

III

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain and implement linear data structures such as lists, stacks, and queues using appropriate Abstract Data Types (ADTs) to solve computing problems.	-
CO2	Apply suitable sorting and searching algorithms by analyzing their efficiency for different application requirements..	PO 1,PO 2, PO 3,PO 4,PSO 1
CO3	Design and implement tree-based data structures, including binary search trees, AVL trees, Red-Black trees, and B-Trees, for efficient data organization and retrieval.	PO 1,PO 2, PO 3,PO 4,PSO 1
CO4	Analyze graph problems and implement graph algorithms such as traversal, shortest path, and minimum spanning tree algorithms for real-world applications .	PO 1,PO 2, PO 3,PO 4,PSO 1
CO5	Evaluate hashing techniques and priority queue implementations to design efficient solutions for searching, insertion, deletion, and optimization problems. .	PO 1,PO 2, PO 3,PO 4,PSO 1

MAPPING

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COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Recall the fundamental concepts of object-oriented programming, Java syntax, data types, control structures, classes, objects, inheritance, packages, interfaces, exception handling, multithreading, file handling, generics and JavaFX components.	--
CO2	Explain object-oriented principles and Java programming constructs including inheritance, exception handling, multithreading, file handling, generics and JavaFX event-driven programming through tutorial exercises, laboratory demonstrations, programming assignments and viva-voce.	PO1, PO2, PO3
CO3	Apply Java programming concepts to develop applications using classes, inheritance, packages, exception handling, multithreading, file handling, generics and JavaFX controls through laboratory experiments, programming assignments and continuous assessments.	PO1, PO2, PO3, PO5
CO4	Analyze Java programs to identify appropriate object-oriented design approaches, exception handling mechanisms, thread synchronization techniques and suitable Java APIs for solving application problems through debugging exercises, code reviews, laboratory assessments and internal practical examinations.	PO1, PO2, PO3, PO4, PO5
CO5	Evaluate alternative object-oriented design strategies, Java libraries and GUI components to develop efficient, maintainable and reusable software solutions through case studies, programming assignments, technical presentations and practical examinations.	PO1, PO2, PO3, PO4, PO5, PO10
CO6	Design and develop Java-based applications by integrating object-oriented programming concepts, multithreading, file handling, generics and JavaFX components to solve real-world problems through a mini-project, software demonstration, project presentation and comprehensive viva-voce.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	–	–	–	–	–	–	–	–	–	–	–	2	–
CO2	3	3	2	–	–	–	–	–	–	–	–	3	–
CO3	3	3	3	–	3	–	–	–	–	–	–	3	2
CO4	3	3	3	3	2	–	–	–	–	–	–	3	2
CO5	3	3	3	3	3	–	–	–	–	2	–	3	3
CO6	3	3	3	3	3	–	–	–	2	2	2	3	3
22IPC302	3	3	3	2	2	--	--	--	1	1	1	3	2

III

MAPPING

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COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the architecture, layered design principles, Internet operation, physical layer concepts, transmission media, signal encoding, multiplexing, and spread spectrum techniques used in computer networks.	–
CO2	Analyze data link layer protocols, medium access control mechanisms, error detection techniques, switched LANs, VLANs, Ethernet, and wireless LAN technologies using networking concepts and modern networking tools such as Cisco Packet Tracer, Wireshark, GNS3, and Ethernet protocol analyzers.	PO1, PO2, PO4, PO5
CO3	Apply network layer concepts including IP addressing, subnetting, IPv4/IPv6 configuration, routing algorithms, router architecture, congestion avoidance, and routing protocols using networking simulation and configuration tools such as Cisco Packet Tracer, GNS3, Wireshark, and Linux networking utilities to develop efficient networking solutions.	PO1, PO2, PO3, PO5
CO4	Analyze transport layer protocols, TCP/UDP communication, flow control, congestion control, Quality of Service (QoS), and network performance by evaluating reliable data transmission mechanisms using Wireshark, NS-3, Cisco Packet Tracer, and network performance analysis tools.	PO1, PO2, PO4, PO5
CO5	Design, implement, and evaluate application layer services including DNS, HTTP, SMTP, SNMP, peer-to-peer communication, multimedia streaming, and network security mechanisms such as firewalls and DMZ using modern networking platforms, network security tools, and network management frameworks while considering sustainability, teamwork, communication, project management, and ethical engineering practices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	3	—	—	—	—	—	—	—	—	—	—	2	1
CO2	3	2	—	2	2	—	—	—	—	—	—	2	2
CO3	3	3	2	—	2	—	—	—	—	—	—	3	2
CO4	3	3	—	2	2	—	—	—	—	—	—	2	2
CO5	3	3	3	2	3	1	—	2	2	2	2	3	2
22IPC509	3	3	3	2	2	1	—	2	2	2	2	2	2

COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the fundamental concepts of formal languages, grammars, automata, and their applications in computation.	--
CO2	Construct regular expressions and finite automata for the given languages and computational problems.	PO1, PO2, PO3
CO3	Analyze the properties of regular, context-free, recursive, and recursively enumerable languages and their applications in computational systems.	PO1, PO2, PO3, PO6
CO4	Apply pumping lemma, closure properties, and related techniques to analyze and prove properties of formal languages.	PO1, PO2, PO3, PO4
CO5	Analyze and justify the decidability and undecidability of computational problems using reducibility theory and communicate the results effectively.	PO2, PO4, PO10
CO6	Collaborate effectively in teams to analyze and solve computational problems involving formal languages, automata, and computational models; evaluate their ethical and societal implications, and communicate the solutions and findings effectively through technical reports and presentations.	PO6, PO8, PO9, PO10

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	–	–	–	–	–	–	–	–	–	–	–	–	–
CO2	3	3	2	–	–	–	–	–	–	–	–	2	2
CO3	3	3	2	–	–	2	–	–	–	–	–	2	2
CO4	3	2	3	2	–	–	–	–	–	–	–	2	2
CO5	–	2	–	2	–	–	–	–	–	2	–	2	2
CO6	–	–	–	–	–	2	–	2	3	3	–	2	2
22IPC510	2	2	2	1	--	1	--	1	1	1	--	2	2

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COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Recall the fundamentals of operating systems, computer system organization, operating system services, system calls, process concepts, scheduling concepts, memory management and file system terminology.	--
CO2	Explain operating system structures, process and thread management, CPU scheduling, process synchronization, memory management, storage management, file systems and virtualization concepts through unit tests, tutorial exercises, concept mapping and written assignments.	PO1, PO2, PO3
CO3	Apply operating system concepts to solve process scheduling, synchronization, deadlock handling, memory allocation, page replacement and disk scheduling problems using appropriate algorithms and system calls through problem-solving exercises, programming assignments, laboratory experiments and internal assessments.	PO1, PO2, PO3, PO5
CO4	Analyze the performance of process scheduling, synchronization mechanisms, deadlock handling, memory management, file systems and virtualization techniques for different computing environments through case studies, analytical assignments, laboratory investigations and internal examinations.	PO1, PO2, PO3, PO4
CO5	Evaluate operating system resource management, scheduling, synchronization, and memory management and virtualization techniques to recommend efficient and secure solutions for computing environments through case study presentations, seminars, technical reports and end-semester examinations.	PO1, PO2, PO3, PO4, PO5, PO10
CO6	Design and develop operating system-based solutions by integrating process management, synchronization, memory management, file systems and virtualization concepts for real-world computing applications through mini-projects, laboratory implementation, project demonstrations and comprehensive viva-voce examinations.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	–	–	–	–	–	–	–	–	–	–	–	2	–
CO2	3	3	2	–	–	–	–	–	–	–	–	2	–
CO3	3	3	3	–	2	–	–	–	–	–	–	3	2
CO4	3	3	3	3	–	–	–	–	–	–	–	2	2
CO5	3	3	3	3	2	–	–	–	–	2	–	2	3
CO6	3	3	3	3	3	–	–	–	2	2	2	3	3
22IPC512	3	3	3	2	2	--	--	--	1	1	1	3	2

COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Develop Python programs using control flow statements, functions, modules, and basic data structures (strings, lists, tuples, dictionaries, sets) to solve computational problems through hands-on coding exercises, programming assignments, and case studies.	-
CO2	Implement advanced data structures using NumPy and Pandas for numerical computing, data manipulation, and analysis, including array operations, DataFrame handling, and data file processing through lab exercises, data analysis projects, and competitive programming challenges.	PO1, PO2, PO3
CO3	Design object-oriented solutions using classes, inheritance, polymorphism, data hiding, and abstraction, and create graphical user interfaces using GUI frameworks through application development projects and case studies.	PO3, PO4, PO5
CO4	Apply file handling operations and exception handling mechanisms to build robust applications, including user-defined exceptions, file I/O, and error management through file processing assignments and error handling exercises.	PO3, PO4, PO5
CO5	Construct web applications using Flask framework with SQLAlchemy ORM, RESTful APIs, and deployment strategies, incorporating security features and testing through end-to-end web application development projects.	PO5, PO7, PO9, PO10, PO1

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO3	-	-	3	3	3	-	-	-	-	-	-	2	2
CO4	-	-	2	2	3	-	-	-	-	-	-	2	2
CO5	-	-	-	-	3	-	2		3	2	2	2	2
22IPC513	1	1	2	2	2	-	1	1	1	1	1	2	2

COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Install, configure, and use open-source software development tools and build automation tools for software project development.	-
CO2	Install, configure and use Maven and its plugins for project management and build automation.	P01, P02, P03,P05, P09
CO3	Develop multi-module and web applications using Maven.	P01, P02, P03,P04,P05,P09,P010
CO4	Develop applications using Scala by applying procedural, object-oriented and functional programming concepts.	P01, P02, P03,P04,P05,P09
CO5	Perform version control operations using Git and GitHub, including branching, merging and collaboration.	P01, P02, P03,P04,P05,P08,P09, P010
CO6	Implement CI/CD workflows using open-source tools to automate software build, testing and deployment.	P01, P02, P03,P04,P05,P07,P09, P010,P011

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	3	-	-	-	1	-	-	2	3
CO3	3	2	3	2	3	-	-	-	2	1	-	2	3
CO4	3	3	3	2	2	-	-	-	1	-	-	2	3
CO5	2	2	3	2	3	-	-	1	3	2	-	2	2
CO6	3	3	3	3	3	-	1	-	3	2	1	3	3
22IPC514	3	2	3	2	3	-	1	1	2	2	1	2	3

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Demonstrate the configuration and administration of computer networks using Linux networking utilities, server configuration tools, and packet analysis software to understand network interfaces, addressing, routing, and application services.	–
CO2	Analyze network protocols, packet structures, and communication behavior using Wireshark, Linux networking commands, ping, traceroute, whois, and network diagnostic tools to investigate network performance and troubleshoot communication problems.	PO1, PO2, PO4, PO5
CO3	Develop client-server applications using TCP and UDP socket programming, implement concurrent server communication, and configure network routing and mesh topologies using Linux networking utilities, Mininet, and routing techniques to solve networking problems.	PO1, PO2, PO3, PO5
CO4	Evaluate network performance by conducting experiments on TCP throughput, congestion control, Quality of Service (QoS), wireless communication, medium access protocols, and routing using NS-2/NS-3, iPerf, tc, Wireshark, and network simulation tools.	PO1, PO2, PO4, PO5
CO5	Design, simulate, and implement secure and efficient networking solutions including mesh networks, multimedia streaming servers, wireless networks, and performance evaluation using NS-2/NS-3, Mininet, Linux networking tools, open-source server software, and network monitoring frameworks while demonstrating teamwork, communication, project management, sustainability, and ethical engineering practices.	PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11

MAPPING

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COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Recall UNIX commands, shell programming constructs, operating system services and system calls through laboratory exercises, quizzes and viva-voce.	--
CO2	Explain process management, CPU scheduling, inter-process communication, synchronization, deadlock handling and memory management concepts through laboratory demonstrations, observation records and viva-voce.	PO1, PO2, PO5
CO3	Implement operating system algorithms for process scheduling, synchronization, deadlock handling, paging, memory allocation, page replacement, file organization and disk scheduling through programming exercises, laboratory experiments and continuous assessments.	PO1, PO2, PO3, PO5
CO4	Analyze the performance of CPU scheduling, memory management, page replacement, file allocation and disk scheduling algorithms by comparing their efficiency through experiment analysis, laboratory records and internal practical examinations.	PO1, PO2, PO3, PO4, PO5
CO5	Evaluate suitable operating system algorithms and virtualization techniques for efficient resource management and system performance through case studies, practical examinations, laboratory demonstrations and viva-voce.	PO1, PO2, PO3, PO4, PO5, PO10
CO6	Develop operating system solutions by integrating process management, synchronization, memory management, file systems and virtualization concepts using Linux and VMware through mini-projects, laboratory implementation, project demonstrations and comprehensive viva-voce.	PO1, PO2, PO3, PO4, PO5, PO9, PO10, PO11

MAPPING

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22IPC723
COURSE OUTCOMES

INTERNET OF THINGS

VII

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain IoT system architecture, communication protocols, cloud-based data analytics, sensor integration, prototyping techniques, security requirements, and their role in developing IoT applications.	-
CO2	Interpret the principles and functionalities of IoT architectures, communication technologies, cloud computing, sensor-based systems, security mechanisms, and application frameworks to support the design of efficient IoT solutions by oral questions .	PO1, PO2, PO4
CO3	Apply IoT design principles, communication protocols, cloud computing platforms, sensor technologies, embedded software, web APIs, and security mechanisms to develop IoT-enabled solutions for practical applications by conducting online quiz .	PO1, PO2, PO3,PO5, PO8
CO4	Analyze IoT systems by examining architecture, communication protocols, data processing techniques, cloud services, sensor performance, security challenges, and application requirements to select appropriate IoT solutions using assignments .	PO1, PO2, PO4,PO5, PO8
CO5	Evaluate and justify the suitability of IoT technologies, communication standards, cloud analytics, sensing devices, security mechanisms, and application frameworks to design reliable, intelligent, and sustainable IoT systems for engineering applications by conducting online interactive test .	PO1, PO2, PO4,PO5, PO8
CO6	Create secure, scalable, and efficient IoT solutions by integrating IoT architecture, communication technologies, cloud-based data analytics, sensors and actuators, embedded prototyping, and security mechanisms to address real-world engineering applications by presenting report .	PO1, PO2, PO3, PO4, PO5, PO8, PO9, PO10, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	—	—	—	—	—	—	—	—	—	—	—	—	—
CO2	2	3	—	2	—	—	—	—	—	—	—	2	1
CO3	3	2	2	—	2	—	—	2	—	—	—	2	1
CO4	2	3	—	2	2	—	—	2	—	—	—	2	1
CO5	2	3	—	2	2	—	—	2	—	—	—	2	1
CO6	3	3	3	2	2	—	—	3	2	1	2	2	1
22IPC723	2	3	1	2	2	—	—	2	1	1	1	2	1

COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Explain the architecture of modern full-stack web applications, including client-server models, MVC frameworks, and the roles of different stacks (MEAN, MERN) through stack comparison reports and architecture diagramming exercises.	-
CO2	Develop server-side applications and RESTful APIs using Node.js and Express, handling events, asynchronous operations, and data I/O through hands-on coding assignments, API testing with Postman and debugging sessions.	PO1, PO2, PO3
CO3	Implement data persistence solutions using MongoDB, including database administration, schema design, indexing strategies, and integration with Node.js applications through NoSQL queries and performance benchmarking reports.	PO3, PO4, PO5
CO4	Construct dynamic user interfaces using Angular or React, utilizing components, state management, data binding and routing to create responsive single-page applications through component design projects and UI/UX evaluation checklists.	PO3, PO4, PO5
CO5	Integrate frontend, backend and database components to create a fully functional full-stack web application, applying version control, testing, and deployment strategies through end-to-end project development, sprint reviews and deployment demonstrations.	PO5, PO7, PO9, PO11
CO6	Analyze the security, scalability, and societal implications of full-stack applications through recent case studies, security audit reports and ethical debate presentations.	PO6, PO8, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO3	-	-	2	3	2	-	-	-	-	-	-	2	2
CO4	-	-	3	2	3	-	-	-	-	-	-	2	2
CO5	-	-	-	-	2	-	2	-	3	2	-	2	2
CO6	-	-	-	-	-	3	-	3	-	-	3	1	2
22IPC724	1	1	2	2	2	1	1	1	1	1	1	2	2

COURSE OUTCOMES

The Course Outcome(CO)		PO's Mapped
At the end of the course, the students will have the ability to		
CO1	Execute frontend development tasks by designing responsive user interfaces using HTML, CSS, JavaScript, and modern frameworks (React/Angular) through UI prototyping experiments.	-
CO2	Design and develop responsive user interfaces and database schemas by implementing CRUD operations, data modeling and UI/UX principles through portfolio website development and database design.	PO1, PO2, PO3
CO3	Implement user authentication and authorization systems using JWT, sessions, or OAuth, integrating login/registration functionality with database backends through security implementation and testing exercises.	PO3, PO4, PO5
CO4	Construct full-stack web applications by integrating frontend interfaces, backend APIs, and databases for various real-world domains (portfolio, to-do list, micro-blogging, e-commerce, survey, food delivery, leave management, project management) through application development projects.	PO3, PO4, PO5, PO10
CO5	Develop functional web applications with advanced features such as real-time updates, search/filter capabilities, task management, and survey systems by implementing business logic and data processing through application development and performance optimization tasks.	PO4, PO5, PO9, PO10
CO6	Analyze ethical considerations, societal impact, data privacy, and accessibility aspects of web applications through case studies, accessibility audits, and reflective journals, ensuring sustainable and inclusive design practices.	PO6, PO8, PO11

MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	2
CO3	-	-	2	3	2	-	-	-	-	-	-	2	2
CO4	-	-	3	2	3	-	-	-	-	2	-	2	2
CO5	-	-	-	2	2	-	-	-	3	2	-	2	2
CO6	-	-	-	-	-	3	-	3	-	-	3	1	2
22IPC725	1	1	2	2	2	1	-	1	1	1	1	2	2