KUMARAGURU COLLEGE OF TECHNOLOGY

An autonomous Institution affiliated to Anna University, Chennai.

COIMBATORE – 641 049

Master of Computer Applications

REGULATION 2024

I to IV Semesters

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: Prepare students to intellect in computing skills and innovation of software products to meet the industry needs.

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

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

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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

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| **Signature of the BOS Chairman** |

approach for solutions incorporating ESG/SDG goals.

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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Signature of the BOS Chairman

KUMARAGURU COLLEGE OF TECHNOLOGY
DEPARTMENT OF COMPUTER APPLICATIONS
REGULATION 2024
Master of Computer Applications - Curriculum

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	24CAI503	Object Oriented Programming	Embedded	PC	3	0	2	0	4
4	24CAT504	Operating Systems	Theory	PC	3	0	0	0	3
5	24CAT505	Cloud Computing	Theory	PC	3	0	0	0	3
6	24MAI504	Probability and Statistics for Data Analysis	Embedded	BS	3	0	2	0	4
7	24HST506	Professional Communication Strategies	Theory	HSS	2	0	0	0	2
								Total Credits	**24**
							Total Contact Hours/week		**28**

Semester II

S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24CAT506	Cyber Security	Theory	PC	3	0	0	0	3
2	24CAI507	Automation and Artificial Intelligence	Embedded	PC	2	0	2	0	3
3	24CAI508	Full Stack Application Development	Embedded	PC	3	0	2	0	4
4	24CAI509	Data Analysis and Visualization	Embedded	PC	3	0	2	0	4
5	24CAT510	Finance, Economics & Marketing	Theory	HSS	3	0	0	0	3
6	24CAE0--	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 III									
S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24CAT601	Software Project Management	Theory	PC	3	0	0	0	3
2	24CAE0--	Professional Elective III	Embedded	PE	2	0	2	0	3
3	24CAE0--	Professional Elective IV	Embedded	PE	2	0	2	0	3
4	24CAE0--	Professional Elective V	Embedded	PE	2	0	2	0	3
5	OE	Open Elective	Theory	OE	3	0	0	0	3
6	24CAJ602	Midgrade Capstone / Internship*	Project	PROJ	0	0	0	4	2
Total Credits									17
Total Contact Hours/week									18

* - Midgrade Capstone / Internship should begin during summer vacation (At the end of semester II)

Semester IV									
S.No	Course code	Course Title	Course Mode	Course Type	L	T	P	J	C
1	24CAS603	Environmental Science and Sustainability	Online	MOOC	1	0	0	0	1
2	24CAJ604	Project Work/Internship	Project	PROJ	0	0	0	30	15
Total Credits									16
Total Contact Hours/week									30

Semester-wise Credits	
Semester - I	24
Semester - II	23
Semester - III	17
Semester - IV	16
Total Credits	**80**

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Course types	Credits
Basic Science	4
Humanities and Social Sciences	5
Professional Core	35
Professional Electives	15
Project/Internship	17
Open Elective	3
Online Course	1
Total Credits	**80**

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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

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)
CO 1	Understand the fundamental concepts and the implementation of algorithms in problem-solving contexts.	U
CO 2	Apply linear and non-linear data structures in various practical applications.	Ap
CO 3	Analyze the representation of different types of data structures and implement them in hierarchical data management.	An
CO 4	Analyze the efficiency of various algorithms and evaluate their performance for efficient memory usage and algorithmic performance in solving problems.	An
CO 5	Develop programs by applying various techniques to optimize data organization and retrieval.	E

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Course Outcomes (CO)	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	

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 Tees 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 Hours:45	Tutorial Hours: -	Practical Hours:30	Project Hours: -	Total 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.

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	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.V.Vijilesh, Dr.V.Geetha, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

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

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)**
CO 1	Understand fundamental database concepts and architecture, including relational and NoSQL systems, to support data management needs in various applications.	U
CO 2	Apply relational database design principles, including normalization and SQL operations, to effectively structure and query databases.	Ap
CO 3	Analyze different database technologies to select appropriate solutions for diverse organizational needs.	An
CO 4	Implement concurrency control techniques and recovery mechanisms to achieve fault tolerance in database management systems.	Ap
CO 5	Develop database systems using SQL and NoSQL technologies, ensuring efficient data storage, retrieval, and transaction management across various platforms.	E

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
3	2						2
		3					
	2		2				
		2			2		
5							3

(Course Outcomes (CO) rows 1–5 shown at left of the Program Outcomes table.)

Course Content

INTRODUCTION TO DATABASES 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.	**9 Hours**
Practical Component • Execute Data Definition Language (DDL) and Data Manipulation Language (DML) commands. • Implement Data Query Language (DQL). • Implement Join Operations.	**8 Hours**
DATABASE DESIGN 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.	**9 Hours**
Practical Component • Create Database Objects • Execute Complex and Sub Queries	**7 Hours**
DATABASE IMPLEMENTATION 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.	**9 Hours**
Practical Component • Demonstrate Data Control Language (DCL) and Transaction Control Language (TCL) commands • Execution of PL/SQL Commands • Record Management using Cursors and Functions	**8 Hours**
EMERGING TECHNOLOGIES AND APPLICATIONS Distributed Databases: Concepts – Database Design and Types – Database Applications in Mobile Communication – Multimedia Databases – Blockchain Databases – Cloud Databases.	**9 Hours**
NoSQL Introduction – Aggregate Data Model – Distribution Model – NoSQL Implementation: Key Value Database – Document Database – Graph based Database - MongoDB.	**9 Hours**
Practical Component • CRUD Operations in NoSQL • Indexing and Aggregation Framework in NoSQL	**7 Hours**

Theory	Tutorial	Practical	Project	Total
Hours:45	**Hours: -**	**Hours:30**	**Hours: -**	**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.

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/oracle-database/index.html

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.M.Manikantan, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

24CAI503	OBJECT ORIENTED PROGRAMMING	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

Course Objectives:	**The purpose of taking this course is to:**
1	Introduce Java programming fundamentals, focusing on object-oriented principles, exception handling, and GUI development for a strong software design foundation.
2	Develop proficiency in utilizing advanced Java frameworks, enabling students to create scalable and modular software solutions that meet industry standards.
3	Foster the ability to integrate database technologies with Java-based web applications, ensuring students can manage backend data effectively within software projects.
4	Develop analytical skills by evaluating Java libraries and frameworks to address software challenges like GUI and network programming.
5	Provide practical experience in distributed objects and network programming through case studies, allowing students to apply performance optimization techniques in real-world scenarios.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Understand the core concepts of Java programming, including object-oriented principles, exception handling, and GUI to build a solid foundation in software development.	U
CO 2	Apply advanced frameworks to develop modular, scalable, and efficient Java-based software solutions.	Ap
CO 3	Apply various technologies to connect and manipulate databases, demonstrating the ability to integrate backend data management with web applications.	Ap
CO 4	Analyze the effectiveness of different Java frameworks and libraries in addressing specific software development challenges, including GUI design and network programming.	An
CO 5	Evaluate distributed objects and network programming techniques to enhance application performance and scalability, using case studies and real-world examples.	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	3				1
3	3		2	2				
4	2		3	3				
5	2			3				

Course Content

FUNDAMENTALS OF OBJECT-ORIENTED PROGRAMMING Overview of Java – Java Fundamentals: Classes, Objects, Methods and Strings – Methods: A Deeper Look – Arrays and Array List – Classes and Objects: A Deeper Look – Inheritance – Polymorphism – Interfaces – Packages – Exception Handling.	**9 Hours**
Practical Component • Experiments related to Class and Object declaration, Access Control, Flow control statements, exception handling, and core OOP concepts such as inheritance, polymorphism, and interfaces.	**6 Hours**
GUI, I/O AND NETWORK PROGRAMMING Abstract Window Toolkit (AWT) – Strings, Characters and Regular Expressions – Files, Streams and Objects Serialization – Generic Collections – Generic Classes and Methods – Networking: Manipulation URLs – Reading Web Pages – Using Stream Sockets – Datagrams – Multicasting – Multicasting Sockets.	**9 Hours**
Practical Component • Experiments related to AWT for GUI development, string manipulation, file handling, generic collections, and networking with URLs, web pages, and sockets.	**6 Hours**
DISTRIBUTED OBJECTS JSON – AJAX Enabled Rich Internet Applications with JSON – Java Mail API – SMTP, POP3 & IMAP.	**9 Hours**
Practical Component • Experiments related to JSON, AJAX for rich internet applications, Java Mail API, and protocols like SMTP, POP3, and IMAP	**6 Hours**
JDBC AND WEB APPLICATION DEVELOPMENT Servlet – Servlet Architecture – Servlet lifecycle – Generic Servlet – HTTP Servlet – Server-Side Including – Overview of JSP – JSP Components – Bean – Session Tracking - Accessing Databases with JDBC – Basics – Manipulating Databases with JDBC.	**9 Hours**

Practical Component • Experiments related to servlet architecture and lifecycle, generic and HTTP servlets, JSP components and beans, session tracking, and accessing and manipulating databases with JDBC.	**6 Hours**
ADVANCED FRAMEWORKS Advanced Frameworks – MVC Frameworks – Hibernate- Using Annotations – Hibernate Query Language – Object Relational Mapping – Spring Framework – JMF- Case Studies.	**9 Hours**
Practical Component • Experiments related to advanced frameworks, including MVC frameworks, Hibernate with annotations and HQL, object-relational mapping, the Spring Framework, and Java Media Framework.	**6 Hours**

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

Learning Resources
Textbooks
1. A P Putambekar, "Object Oriented Programming", 4th Edition, Technical Publications,2022. 2. Herbert Schildt, "The Complete Reference – Java 2". 12th Edition, Tata McGraw Hill,2020.
Reference books/ Web Links
1. Joyce Farrell,"Java Programming",10th Edition, Cengage Learning, 2022. 2. Y.Daniel Liang,"Intro to Java Programming, Comprehensive Version",10th Edition, Pearson Publications,2020. 3. Paul J.Deitel, Harvey Deitel, "Java How to Program", Eleventh Edition, Pearson,2017. 4. Paul J.Dietel, Harvey Dietel, Abbey Dietel, "Internet and World Wide Web", Fifth Edition, Pearson Education, 2018.
Online Resources
1. https://docs.oracle.com/javase/tutorial

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.N.Jayakanthan, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

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

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)
CO 1	Understand the core components and functions of operating systems.	U
CO 2	Apply process management techniques to manage and schedule processes effectively.	Ap
CO 3	Analyze different mechanisms for process synchronization and deadlock management, in solving synchronization problems.	An
CO 4	Implementation of appropriate memory management techniques in operating systems.	Ap
CO 5	Analyze and apply core operating system concepts and techniques through case studies, focusing on process management, synchronization, and memory management.	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	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: -	Practical Hours: -	Project Hours: -	Total Hours:45

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.Dhamdhere, "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	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.P.Parameswari, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	16/08/2024

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

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)
CO 1	Apply the fundamentals of cloud computing and deployment models to real-world scenarios.	Ap
CO 2	Analyze cloud service models and explore the basics of virtualization.	An
CO 3	Evaluate hypervisor technologies and cloud scalability solutions.	E
CO 4	Analyze cloud storage solutions and foundational cloud security principles.	An
CO 5	Apply monitoring, encryption, and access management strategies in cloud 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	3	2	2				2	
2	2	3		3				
3	2	2						3
4	2			2				2
5		2	2					

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 Hours:45	Tutorial Hours: -	Practical Hours: -	Project Hours: -	Total 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_01384333102437990436162_shared/overview

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.C.Rajan Krupa, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	16/08/2024

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

Pre-requisite courses	Nil	**Data Book / Codes / Standards (If any)**	Statistical Tables

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)**
CO 1	Summarize data using appropriate collection methods, central tendency measures, variation metrics, and graphical tools such as charts and box plots.	Ap
CO 2	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
CO 3	Apply the concept of probability distributions for random variables, expectation and normal distribution to solve real-world problems.	Ap
CO 4	Perform hypothesis testing using statistical methods such as large sample tests and chi-square tests to make data-driven conclusions	Ap
CO 5	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
CO 6	Implement statistical methods in R programming to analyze, interpret, and draw insights from data.	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		2				
2	2			2				
3	2	2		2				
4	3			2				
5	2		3	2				
6	2			3				

Course Content

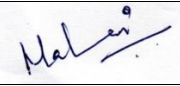|	
DESCRIPTIVE STATISTICS Collection of Data-Classification-Tabulation-Graphical Representation – Simple Bar Chart – Pie Chart -Measures of Central Tendency: Arithmetic Mean, Median and Mode – Measures of Variation: Range, Quartile Deviation - Standard Deviation and Coefficient of Variation – Five Number 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**
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	Tutorial	Practical	Project	Total
Hours: 45	Hours: -	Hours: 30	Hours: -	Hours: 75

Learning Resources
Textbooks
1. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, 2020. 2. Freund John, E and Miller, Irvin, "Probability and Statistics for Engineering", Duxbury Press, 9th Edition, 2018. 3. Sharma J. K., "Operations Research", Macmillan India Ltd, Delhi, 5th Edition, 2019. 4. Veerarajan. T., "Probability, Statistics and Random Process", Tata McGraw Hill, 4th Edition, 2021.
Reference books/ Web Links
1. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson and Duxbury, 9th Edition, 2021. 2. Freund, J.E., "Mathematical Statistics", Prentice Hall of India, 7th Edition, 2017. 3. Gupta S.C. and Kapur J.N., "Fundamentals of Mathematical Statistics", 11th Edition, 2019, Sultan & Chand, Publishers, New Delhi. 4. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", 6th Edition, Pearson Education, Asia, 2019. 5. Johnson, R. A., "Miller & Freund's Probability and Statistics for Engineers", 8th Edition, Pearson Education, 2017. 6. Spiegel, M.R. and Stephens, L.J., "Schaum's Outlines: Statistics", Tata McGraw-Hill, 5th Edition, 2020.
Online Resources
1. NPTEL – Probability and Statistics - https://nptel.ac.in/courses/111105090 2. Coursera – Data Analysis with R - https://www.coursera.org/learn/data-analysis-r 3. edX – Introduction to Probability - https://www.edx.org/course/introduction-to-probability 4. Stack Overflow – R Programming - https://stackoverflow.com/questions/tagged/r

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**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 2. Dr. K.Meena, Mathematics

Approved by: BoS Chairman	
BoS Approval date:	**16.08.2024**

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

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil

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)
CO 1	Show expertise in creating, revising, and organizing various types of professional documents.	Ap
CO 2	Communicate clearly and effectively in both written and verbal forms across different professional settings, adjusting to diverse audiences and cultural environments.	An
CO 3	Establish and maintain a professional presence online, utilizing digital platforms to enhance networking and career progression.	U
CO 4	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

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	Tutorial	Practical	Project	Total
Hours:30	**Hours: -**	**Hours: -**	**Hours: -**	**Hours:30**

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	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**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

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

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

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)
CO 1	Understand the fundamental security goals, the need for security, and various security approaches.	U
CO 2	Apply symmetric and asymmetric cryptography techniques to secure data.	Ap
CO 3	Analyze penetration testing methodologies and tools to identify potential vulnerabilities in systems.	An
CO 4	Evaluate the effectiveness of various methods for exploiting and securing application vulnerabilities, and insecure coding practices.	E
CO 5	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

Theory 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	Tutorial	Practical	Project	Total
Hours:45	**Hours: -**	**Hours: -**	**Hours: -**	**Hours:45**

Learning Resources
Textbooks
1. Mike Chapple David Seidl, "CompTIA PenTest+ Study Guide" Wiley, 2019. 2. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", John Wiley, 2011.
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. John Sammons, "The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics", Elsevier Inc, 2015. 4. Gerard Johansen "Digital Forensics and Incident Response", Packt Publishing, 2017. 5. Atul Kahate "Cryptography and Network Security", McGraw Hill Education (India) Private Limited, 2013. 6. 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

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Dr.C.Rajan Krupa, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

24CAI507	**AUTOMATION AND ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**J**	**C**
		2	**0**	**2**	**0**	**3**
PC		**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	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)**
CO 1	Apply the principles and strategies of automation to identify and solve automation problems in production systems.	Ap
CO 2	Analyze the role of intelligent agents in AI and compare different types of agents in various environments.	An
CO 3	Evaluate the effectiveness of various machine learning algorithms in solving specific problems by examining their application and outcomes.	E
CO 4	Examine criteria-based solutions by applying intelligent automation techniques in industries like automotive, healthcare, and insurance.	An
CO 5	Apply intelligent automation technologies in various industrial scenarios and recommend future directions for AI integration.	Ap

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

Course Content

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. **Practical Component** • Study on UI path Tool • Recording Modes • Notepad/Word Automation • Screen Scrapping Techniques to extract text from Images/Web/Document	**7 Hours** **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. **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.	**9 Hours** **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: -	Hours:30	Hours: -	Hours:60

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

Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Dr.P.Parameswari, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	**16/08/2024**

24CAI508	FULL STACK APPLICATION DEVELOPMENT	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

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)
CO 1	Apply the basics of HTML, CSS, JavaScript, and Git to create and manage web projects using version control.	Ap
CO 2	Analyse the concepts of Node.js to develop and manage server-side JavaScript applications.	An
CO 3	Distinguish the principles of asynchronous I/O and callbacks to effectively handle Node.js events and errors.	An
CO 4	Evaluate the use of Express framework to implement robust back-end web applications with middleware and routing.	E
CO 5	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		

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**

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

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-javacript?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

Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Dr.M.Manikantan, Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	16/08/2024

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

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)
CO 1	Understand key data analysis and visualization techniques to effectively interpret and communicate insights from complex datasets	U
CO 2	Apply various tools and methods for data wrangling and transformation to prepare datasets for detailed analysis and visualization.	Ap
CO 3	Apply advanced visualization tools to present data insights and support informed decision making across various contexts.	Ap
CO 4	Analyze relationships and patterns in data using diverse analytical methods to draw meaningful conclusions and support strategic decisions.	An
CO 5	Evaluate different data analysis and visualization strategies to address complex data challenges and generate actionable insights.	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	3					
2	3	3						
3			2	2				
4	3	3						
5			2	2				

Course Content	
EXPLORATORY DATA ANALYSIS FUNDAMENTALS 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.	**6 Hours**
Practical Component • Experiments on data transformation, merging and reshaping datasets, pivot tables, univariate, bivariate, and multivariate analysis, handling missing values, outliers, and developing dashboards.	**5 Hours**
VISUALIZING USING MATPLOTLIB 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.	**6 Hours**
Practical Component • Experiments on line 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.	**5 Hours**
DATA WRANGLING AND DATA VISUALIZATION Group By Mechanics-Data Aggregation-General Split-Apply-Combine, Pivot Tables and Cross Tabulation. Time Series Data Analysis: Date and Time Data Types a nd Tools-Time Series Basics, -Date Ranges, Frequencies and Shifting-Time Zone Handling-Periods and Periods Arithmetic-Resampling and Frequency Conversion-Moving Window Functions.	**8 Hours**
Practical Component • Experiments online plots, scatter plots, histograms, subplots, 3D plotting, and visualizing data with Basemap and Seaborn.	**5 Hours**

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.	**8 Hours**
Practical Component • Experiments on evaluating classifier performance, cross-validation, ROC curves, and improving classification accuracy using bagging, boosting, and random forest techniques.	**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.	**9 Hours**
Practical Component • Experiments on distributions, numerical summaries, scaling, time series smoothing, analysing relationships between variables, scatterplots, and contingency tables.	**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.	**8 Hours**
Practical Component • Experiments on three-variable contingency tables, time series data analysis, data cleaning, time-based indexing, visualization, grouping, and resampling.	**5 Hours**

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

Learning Resources
Textbooks
1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing Ltd., 2020.
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	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)
		Dr.N.Jayakanthan , Dept. of Computer Applications

Approved by: BoS Chairman	
BoS Approval date:	16/08/2024

24CAT510	FINANCE, ECONOMICS & MARKETING	L	T	P	J	C
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HSS		SDG		4,8,9		

Pre-requisite courses	Nil	Data Book / Codes / Standards (If any)	Nil

Course Objectives:	The purpose of taking this course is to:

1	To provide students with a foundational understanding of key financial, economic, and marketing principles required for effective business decision-making.
2	To enhance students' analytical skills in evaluating business environments and market conditions to support strategic planning.
3	To develop the ability to create and implement business strategies that align with organizational goals and customer needs.
4	To foster an integrated approach to applying financial, economic, and marketing knowledge for making informed and strategic business decisions.

Course Outcomes:	After successful completion of this course, the students shall be able to	Bloom's Taxonomy Level (BTL)
CO 1	Understand fundamental financial concepts, including financial statement analysis and investment decision-making.	U
CO 2	Analyze economic conditions and market dynamics to inform business strategies.	An
CO 3	Develop and implement marketing plans that align with business objectives and create customer value.	Ap
CO 4	Integrate knowledge from finance, economics, and marketing to make strategic business decisions.	An

	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)							
	1	2	3	4	5	6	7	8
Course Outcomes (CO)	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		3	2					
3					2			
4	2	3	3					2

Course Content

INTRODUCTION TO FINANCIAL MANAGEMENT Overview Of Finance in Business Management. Financial Statements: Income Statement, Balance Sheet, Cash Flow Statement. Financial Ratio Analysis and Interpretation. Basics of Capital Budgeting and Investment Appraisal (NPV, IRR).	**15 Hours**
PRINCIPLES OF ECONOMICS FOR BUSINESS Microeconomic Principles: Supply and Demand, Market Structures. Macroeconomic Indicators: GDP, Inflation, Interest Rates, and their Impact on Business. Economic Policies: Fiscal and Monetary Policies and their Implications for Business. Global Economics: Trade, Exchange Rates, and Economic Integration.	**13 Hours**
MARKETING CONCEPTS AND STRATEGIES The Role of Marketing in Business Strategy. Understanding Consumer Behaviour and Market Segmentation. The Marketing Mix: Product, Price, Place, And Promotion Strategies. Developing a Marketing Plan and Measuring its Effectiveness.	**9 Hours**
INTEGRATED BUSINESS STRATEGY Integrating Finance, Economics, and Marketing for Strategic Decision-Making. Case Studies on Successful Business Strategies that Align Financial, Economic, and Marketing Goals. Strategic Planning: Aligning Financial Management, Economic Analysis, And Marketing to Achieve Business Objectives.	**8 Hours**

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

Learning Resources
Textbooks
1. Brigham, E. F. and Ehrhardt, M. C., "Financial Management: Theory & Practice", Cengage Learning, 2016. 2. Mankiw, N.G ,"Principles of Economics", Cengage Learning, 2014. 3. Kotler, P., & Keller, K. L., "Marketing Management", Pearson Education, 2016.
Reference books/ Web Links
(Selected case studies and journal articles provided by the instructor.)
Online Resources
1. https://www.khanacademy.org/economics-finance-domain/core-finance 2. https://hbr.org/topic/marketing

Assessment	
Formative	Summative
Assignments / Mini project), Quiz, Lab	CAT- I, CAT – II and End Semester Examination (ESE)

Course Curated By		
Expert(s) from Industry	**Expert(s) from Higher Education Institutions**	**Internal Expert(s)**
		Mr.Aman Kumar Dubey, KCT BS

Approved by: BoS Chairman	
BoS Approval date:	16/08/2024