cloud-native tools: AWS Backup, Azure Backup - RTO, RPO, and DR strategies - Data Governance and Compliance - Compliance frameworks: GDPR, HIPAA, ISO - Data privacy, retention policies, audit trails - Cloud SLAs and service reliability Practical Component : Automate backup and restore using AWS Backup or Azure Recovery Services - Perform versioning and lifecycle-configuration on object storage - Simulate data replication and snapshot in a lab setup	7 Hours 10 Hours
SECURITY, MONITORING, AND EMERGING TRENDS Storage Security - IAM roles, policies, access controls - Encryption at rest and in transit - Key Management Services (AWS KMS, Azure Key Vault) - Threats and Risk Mitigation - Data leakage, insider threats, ransomware - Security best practices and configurations - Monitoring and Optimization - Storage metrics: IOPS, latency, throughput - Monitoring tools: AWS CloudWatch, Azure Monitor - Real-world Case Studies & Hands-on Tools - Healthcare, media, IoT, education use cases. Practical Component : Implement IAM policies to restrict access to storage buckets - Encrypt data in S3 using SSE-S3 and SSE-KMS - Monitor storage metrics using AWS CloudWatch or Azure Monitor.	7 Hours 10 Hours

Theory	30	Tutorial	0	Practical	30	Project	0	Total	60
Hours:		Hours:		Hours:		Hours:		Hours:	


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Learning Resources	
Textbooks	
1.	The Art of Service, Data Storage Solutions: A Complete Guide, The Art of Service - Data Storage Solutions Publishing, Brisbane , 2023.
2.	Prashant S. Gumgaonkar , Cloud Computing and Storage Management, SPI Publications, 2025
3.	Quick, Darren, Cloud Storage Forensics, Syngress, Elsevier, Waltham , 2013.
4.	Erl, Thomas., Puttini, Ricardo., Mahmood, Zaigham, Cloud Computing: Concepts, Technology & Architecture, Prentice Hall, Boston , 2013.
Reference books/ Web Links	
1.	Voulodimos, Athanasios, Kyriazis, Dimosthenis P., Gogouvitis, Spyridon V., Varvarigou, Theodora, Data Intensive Storage Services for Cloud Environments, Business Science Reference, 2013.
2.	O'Dell, Michael, Corey, Michael. Cloud Storage Management in Contemporary IT Environments. Packt Publishing, 2012.
3.	Furht, Borko, Escalante, Armando. Handbook of Cloud Computing. Springer Science+Business Media, LLC, 2010.
4.	Emc Education S., Information Storage and Management, John Wiley & Sons, Incorporated, 2012.
5.	Gareth Stevens Publishing., The Cloud: Understanding Modern Data Storage, Gareth Stevens Publishing, New York ,2022.
6.	Tariq, Muhammad Imran., Balas, Valentina Emilia., Tayyaba, Shahzadi. Security and Privacy Trends in Cloud Computing and Big Data. CRC Press, Boca Raton ,2022.
Online Resources	
1.	https://docs.aws.amazon.com/storage
2.	https://cloud.google.com/storage/docs
3.	https://learn.microsoft.com/en-us/azure/storage
4.	https://www.coursera.org/learn/introduction-to-networking-and-storage
5.	https://www.coursera.org/learn/computer-networking#modules
6.	https://www.coursera.org/learn/essential-aspects-of-software-hardware-and-data-backup#modules
7.	https://www.coursera.org/learn/aws-storage

Assessment (Embedded Course)
SAI, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution		Internal Expert
			Dr.S.Kanagaraj, IT
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


 Signature of the BOS Chairman

24CAC652	VIRTUALIZATION AND RESOURCE MANAGEMENT	L	T	P	J	C
		2	0	2	0	3
PE		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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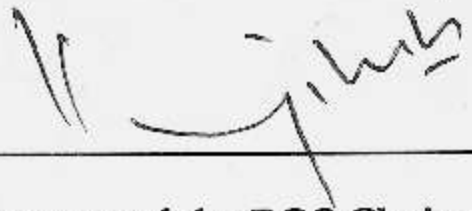
Course Objectives:		The purpose of taking this course is to:
1	Learn the basic concepts of virtualization, recognize various types of virtualization	
2	Explore binary translation and trap-and-emulate techniques utilized in full virtualization.	
3	Enable learners to apply virtual memory management concepts for efficient address translation and memory management in virtualized computing environments.	
4	Learn the principles and architecture of Network Function Virtualization (NFV) and Software-Defined Networking (SDN)	
5	Enable learners to design and implement virtualized cloud data center infrastructures by integrating compute, memory, storage, and network resource management for efficient, scalable, and reliable cloud environments.	

Course Outcomes	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply virtualization concepts to create and manage virtual machine environments using hypervisors, virtualization platforms.	Ap
CO2	Analyze and implement CPU virtualization including Virtual Machine live migration and checkpointing.	An
CO3	Apply memory virtualization techniques and perform ballooning and memory sharing in a hypervisor-managed environment.	Ap
CO4	Deploy Virtual Network Functions to examine network isolation and analyze resource utilization in a virtualized network environment.	Ap
CO5	Design a virtualized infrastructure integrating compute, memory, storage, and network resource management for cloud data center environments.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1			2	3	2			
2				2		2		
3			2	3	2			
4	2			3		2		
5		3		2		2		


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Course Content	
INTRODUCTION Introduction to Virtualization - Physical infrastructure and virtual infrastructure - Difference between cloud and virtualization -- Challenges to Virtualization - Virtualization approaches - Partitioning - Hosting - Isolation - Hardware independence - Virtual machine - Virtual machine manager – Hypervisor – Trap and emulate VMM - Problems with trap and emulate - Popek Goldberg theorem. Practical Component : Setup a virtualized environment using Virtualbox/ KVM – launch a Linux VM – create a snapshot - Explore how VMs are isolated in KVM using top and htop.	6 Hours 6 Hours
CPU VIRTUALIZATION Hardware assisted virtualization: Libvirt and QEMU/KVM - QEMU architecture - QEMU/KVM operation - VMX mode - VM control structure (VMCS) – VMX Mode Execution. Full virtualization: Full virtualization VMM architecture - Host and VMM - Binary translation - Dynamic binary translation - Use of segmentation for protection. Para Virtualization: Introduction - Xen and Paravirtualization - Xen Architecture - CPU virtualization in Xen - Trap handling in Xen. VM Live migration: Flavors of migration techniques – performance optimization. VM Checkpointing and cloning: Techniques for reliability – VM cloning – VM Fork. Practical Component : Verify virtualization support using egrep '(vmx svm)' /proc/cpuinfo in QEMU/KVM on a Linux machine - Launch a Virtual Machine in KVM - Bringing Virtualization to the x86 Architecture with the Original VMware Workstation - Paravirtualization in Xen - VM live migration.	8 Hours 8 Hours
MEMORY VIRTUALIZATION TECHNIQUES Introduction: Physical Vs Virtual Memory - Virtual memory and address translation - Techniques for memory virtualization - Demand Paging and Page Faults - Extended page tables(Intel) / Nested Page Tables (NPT – AMD) - Shadow page tables - Two-dimensional paging - MMU virtualization (hardware vs. software-assisted). Hypervisor and Guest Memory Mapping: Guest virtual to guest physical mapping - Guest physical to host physical mapping - Memory mapping strategies in Type-1 and Type-2 hypervisors. Memory reclamation techniques: Uncooperative swapping, Ballooning, Memory sharing. Practical Component : : Kernel Same-page Merging(KSM) and Ballooning in KVM/QEMU – Adjust Balloon Size Dynamically from host using libvirt in a VM - clone/ identical memory content in two VMs.	6 Hours 6 Hours
NETWORK VIRTUALIZATION Network Function Virtualization: NFV vs Traditional networking - Benefits and challenges of NFV - NFV vs. Software-Defined Networking (SDN). NFV Architecture : NFV Infrastructure (NFVI) - Virtual Network Functions (VNFs) - NFV Management and Orchestration (MANO). Security in NFV: VNF isolation and sandboxing -Secure VNF provisioning - Protecting MANO components - Threats in multi-tenant NFV environments. Practical Component : Set up a basic traditional network service using a physical router and firewall (or simulate using iptables) and Replace the firewall and load balancer with VNFs (e.g., firewall, nginx) running in virtual machines. Measure Elasticity and Resource Utilization in KVM/QEMU, using Virt-Manager, stress-ng, htop.	5 Hours 6 Hours


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RESOURCE MANAGEMENT	5 Hours
Network Optimization - Configure and manage vSphere distributed switches - Migrate virtual machines from standard switches to distributed switches - Explain distributed switch features such as port mirroring - LACP - QoS tagging - and NetFlow - CPU Optimization - Explain the CPU scheduler operation - NUMA support - and other features that affect CPU performance - Monitor key CPU performance metrics - Memory Optimization - Explain ballooning - memory compression - and host swapping techniques for memory reclamation when memory is overcommitted - Monitor key memory performance metrics - Storage Optimization - Diagnose storage access problems - Configure VMware vSphere Flash Read Cache - Monitor key storage performance metrics.	4 Hours
Practical Component :	
Deploy a multi-vCPU VM - Configure and Manage vSphere Distributed Switches and observe Configure and Manage vSphere Distributed Switches	

Theory 30 Hours:	Tutorial Hours:	Practical 30 Hours:	Project Hours:	Total 60 Hours:
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Learning Resources
Textbooks
1. Dac-Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Cloud Computing and Virtualization, Wiley-Scrivener, 2018. 2. Dan Kusnetzky, Virtualization: A Manager's Guide, Stone publisher, 2011.
Reference books/ Web Links
1. Brij B Gupta, Amrita Dahiya, Elhadj Benkhelifa, SDN and NFV: A New Dimension to Virtualization, 2024. 2. Rajendra Chayapathi, Rajendra Chayapathi. Syed Hassan Farrukh. Paresh Shah, Syed Farrukh Hassan, Paresh Shah, Network Functions Virtualization (NFV) with a Touch of SDN, 2016.
Online Resources
1. https://www.coursera.org/programs/kumaraguru-college-of-technology-on-coursera-emrt8/projects/azure-create-a-virtual-machine-and-deploy-a-web-server?search

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), Assignments, MCQ, Viva-voce , End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert	
		Dr.R.Kalaiselvi, AP/CSE	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

24CAC653	CLOUD SECURITY	L	T	P	J	C
PE		2	0	2	0	3
		SDG		4,9,16		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Understand the fundamental principles of cloud computing and identify key security challenges associated with various deployment and service models.
2	Design secure cloud architectures and virtual network configurations.
3	Analyze compliance, governance, and risk management practices to ensure secure and lawful use of cloud services.
4	Apply secure development practices throughout the development lifecycle to protect cloud-native applications.
5	Explore emerging trends in cloud security, including edge computing, zero-trust models, and AI/ML-based threat detection approaches.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Apply core cloud security concepts and models to identify and address security requirements in cloud environments.	Ap
CO2	Apply access control, encryption, and network isolation techniques to secure cloud environments.	Ap
CO3	Analyze security risks, compliance needs, and governance frameworks for maintaining secure deployments	An
CO4	Apply DevSecOps practices in cloud-native applications by integrating automation tools and secure coding techniques.	Ap
CO5	Analyze AI-based threat detection to evaluate their role in shaping the future of cloud security.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)								
	1	2	3	4	5	6	7	8	
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning	
1	3	2				2			
2	2	3		3					
3	3	3				2			
4		2		3		2			
5		2		3					


 Signature of the BOS Chairman

Course Content	
INTRODUCTION TO CLOUD SECURITY Overview of Cloud Computing and Security Challenges, Importance of Cloud Security for Organizations, Shared Responsibility Model, Cloud Deployment Models – Public, Private, Hybrid, Community, CIA Triad in Cloud Security, Cloud Service Models – IaaS, PaaS, SaaS – Security Considerations and Risks, Case Studies on Cloud Security Vulnerabilities. Practical Component :: Securing free tier account in cloud platform - Securing Free Tier Account with IAM Users and Roles	6 Hours 6 Hours
CLOUD SECURITY ARCHITECTURE AND DATA PROTECTION Designing Secure Cloud Architectures, Identity and Access Management (IAM), Network Security in Cloud Environments, Virtualization and Container Security, Encryption for Data at Rest and in Transit, Key Management Practices, Data Loss Prevention (DLP), Secure Cloud Configuration and Monitoring. Practical Component :: Creating IAM Roles, Groups, and Policies for Role-Based Access Control - Securing Instances Using Virtual Private Cloud (VPC) - Data encryption and decryption using cloud platforms	6 Hours 8 Hours
COMPLIANCE, GOVERNANCE, AND RISK MANAGEMENT Compliance Requirements – GDPR, HIPAA, PCI DSS, Risk Assessment and Mitigation in Cloud, Governance Frameworks – ISO 27001, NIST, CSA CCM, Cloud Threats and Vulnerabilities, Business Continuity and Disaster Recovery, Third-Party Risk and SLA Management, Security Monitoring and Incident Response. Practical Component :: Configuring networking firewall for an application - Securing and restricting access to storage	6 Hours 6 Hours
SECURE DEVELOPMENT AND DEVSECOPS Security in Cloud-Native Applications, Secure Coding Practices, CI/CD Pipeline Security, DevSecOps Principles and Tools, Best practices for DevSecOps in the cloud-Infrastructure as Code (IaC) Security – Cross cloud platforms in Terraform, Security Policies in Ansible, Detecting vulnerabilities Dynamic Code Analysis. Practical Component :: Securing code with automated vulnerability scanning in CI/CD pipeline.	6 Hours 4 Hours
EMERGING TRENDS AND FUTURE OF CLOUD SECURITY Edge Computing Security, Zero Trust Architecture, Serverless Security, AI/ML for Threat Detection, Quantum Computing and Cloud Security, Future Research Directions, Open Challenges. Practical Component :: Securing an ERP or Healthcare App in the Cloud - Simulating a Cloud Security Threat Detection Model Using ML	6 Hours 6 Hours

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Learning Resources	
Textbooks	
1. Preeti Mishra, Emmanuel S. Pilli, R.C. Joshi, Cloud Security Attacks, Techniques, Tools and Challenges, 2021.	
2. Brij B. Gupta, Cloud Security: Concepts, Applications and Perspectives, 2021.	
Reference books/ Web Links	
1. Kief Morris, Infrastructure as Code: Dynamic Systems for the Cloud Age, 2nd Edition, O'Reilly Media, 2020.	
2. Vic (J.R.) Winkler, Bill Meine, Securing the Cloud: Cloud Computer Security Techniques and Tactics, Syngress Media Inc, 2011.	
3. Ronald L. Krutz, Russell Dean Vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, 2010.	
4. Tim Mather, Subra Kumaraswamy, Shahed Latif, Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, 1st Edition, 2009.	
Online Resources	
1. https://www.coursera.org/learn/cloud-security-basics	
2. https://www.coursera.org/learn/sscp-4th-ed-course-6	
3. https://www.coursera.org/learn/cloud-data-security	
4. https://www.checkpoint.com/cyber-hub/cloud-security/what-is-cloud-security/	
5. https://www.zscaler.com/resources/security-terms-glossary/what-is-cloud-security	
6. https://medium.com/@goodycyb/exploring-cloud-security-in-depth-labs-and-insights-for-aws-and-gcp-50ca038478c4	
7. https://goodycyb.hashnode.dev/	

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution		Internal Expert
			R Asmitha shree, AP/CSE
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


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24CAC654	CLOUD AUTOMATION	L	T	P	J	C
PE		2	0	0	2	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Understand the principles and practices of automating cloud infrastructure and operational tasks.
2	Apply the concept of Infrastructure as Code (IaC) to provision, configure, and manage cloud resources efficiently.
3	Implement continuous integration and continuous deployment (CI/CD) pipelines to streamline application delivery in cloud environments.
4	Learn to automate cloud resource management to improve scalability, cost-effectiveness, and operational efficiency.
5	Explore cloud-based services to troubleshoot and ensure optimal performance for reliability.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Deploy tools to automate the set up for cloud infrastructure.	Ap
CO2	Build a Continuous Integration / Continuous Delivery pipeline and automate testing and deployment.	Ap
CO3	Manage and optimize cloud resources provisioning automatically using containers.	An
CO4	Compare different monitoring tools to track cloud performance.	An
CO5	Analyze and integrate public cloud services to design and implement a complete cloud automation project.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1		2		3		3		
2			3	2		3		
3		3		3		2		
4		3				3		
5			3	3		3		


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Course Content	
INTRODUCTION TO CLOUD AUTOMATION Benefits of cloud automation - Types of cloud automation tools - Use cases for cloud automation. Managing and provisioning infrastructure through code (using tools like Terraform, Ansible, Puppet, Chef), Automating code integration and verification through tools like Jenkins, GitLab CI, or CircleCI, Automating the deployment process to push code changes into production environments reliably.	7 Hours
CLOUD RESOURCE SCALING AND STORAGE AUTOMATION Automating resource allocation, de-allocation, and right-sizing of resources based on usage. Kubernetes - Salt -CircleCI - Ansible and puppet, AWS DataSync, Azure Data Factory.	8 Hours
CLOUD AUTOMATION TOOLS FOR DEVOPS DuploCloud - Puppet - Heroku -HashiCorp, Monitoring and Logging Tools – Prometheus, Grafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo.	7 Hours
CLOUD DEPLOYMENT AUTOMATION NetApp Cloud Volumes ONTAP - CFEngine -VMware vs Realize Automation - Cisco Intelligent - Automation for Cloud - Microsoft Azure Automation - Google Cloud Deployment Manager – AWS CloudFormation - IBM Cloud Schematics.	8 Hours
PROJECT Projects involving different cloud platform services like Puppet, Heroku, HashiCorp and monitoring & Logging Tools – Prometheus, GrSafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo.	30 Hours

Theory Hours:	30	Tutorial Hours:	0	Practical Hours:	0	Project Hours:	30	Total Hours:	60
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Learning Resources	
Textbooks	
1. Morris, Kief, Infrastructure as Code: Managing Servers in the Cloud. O'Reilly Media, Sebastopol, 2021. 2. Kim, Gene., Humble, Jez., Debois, Patrick., Willis, John., The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations. IT Revolution Press, Portland , 2021.	
Reference books/ Web Links	
1. Burns, Brendan., and Grant, Joe Beda. Kubernetes: Up and Running: Dive into the Future of Infrastructure. O'Reilly Media, Sebastopol ,2022. 2. Turnbull, James, The Terraform Book. Turnbull Press, San Francisco , 2022. 3. Huttermann, Michael. DevOps for Developers. Apress, New York ,2012.	
Online Resources	
1. https://www.coursera.org/learn/gcp-fundamentals/home/module/1 2. https://www.coursera.org/learn/information-technology-and-aws/home/week/1 3. https://www.coursera.org/learn/devops-capstone-project/home/welcome	

Assessment (Embedded Course)
SA I, SA II Activity and Learning Task(s), Assignments, MCQ, Project Demo, viva-voce , End Semester Examination (ESE)


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Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert	
		Dr.S.Kanagaraj, AP/ IT	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

ARTIFICIAL INTELLIGENCE AND DATA SCIENCE



Signature of the BOS Chairman

24CAC655	BUSINESS INTELLIGENCE FOR DECISION MAKING	L	T	P	J	C
PE		2	0	2	0	3
		SDG		8,9		

Pre-requisite courses	NIL	Data Book / Code book (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Introduce the foundational concepts of Business Intelligence and Business Analytics, including system architectures, types of analytics, and the end-to-end analytics process from problem definition to deployment.
2	Develop practical skills in data preparation, exploration, and visualization using industry-standard BI tools such as Qlik, with emphasis on data warehousing, OLAP operations, and knowledge management.
3	Equip students with predictive analytics and machine learning techniques for business forecasting, competitive analysis, and data-driven organizational decision-making.
4	Enable the application of domain-specific analytics for HR and Supply Chain Management by integrating cross-functional data and AI-assisted tools to generate operational insights.
5	Foster the ability to apply and analyze BI solutions for marketing and sales analytics, incorporating ethical considerations and critical evaluation of AI-assisted outputs.

Course Outcomes:	After successful completion of this course, the students shall be able to:	Bloom's Taxonomy Level (BTL)
CO1	Explain the Business Analytics process — from problem definition and data preparation to model deployment — and demonstrate the use of industry-standard BI tools for insight generation.	U
CO2	Analyze Business Intelligence architectures, data warehousing principles, OLAP operations, and analytic functions to extract actionable intelligence from enterprise data.	An
CO3	Apply predictive analytics and machine learning techniques for business forecasting, competitive analysis, and data-driven decision-making.	Ap
CO4	Apply analytics techniques for HR and Supply Chain domains by integrating cross-functional data and AI-assisted tools to generate operational insights and support workforce and logistics decisions.	Ap
CO5	Analyze an end-to-end BI application for marketing and sales analytics by examining AI tool contributions, advanced visualization effectiveness, and ethical implications of data-driven decisions.	An


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						
2		3	2	3				
3		3	3	2		2		
4		2	3	3	2		2	
5			2	3	3	2	2	3

Course Content	
INTRODUCTION TO BUSINESS ANALYTICS Analytics and Data Science – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration. Practical Component : Explore the interface and basic features of the BI tool (Qlik) – Load and visualize a sample dataset – Navigate the analytics workflow from data ingestion to basic insight generation.	6 Hours
BUSINESS INTELLIGENCE Data Warehouses and Data Mart – Knowledge Management – Types of Decisions – Decision Making Process – Decision Support Systems – Business Intelligence – OLAP – Analytic Functions. Practical Component : Import a dataset into the BI tool – Cleanse data by handling missing values, outliers, and inconsistencies – Transform data to suit BI reporting requirements.	6 Hours
BUSINESS FORECASTING AND COMPETITIVE ANALYSIS Introduction to Business Forecasting and Predictive Analytics – Logic and Data-Driven Models – Data Mining and Predictive Analysis Modelling – Machine Learning for Predictive Analytics – Industry Analysis – Profit Frontier, Risk vs. Return, Competition Positioning – Enterprise Diagnosis. Practical Component : Apply BI tools for forecasting and predictive analytics – Build and evaluate a predictive model for a business scenario – Interpret model outputs and translate findings into actionable business recommendations.	6 Hours
ANALYTICS – HR AND SUPPLY CHAIN Human Resources – Planning and Recruitment – Training and Development – Supply Chain Network – Planning Demand, Inventory and Supply – Logistics – Analytics Applications in HR and Supply Chain – Applying HR Analytics to predict the demand for talent. Practical Component : Integrate data from various sources for comprehensive cross-functional analysis (SCM/HR) – Apply analytics techniques to monitor key performance indicators via an HR/SCM dashboard.	6 Hours


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AI Tool Integration: Use an AI assistant (GitHub Copilot or Claude) to help write data transformation scripts and automate KPI calculations for the HR/SCM dashboard – Use AI-generated DAX or SQL suggestions to accelerate cross-functional data integration – Critically evaluate AI-generated code for correctness, bias in HR predictions, and appropriateness for supply chain contexts.	
MARKETING AND SALES ANALYTICS Marketing Strategy – Marketing Mix – Customer Behaviour – Selling Process – Sales Planning – Analytics Applications in Marketing and Sales – Predictive Analytics for customers' behaviour in marketing and sales. Practical Component : AI-Assisted Mini Project: Apply BI tools to build an end-to-end dashboard for a real-world marketing or sales scenario – Use AI tools (GitHub Copilot, Cursor, or Claude) to assist with data wrangling scripts, visualization code, and predictive model integration – Implement advanced chart types (tree maps, heatmaps) and interactive customer segmentation features – Document all AI tool interactions and prompts used – Analyze the dashboard outputs and present a critical examination of the AI's contribution, output quality, limitations, and ethical considerations in marketing analytics.	6 Hours
	6 Hours

Learning Resources

1. Camm, Jeffrey D., James J. Cochran, Michael J. Fry, and Jeffrey W. Ohlmann. Business Analytics. 5th ed. Cengage Learning, 2024.
2. Hair, Joseph F., Dana E. Harrison, and Haya Ajjan. Essentials of Marketing Analytics. 2nd ed. McGraw-Hill Education, 2024.

1. Kimball, Ralph, and Margy Ross. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling. 3rd ed. Wiley, 2013.
2. Provost, Foster, and Tom Fawcett. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking. O'Reilly Media, 2013.
3. Ivanov, Dmitry. Introduction to Supply Chain Analytics: With Examples in AnyLogic and anyLogistix Software. Springer, 2024.

1. Business Analytics Specialization, University of Pennsylvania – Coursera: <https://www.coursera.org/specializations/business-analytics>
2. Business Intelligence and Analytics, IIT Madras – NPTEL/SWAYAM (2025): https://onlinecourses.nptel.ac.in/noc25_cs09/preview
3. Business Analytics Courses – edX: <https://www.edx.org/learn/business-analytics>

SA I, SA II, Activity and Learning Task(s), Mini Project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle Tests, Viva-Voce

Course Curated By			
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
Mr. Karthick K Operations Manager, Fractal Analytics, Chennai	Dr. Antony Seba P Assistant Professor Grade 1, School of Computer Science and Engineering , Dept of Computational Intelligence, VIT, Vellore Campus	Ms. Preethi G , AP/ AI &DS	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


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24CAC656	DEEP LEARNING APPLICATIONS	L	T	P	J	C
PE		2	0	2	0	3
		SDG	9			

Pre-requisite courses	NIL	Data Book / Code book (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Introduce the fundamentals of deep learning and artificial neural networks for intelligent systems.
2	Develop convolutional neural network models for image classification and computer vision applications.
3	Explore sequential deep learning models for natural language processing tasks.
4	Analyze generative and unsupervised deep learning models for feature learning and data generation.
5	Examine transformer architectures and large language models for modern AI applications.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Implement neural network training mechanisms, activation functions, optimization strategies, and regularization methods to construct deep learning models for regression and classification problems.	Ap
CO2	Apply convolution-based deep learning techniques and pretrained models for solving image analysis and recognition tasks.	Ap
CO3	Develop deep learning models for sequential data processing and natural language applications using sequence learning techniques.	Ap
CO4	Analyze unsupervised and generative deep learning approaches for feature representation, dimensionality reduction, and data generation tasks.	An
CO5	Analyze transformer-based architectures and advanced language modeling techniques for developing intelligent AI-driven applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium - 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						
2		3	3	3				2
3		2	3	3				2
4		2	3	3			2	3
5			2	3	3	2	2	3


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Course Content	
INTRODUCTION TO DEEP LEARNING Introduction to Artificial Neural Networks - MP Neurons and Perceptrons - Feedforward Neural Networks and Network Layers - Activation Functions: Sigmoid, Tanh and ReLU - Training Neural Networks: Weights, Biases, Loss Functions and Backpropagation - Optimization Methods: Gradient Descent and Variants - Regularization Techniques. Practical Component : Build and train a simple Artificial Neural Network (ANN) using TensorFlow or PyTorch for regression and classification tasks - Visualize Sigmoid, Tanh and ReLU activation functions and compare their effects on model performance - Experiment with Gradient Descent optimization variants and analyze convergence behavior during training - Implement and manage Deep Learning experiments using Google Colab and GitHub.	6 Hours 6 Hours
CONVOLUTIONAL NEURAL NETWORKS Introduction to Convolutional Neural Networks (CNNs) - Convolution Operation - Filters, Stride, Padding and Parameter Sharing - Pooling Layers - Fully Connected Layers - Regularization Techniques for CNNs - Popular CNN Architectures: AlexNet, VGGNet and ResNet. Practical Component : Implement CNN model for image classification - Apply transfer learning using ResNet/AlexNet for image recognition - Use Kaggle datasets and Hugging Face pre-trained vision models for experimentation.	6 Hours 6 Hours
SEQUENTIAL MODELING Recurrent Neural Networks (RNNs) - Vanishing and Exploding Gradient Problems in RNNs - Bidirectional RNNs - Long Short-Term Memory (LSTM) Networks - Gated Recurrent Units (GRUs) - Tokenization and Word Embeddings - Natural Language Processing using RNNs. Practical Component : Train a Recurrent Neural Network (RNN) for text generation - Implement LSTM for sentiment analysis - Perform text preprocessing and embedding generation using NLP libraries.	6 Hours 6 Hours
GENERATIVE AND UNSUPERVISED DEEP LEARNING MODELS Introduction to Representation Learning - Unsupervised Deep Learning - Energy-Based Models - Boltzmann Machines - Deep Belief Networks - Autoencoders and Variants - Generative Adversarial Networks (GANs) . Practical Component : Train a simple Autoencoder for dimensionality reduction and feature learning - Generate synthetic images using a Generative Adversarial Network (GAN) .	6 Hours 6 Hours
TRANSFORMERS & ADVANCED DEEP LEARNING TECHNIQUES Transformer Architecture - Self-Attention and Multi-Head Attention Mechanism- Pretrained Language Models: BERT and GPT- Large Language Models (LLMs)- Prompt Engineering Techniques and Applications in LLMs. Practical Component : Fine-tune BERT for text classification - Develop a simple sequence-to-sequence application using Transformers - Build a simple chatbot or AI application using Transformer-based Large Language Models (LLMs) and deploy using Streamlit/Gradio.	6 hours 6 Hours

Theory Hours:30	Tutorial Hours:0	Practical Hours:30	Project Hours:0	Total Hours:60
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Learning Resources	
Textbooks:	
1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", First Edition, MIT Press, 2016.	
2. François Chollet, "Deep Learning with Python, Second Edition", Manning, 2021.	
Reference Books:	
1. David Foster, Generative Deep Learning, 2nd Edition, O'Reilly Media, Inc, 2023.	
2. Vaswani, Ashish, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Lukasz Kaiser, and Illia Polosukhin. "Attention is all you need." Advances in neural information processing systems 30, 2017.	
3. Aggarwal, C. C. Neural networks and Deep Learning (Vol. 10, No. 978, p. 3). Cham: Springer, 2018.	
Online Educational Resources:	
1. https://onlinecourses.nptel.ac.in/noc19_cs85/preview	
2. https://ocw.mit.edu/courses/6-s191-introduction-to-deep-learning-january-iap-2020/	

Assessment (Embedded course)
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated by			
Expert(s) from Industry	Expert(s) from Higher Education Institution		Internal Expert(s)
	Dr M Karthiga, Associate Professor, Bannari Amman Institute of Technology		Tharsanee R M, AP/AI&DS
Recommended by BoS on	06.06.2026		
Academic Council Approval	No: 30	Date	19.06.2026


Signature of the BOS Chairman

24CAC657	RESPONSIBLE AI	L	T	P	J	C
PE		3	0	0	0	3
		SDG		9, 13		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives: The purpose of taking this course is to:

1	Understand the importance of Responsible AI and its impact on society.
2	Examine fairness, accountability, and ethical issues in AI systems.
3	Use tools and techniques to improve transparency, privacy, and trust in AI models.
4	Learn sustainable and Green AI practices to reduce environmental impact.
5	Understand AI ethics frameworks, legal regulations, and responsible AI practices.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO1	Analyze the principles of Responsible AI and the societal benefits, challenges, and impacts of AI systems.	An
CO2	Apply bias detection and mitigation techniques to improve fairness in AI systems.	Ap
CO3	Analyze privacy, security, transparency, and explainability issues in trustworthy AI systems using appropriate methods and tools.	An
CO4	Apply sustainable AI strategies and Green AI tools to evaluate and reduce the environmental impact of AI models.	Ap
CO5	Analyze global AI ethics frameworks, legal standards, and case studies to support responsible AI practices.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2					3	2
2		3	2	3			3	2
3		2	3	3			2	2
4		2	2	2		2	3	3
5		2	3	3	3	2	3	3


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Course Content	
INTRODUCTION TO RESPONSIBLE AI Role of AI in society: Benefits and challenges - Need for Responsible AI: Ethical, legal, social, and environmental perspectives - Core principles: Fairness, Accountability, Transparency, Safety, Sustainability - Stakeholders of AI: Developers, Users, Affected communities, Policymakers - Case studies of AI failures and unintended consequences - Introduction to Responsible AI tools and platforms.	7 Hours
BIAS DETECTION AND MITIGATION Types of bias in AI: Historical bias, Representation bias, Measurement bias, Aggregation bias - Fairness in machine learning: Definitions, Trade-offs, Limitations - Detection and mitigation of bias: Pre-processing, In-processing, Post-processing techniques - Case studies: AI in hiring, Loan approval, Predictive policing - Tools and frameworks for fairness auditing: AI Fairness 360, Fairlearn, What-If Tool.	10 Hours
SECURE AND TRUSTWORTHY AI SYSTEMS Privacy issues in AI: Data collection, Surveillance, Consent - Privacy-preserving techniques: Anonymization, Differential privacy, Federated learning - Adversarial threats: Model stealing, Adversarial examples, Membership inference - Trust and transparency in AI systems: Interpretability, Explainability (XAI) - Interpretable Models: Linear Regression, Logistic Regression, Decision Tree - Tools for explainability and privacy: LIME, SHAP, Captum, TensorFlow Privacy.	10 Hours
SUSTAINABLE AND GREEN AI Introduction to Green AI: Definition, Red vs Green AI paradigm - Carbon footprint of large-scale AI models: GPT, BERT, Training and inference phases - Estimating emissions: Experiment tracking, Energy profiling tools, ML CO2 - Infrastructure and sustainability: GPU vs TPU, Data centres, Renewable energy use - Strategies for sustainable AI: Efficient model design, Pruning, Quantization, Transfer learning - Green AI tools: CodeCarbon, ML CO2 Calculator, Energy monitoring tools.	10 Hours
GLOBAL ETHICS, LEGAL STANDARDS, PROJECT AND CASE STUDY Overview of global AI ethics frameworks: OECD, UNESCO, EU AI Act, India's NITI Aayog - Legal and governance frameworks: GDPR, AI Bill of Rights - Algorithmic accountability and audit mechanisms - Open-source ethics initiatives: Partnership on AI, AI Now Institute - Future directions in Responsible AI: Human-in-the-loop AI and Ethics by design - Mini project or case study analysis related to Responsible AI, Bias detection, Explainable AI, Privacy-preserving AI, or Green AI systems.	8 Hours

Theory Hours:45	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 0	Total Hours:45
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Learning Resources
Textbooks
1. Agarwal, Sray., Mishra, Shashin., Responsible AI: Implementing Ethical and Unbiased Algorithms. Switzerland: Springer International Publishing, 2021. 2. Ammanath, Beena., Trustworthy AI: A Business Guide for Navigating Trust and Ethics in AI. United States: Wiley, 2022. 3. Gambelin, Olivia., Responsible AI: Implement an Ethical Approach in Your Organization. United Kingdom: Kogan Page, 2024. 4. Alloghani, Mohamed Ahmed., Artificial Intelligence and Sustainability. Germany: Springer Nature Switzerland, 2023.


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Reference Books	
1.	Dignum, Virginia., Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way. Germany: Springer International Publishing, 2019.
2.	R. Schmidpeter., Reinhard, Altenburger., Responsible Artificial Intelligence: Challenges for Sustainable Management. Germany: Springer International Publishing , 2023.
3.	Coeckelbergh, Mark., AI Ethics. United Kingdom: MIT Press , 2020.
4.	Tzimas, Themistoklis, Legal and Ethical Challenges of Artificial Intelligence from an International Law Perspective. Switzerland: Springer International Publishing , 2021.
Online Resources (Weblinks)	
1.	https://onlinecourses.nptel.ac.in/noc24_cs132/preview
2.	https://www.coursera.org/learn/principles-ethical-considerations-responsible-ai
3.	https://www.coursera.org/learn/ethics-of-artificial-intelligence
Assessment (Theory course)	
SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE)	

Course Curated By					
Expert(s) from Industry		Expert(s) from Higher Education Institutions		Internal Expert(s)	
Revathi S Senior specialist, HPE Nonstop Database Products, Hewlett-Packard Enterprise R&D Division, Mahadevapura, Bangalore.		Dr. Sangeetha S ASP/ Department of Artificial Intelligence and Data Science, PSG Institute of Technology and Applied Research, Coimbatore.		Ms Shriarth E ,AP/AI & DS.	
Recommended by BoS on		06.06.2026			
Academic Council Approval		No:30		Date	19.06.2026


Signature of the BOS Chairman

24CAC658	GENERATIVE AI	L	T	P	J	C
PE		2	0	2	0	3
		SDG		4,8		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Provide an understanding of the foundational principles, history, and capabilities of Generative AI, including its tools and economic potential.
2	Familiarize students with Large Language Models, transformer architectures, Retrieval-Augmented Generation, and prompt engineering techniques.
3	Introduce vision, code-capable, and multimodal generative models for applying image generation, code synthesis, and automated testing in practical scenarios.
4	Present video generation techniques using GANs, VAEs, diffusion models, and transformer-based architectures with practical video synthesis workflows.
5	Explore Agentic AI frameworks and real-world Generative AI applications, with emphasis on analyzing ethical considerations, societal impacts, and regulatory challenges.

Course Outcomes	After successful completion of this course, the students shall be able to	Revised Bloom's Taxonomy Levels (RBT)
CO1	Explain the foundational concepts of Generative AI, including its history, capabilities, tools, and prompt engineering techniques.	U
CO2	Apply Large Language Models and Retrieval-Augmented Generation techniques to perform natural language processing tasks using transformer-based architectures.	Ap
CO3	Apply vision-capable and code-generation models to produce, edit, and test outputs from natural language prompts across image generation and code synthesis tasks.	Ap
CO4	Analyze video generation techniques using GANs, diffusion models, and transformers, comparing their effectiveness for various synthesis tasks.	An
CO5	Analyze real-world Generative AI applications and autonomous agent architectures, examining ethical, societal, and regulatory implications of their deployment.	An


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2						2
2		3	3	3				2
3		2	3	3				2
4		2	3	3	2		3	2
5		2	3	3	3	2	2	3

Course Content

INTRODUCTION TO GENERATIVE AI

Capabilities - History and Evolution - Benefits - Challenges - Applications of Generative AI – Tools for Text, Image, Code, Audio and Video generation – Economic Potential of Generative AI - Prompt Creation - Writing effective prompts - Techniques for using text prompts: Zero-shot and few-shot prompt techniques – Prompt engineering approaches: Interview pattern, Chain-of-Thought, Tree-of-Thought - Benefits of using text prompts - Challenges in generating meaningful and coherent prompts.

Practical Component ::

Text Generation - Image Generation - Chain-of-Thought Approach - Interview Pattern Approach - Tree-of-Thought Approach - Write a function that accepts English sentences and converts them into predicate logic format using a rule-based approach.

6 Hours

6 Hours

LARGE LANGUAGE MODELS

Overview - Transformer architecture - Types of LLM - Small language models – Tokens - Embeddings - Prompt engineering - Model adaptation - Metrics - Working through an API – RAG - Vector databases - RAG architecture - RAG metrics - Overcoming challenges for chunking.

Practical Component ::

Interacting with a Large Language Model through an API - Perform text summarization and question answering - Retrieval-Augmented Generation pipeline using a small language model and a vector database.

6 Hours

6 Hours

GENERATING IMAGES AND CODE

6 Hours



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Vision models - Vision Transformer – Diffusion models – Multimodal models - Editing and enhancing images using Stable Diffusion - Code generation - Code explanation - Generate tests. Practical Component :: Apply a Stable Diffusion model to generate, edit, and enhance images based on textual prompts. Use a code-capable language model to generate code from natural language prompts, explain given code snippets, and automatically generate unit tests.	6 Hours
GENERATING VIDEO GANs for video - Variational Autoencoders for video - Transformer-based video generation - Diffusion models for video - Text-to-Video Generation - Image-to-Video Translation - Pose-guided video synthesis - Audio-to-lip synchronization - Deepfakes and facial reenactment. Practical Component :: Text-to-Video Generation using Transformer or Diffusion-based Models – Audio-to-Lip Synchronization and Pose-Guided Video Synthesis. AI Tool Integration: Use GitHub Copilot or Claude to assist in writing and debugging the video generation pipeline code – Compare and critically evaluate AI-assisted vs. manually written code for the same video generation task.	6 Hours
AGENTIC AI AND GENERATIVE AI APPLICATIONS Agentic AI - Definition – LangGraph Overview - Agent Architecture - Agent Autonomy - The Impacts of Generative AI on Business and Society - Emerging Trends and Technologies in Generative AI - Ethical Challenges and Regulatory Frameworks - Real-world Applications of Large Language Models - Challenges and Limitations of Current Approaches. Practical Component :: AI-Assisted Mini Project: Apply Generative AI capabilities to build a small end-to-end application integrating at least two GenAI components (e.g., LLM + RAG, image generation + agent, or video + agentic workflow) – Use AI tools throughout the development process to assist with code generation, debugging, and documentation – Analyze the AI's role, output quality, limitations, and ethical considerations and present findings. Designing an Autonomous Agent using LangGraph Framework – Case Study on Real-World Application of Generative AI with Ethical and Societal Impact Analysis.	6 Hours

Theory Hours:30	Tutorial Hours:0	Practical Hours: 30	Project Hours:0	Total Hours:60
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Learning Resources
Textbooks
1. Rehmani, Altaf. Generative AI for Everyone: Understanding the Essentials and Applications of this Breakthrough Technology. O'Reilly Media Inc., 2024. 2. Sabesan, Karthikeyan, Sivagamisundari, and Nilip Dutta. Generative AI for Everyone: Deep Learning, NLP and LLM for Creative and Practical Applications. BPB Publications, 2025.
Reference Books
1. Dhamani, Numa. Introduction to Generative AI. Kindle Edition, 2024. 2. Sprinter, Jesse. Generative AI in Software Development: Beyond the Limitations of Traditional Coding. 2023. 3. Kalin, Josh. Generative Adversarial Networks Cookbook: Over 100 Recipes to Build Generative Models using Python, TensorFlow, and Keras. Packt Publishing, 2018.
Online Resources (Weblinks)


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1.Introduction and Applications of Generative AI – Coursera: https://www.coursera.org/learn/generative-ai-introduction-and-applications?specialization=generative-ai-for-everyone
2.Generative AI Learning Path – Google Cloud Skills Boost: https://www.cloudskillsboost.google/paths/118
3.Generative AI with Large Language Models – DeepLearning.AI (Coursera): https://www.coursera.org/learn/generative-ai-with-llms

Assessment (Embedded course)

SA I, SA II, Activity and Learning Task(s), Mini Project, MCQ, End Semester Examination (ESE), Lab Workbook, Experimental Cycle Tests, Viva-Voce

Course Curated By		
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr. Vignesh Rajendran Senior Principal Engineer, Oracle, Bengaluru, Karnataka, India.	Dr. S. Sangeetha Associate Professor Department of Artificial intelligence and data science PSG Institute of Technology and Applied Research Neelambur	Ms. Preethi G , AP/AI &DS
Recommended by BoS on	06.06.2026	
Academic Council Approval	No: 30	Date 19.06.2026



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24CAC659	SOCIAL NETWORK ANALYTICS	L	T	P	J	C
		2	0	2	0	3
PE		SDG		9,16		

Pre-requisite courses	NIL	Data Book / Code book (If any)	NIL
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Course Objectives:	
The purpose of taking this course is to:	
1	Acquire knowledge of fundamental graph theory concepts, network data types, and key metrics used in social network analysis.
2	Develop practical skills in collecting, processing, analyzing, and visualizing network data using standard Python libraries and visualization tools.
3	Gain competency in interpreting network structures, identifying key actors and communities, and understanding basic network dynamics.
4	Understand the application of SNA techniques in various domains, particularly social media and organizational contexts, while considering ethical implications.
5	Develop the ability to critically evaluate network analysis results and communicate findings effectively through visualizations.

Course Outcomes	After successful completion of this course, the students shall be able to	Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply graph representation methods, software libraries, and algorithms to model social networks and compute key metrics.	Ap
CO2	Analyze network structures to identify key actors, communities, and overall network properties.	An
CO3	Analyze patterns of connection, influence, and information flow within networks using concepts like homophily, structural holes, and basic diffusion models.	An
CO4	Analyze the suitability and limitations of different SNA metrics and algorithms for specific analytical goals or research questions.	An
CO5	Analyze the broader implications, ethical considerations, and potential applications of social network analysis findings across various domains	An


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Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2		2				2
2		3	2	3				2
3		2	3	3	2			2
4		3	3	3				2
5		2	2	3	3	2	3	3

Course Content	
INTRODUCTION TO NETWORK ANALYSIS AND DATA SNA Definition & Applications-Graph Basics: Nodes, Edges, Weights-Network Representation: Matrices, Edge Lists-Data Collection: APIs & Web Scraping-Intro to NetworkX & Basic Properties. Practical Component : Installing NetworkX environment-Creating/Manipulating graph objects-Loading network data from files-Basic graph inspection & property checks-Cursor/GitHub Copilot-Automated NetworkX script generation and graph schema design-GPT-4o Vision-AI interpretation of complex network visualizations and layout patterns	6 Hours
NETWORK METRICS: CONNECTION AND CENTRALITY Connection Metrics: Density & Degree Dist.-Distance Metrics: Geodesics, Diameter Node Centrality: Degree, Closeness, Betweenness-Eigenvector Centrality & PageRank Identifying 'Brokers' & Key Players. Practical Component : Calculate density & degree distributions-Compute centrality measures (Centrality Suite)-Centrality visualization with Matplotlib-Node resizing based on influence scores-LLM Centrality Analyst-AI-driven interpretation of node influence based on network metadata-GraphGPT-Natural language queries for identifying critical paths in complex networks.	6 Hours
NETWORK STRUCTURE: COHESION AND COMMUNITIES Cohesion: Connected Components-Clustering Coefficients: Global vs Local-Community Detection Algorithms (Louvain)-Modularity Optimization & Graph Partitioning-Introduction to Gephi Visualization. Practical Component : Finding connected components-Implementing Louvain for community detection-Graph data export for Gephi-Justice & Peace influence mapping-Node2Vec Embeddings-AI-based node feature learning for improved community clustering-AI Community Labeller-LLM-powered automatic naming of detected communities based on member attributes.	6 Hours


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NETWORK DYNAMICS AND POSITIONS Topology: Small-World & Scale-Free-Homophily & Assortativity Measurement-Structural Holes & Brokerage Theory (Burt)-Information Diffusion (SI/SIR Models)-Link Prediction & Contagion Concepts.	6 Hours
Practical Component : Calculating network assortativity-Identifying structural hole spanners-Simulating SI diffusion processes-Computing link prediction scores-Deep Graph Library (DGL)-Modeling network dynamics with Graph Neural Networks-Predictive Diffusion AI-AI-driven simulation of information flow in social system.	6 Hours
VISUALIZATION, APPLICATIONS AND EVALUATION Advanced Gephi Layouts (Force Atlas 2)-Social Media Data Analysis Strategies-Organizational Network Analysis (ONA)-Evaluating SNA Results & Ethical Reviews-Reporting Findings via Interactive Visuals.	6 Hours
Practical Component : Gephi attribute mapping (Size, Color)-Filtering networks in Gephi-Social media dataset deep-dive-Ethical review of network monitoring-Visallo / Polinode AI-AI-enhanced investigation and fraud detection in graphs-Auto-Report SNA-AI generation of executive summaries from network metric snapshots. Map and analyze a social subgroup to predict influential communication bridges using graph intelligence and AI-driven simulation.	6 Hours

Theory Hours:30	Tutorial Hours: 0	Practical Hours: 30	Project Hours: 0	Total Hours:60
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Learning Resources

Textbooks

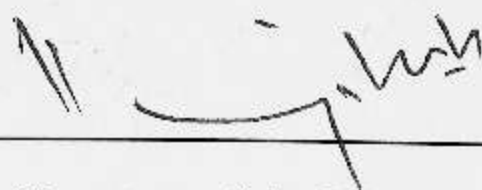
1. Musselwhite, Ben., Graph Data Science with Python, 2nd ed. Packt Publishing, 2024.
2. Harris, Elena, Network Science & AI: A Modern Approach, Wiley, 2024.
3. Leskovec, Jure, Machine Learning with Graphs. Stanford University, 2023.
4. Tsvetovat, Maksim, and Alexander Kouznetsov, Social Network Analysis for Startups, O'Reilly Media, 2011.
5. Barabási, Albert-László. Network Science. Cambridge University Press, 2016.

Reference Books

1. Hanneman, Robert A., and Mark Riddle. Introduction to Social Network Methods. Online textbook, 2005.
2. Easley, David, and Jon Kleinberg. Networks, Crowds, and Markets: Reasoning About a Highly Connected World. Cambridge University Press, 2010.
3. Wasserman, Stanley, and Katherine Faust. Social Network Analysis: Methods and Applications. Cambridge University Press, 1994.
4. Borgatti, Stephen P., Martin G. Everett, and Jeffrey C. Johnson. Analyzing Social Networks. 2nd ed. SAGE Publications, 2018 .

Online Resources (Weblinks)

1. NetworkX Library Documentation: <https://networkx.org/documentation/stable/>
2. Gephi Quick Start & Tutorials: <https://gephi.org/users/>
3. Stanford CS224W: Machine Learning with Graphs (Course Website/Videos): <http://web.stanford.edu/class/cs224w/>
4. Coursera: Social Network Analysis (University of Michigan): <https://www.coursera.org/learn/social-network-analysis>
5. https://onlinecourses.nptel.ac.in/noc22_cs117/preview



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Assessment (Embedded course)

SA I, SA II, Activity and Learning Task(s), MCQ, End Semester Examination (ESE) , Lab Workbook, Experimental Cycle tests, viva-voce

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
Mr.Gokul Kumar R D Senior Consultant EY	Dr. Vishnuvarthan R Assistant Professor- School of Computing- Amrita Vishwa Vidyapeetham- Coimbatore	Ms. Rupashini P R, AP/AI &DS
Recommended by BoS on	06.06.2026	
Academic Council Approval	No:30	Date 19.06.2026


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24CAC660	AGENTIC AI	L	T	P	J	C
PE		1	0	0	4	3
		SDG		9		

Pre-requisite courses	NIL	Data Book / Codes / Standards (If any)	NIL
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Course Objectives:	The purpose of taking this course is to:
1	Build basic Generative AI applications using LLMs, prompts, and simple RAG workflows.
2	Use vector databases and embedding models to perform similarity search and improve retrieval.
3	Create intelligent agents that can call tools, use memory, and solve tasks through reasoning.
4	Develop multi-step agent workflows using LangGraph for structured and collaborative tasks.
5	Implement multi-agent systems using frameworks like CrewAI or AutoGen, including simple multimodal tasks.

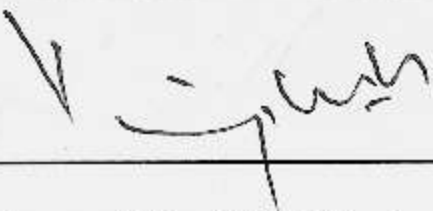
Course Outcomes	After successful completion of this course, the students shall be able to	Revised Bloom's Taxonomy Levels (RBT)
CO1	Apply foundational Generative AI techniques to build LLM-based applications.	Ap
CO2	Develop Retrieval-Augmented Generation systems using vector databases and advanced retrievers.	Ap
CO3	Design agentic systems using LangChain agents, tool calling, and multi-step reasoning frameworks.	Ap
CO4	Build stateful, multi-agent RAG and reasoning workflows using LangGraph and other agentic orchestration frameworks.	Ap
CO5	Analyze multimodal reasoning with advanced agentic frameworks to design and justify intelligent end-to-end applications.	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
	Foundation Knowledge	Problem Analysis	Development of Solutions	Modern Tool Usage	Individual and Teamwork	Project management and Finance	Ethics	Life-long Learning
1	3	2		2				2
2		3	3	3				2
3		2	3	3	2			2
4		2	3	3	2		2	3
5		2	3	3	3	2	2	3


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Course Content	
FOUNDATIONS OF GENERATIVE AI & RAG Introduction to Large Language Models (LLMs) – Prompt Engineering – In-context Learning – Generative AI Applications – Retrieval-Augmented Generation (RAG) – LangChain and LlamaIndex Basics – Document Loading and Chunking – Embeddings and Similarity Search – Retrieval Evaluation – Hallucination Reduction Techniques – Building Simple RAG Applications.	3 Hours
VECTOR DATABASES & ADVANCED RETRIEVERS Introduction to Vector Databases – Similarity Search Techniques – Retrieval Optimization – Embedding Models – Metadata Filtering – Hybrid Retrieval – Advanced Retrievers – Contextual Compression Retrievers – Parent Document Retrievers – Retrieval Evaluation – Building Retrieval Pipelines.	3 Hours
LANGCHAIN AGENTS & TOOL CALLING Introduction to AI Agents – LangChain Agent Workflows – Tool Calling – Agent Memory – LCEL Chaining – External Tool Integration – SQL and Python Tools – API Integration – ReAct Framework – Structured Output Generation – Agent Debugging and Optimization.	3 Hours
LANGGRAPH & AGENTIC RAG WORKFLOWS Introduction to LangGraph – Stateful Agent Workflows – Graph-based Orchestration – Multi-step Reasoning Workflows – Reflection and Reflexion Agents – Agentic RAG Pipelines – Knowledge Base Integration – Workflow State Management – Multi-agent Coordination – Workflow Monitoring and Evaluation.	3 Hours
ADVANCED MULTI-AGENT SYSTEMS Introduction to Multi-Agent Systems – CrewAI Framework – AutoGen Framework – BeeAI Framework – Agent Coordination and Collaboration – Evaluator-Optimizer Patterns – Task Planning and Delegation – Multimodal AI Agents – Image Captioning – Document Inspection – Visual Question Answering (VQA) – Ethical and Responsible Agentic AI.	3 Hours
Project Component: To design and develop an end-to-end Agentic AI application that integrates Retrieval-Augmented Generation (RAG), vector databases, intelligent agents, and multi-agent workflows. The system should support document retrieval, semantic search, tool calling, multi-step reasoning, and collaborative agent interactions through frameworks such as LangChain, LangGraph, CrewAI, AutoGen, or BeeAI, culminating in a functional AI-powered solution for a real-world application. Final Deliverables (Presentation & Report) • GitHub repository with source code, sample datasets/documents, and README. • Functional Agentic AI application with RAG, agents, and workflow orchestration. • 10-minute project presentation demonstrating architecture, workflow, and results. • Final report summarizing problem statement, methodology, tools/frameworks used, implementation, evaluation results, and future enhancements.	60 Hours

Theory Hours:15	Tutorial Hours: 0	Practical Hours: 0	Project Hours: 60	Total Hours:75
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Learning Resources**Reference Books**

1. Srinivasan Venkataraman and Harrison Chase, Building Agentic AI Systems: A Developer's Guide to LLM Agents, LangChain and LangGraph, O'Reilly Media, 2024.
2. Olivier Blais, Practical GenAI: Building Real-World Generative AI Products with LLMs, RAG, Agents, and Workflows, O'Reilly Media, 2024.
3. Sinan Ozdemir, LLM Engineers' Handbook: Retrieval-Augmented Generation, Prompting, Agents, and Production AI, Packt Publishing, 2024.
4. Elbert Gale, Mastering AI Agents: From Design to Deployment of Autonomous Systems, January 18, 2025. ISBN-13: 979-8307403822.
5. Natenapis Faraksa, Building AI Agent: A Practical Guide for Building Intelligent Agents, March 2, 2024.
6. Sujai G. Pillai, Build Your Own AI Agent: A Hands-On Guide for Beginners, January 13, 2025. ISBN-13: 979-8306885971.

Online Resources (Weblinks)

1. <https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/professional-certificates/ibm-rag-and-agentic-ai>
2. <https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/specializations/ai-agents-python>

Assessment (Practical course)

Project, Project presentation/Report, Lab Assignments, Demo presentations, Quiz/peer review(optional)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)	
-	-	Ms Shriarth E, AP/AI & DS	
Recommended by BoS on	06.06.2026		
Academic Council Approval	No:30	Date	19.06.2026



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