

Computer Science and Engineering
Semester –III

22SPC301 DATA STRUCTURES		Sem: 3
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Explain algorithm analysis techniques, Abstract Data Types (ADT), and the organization and operations of fundamental data structures.	PO1,PO2
CO2	Apply linear data structures such as arrays, linked lists, stacks, and queues to implement solutions for computational problems.	PO1,PO2,PO3
CO3	Analyze the performance of tree structures, graph algorithms, searching methods, and sorting techniques using appropriate complexity measures.	PO2,PO3
CO4	Design efficient solutions using trees, graphs, hashing, and advanced data structures for real-world applications.	PO3,PO6
CO5	Develop programs implementing searching, sorting, hashing, traversal, and optimization algorithms using suitable data structures.	PO3,PO5,PO6,PO8,PO11
CO6	Evaluate case studies involving route optimization, network analysis, scheduling systems, database indexing, and resource management using appropriate data structures, and communicate findings through technical reports and seminar presentations.	PO4,PO5,PO7,PO8,PO9,PO10,PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3										3	1	1
CO2	3	3	3									3	2	1
CO3		3	3									3	2	2
CO4			3			3						3	3	3
CO5			3		2	3		2			2	3	3	3
CO6				3	2		2	2	3	2	2	3	3	3
22SPC301	3	3	3	3	2	3	2	2	3	2	2	3	2	2

22SPC302 FOUNDATIONS OF DATA SCIENCE

Course Outcome	BL Mapped
At the end of the course, students will be able to	
CO1 : Describe the fundamental data structures and functions in R (arrays, matrices, lists, data frames, factors), and explain basic statistical concepts including types of data, variables, distributions, and normal/standard (z) scores used in data science.	K2
CO2 : Apply R programming techniques to import, organize, and visualize data using graphical methods (plots, multivariate/matrix plots), and compute descriptive statistics such as averages, variability, and correlation coefficients for real-world datasets.	K3
CO3 : Analyze relationships between variables using correlation and sampling distributions to draw meaningful inferences about underlying data patterns	K4
CO4 : Evaluate statistical hypotheses using z-tests (one-tailed and two-tailed) null and alternate hypothesis formulation, and confidence interval estimation to assess the validity of data-driven claims.	K5
CO5 : Design and construct predictive models using linear and logistic regression in R, and evaluate model quality by interpreting coefficients and model summaries to solve real-world data science problems	K6

CO-PO MAPPING:

COs	Course Outcome	POs mapped
CO1	Describe the fundamental data structures and functions in R (arrays, matrices, lists, data frames, factors), and explain basic statistical concepts including types of data, variables, distributions, and normal/standard (z) scores used in data science.	-
CO2	Apply R programming techniques to import, organize, and visualize data using graphical methods (plots, multivariate/matrix plots), and compute descriptive statistics such as averages, variability, and correlation coefficients for real-world datasets.	PO1,PO5
CO3	Analyze relationships between variables using correlation and sampling distributions to draw meaningful inferences about underlying data patterns	PO2, PO5
CO4	Evaluate statistical hypotheses using z-tests (one-tailed and two-tailed) null and alternate hypothesis formulation, and confidence interval estimation to assess the validity of data-driven claims.	PO1, PO3, PO5
CO5	Design and construct predictive models using linear and logistic regression in R, and evaluate model quality by interpreting coefficients and model summaries to solve real-world data science problems	PO4, PO5, PO6, PO8, PO9, PO10, PO11

COURSE ARTICULATION MATRIX:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3				3							3	3	
CO3		3			3							3	1	
CO4	1		3		2							3	3	1
CO5				3	3	1		2	2	2	1	3	3	3

22SPC303 OBJECT ORIENTED PROGRAMMING		Sem: 3
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Explain the fundamentals of Object-Oriented Programming, Java architecture, JVM, data types, control structures, classes, objects, constructors, inheritance, packages, interfaces, and other core Java programming concepts.	–
CO2	Apply exception handling, multithreading, synchronization, wrappers, and auto-boxing concepts to develop robust and efficient Java applications.	PO1, PO11
CO3	Analyze and implement string manipulation, file handling, object serialization, collections, generics, annotations, and lambda expressions to build efficient Java programs.	PO2, PO11
CO4	Design GUI-based and database-driven Java applications using Swing components, JDBC, SQL queries, transactions, and connection management to meet application requirements.	PO3, PO11
CO5	Develop distributed Java applications using socket programming, HTTP networking, servlets, session management, cookies, and web deployment techniques for enterprise and web-based applications.	PO4, PO5, PO11
CO6	Evaluate real-world Java applications involving desktop, database, networking, and enterprise solutions through mini-projects, technical reports, seminar presentations, and discussions beyond the syllabus.	PO6, PO7, PO9, PO10, PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3										3	2	2	2
CO3		3									3	2	2	2
CO4			3								3	2	2	2
CO5				3	3						3	2	2	2
CO6						3	3		3	3	3	2	2	2
22SPC303	3	3	3	3	3	3	3	–	3	3	3	2	2	2

22SPC304 DATA STRUCTURES LABORATORY		Sem: 3
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Apply linear data structures such as arrays, linked lists, stacks, and queues to implement and solve computational problems using C.	PO1,PO5
CO2	Analyze the performance of searching, sorting, tree, and graph algorithms by evaluating their time and space complexities through experimentation.	PO2,PO4,PO10,PO11
CO3	Design efficient algorithmic solutions by selecting appropriate data structures such as trees, graphs, and hashing techniques for given problem statements.	PO2,PO3,PO5,PO7,PO8,PO9,PO11
CO4	Develop robust C programs to implement linear and non-linear data structures and their associated algorithms for real-world applications.	PO3,PO5,PO8,PO9,PO11
CO5	Create application-oriented solutions or mini-projects by integrating suitable data structures and algorithms to solve practical computing problems.	PO3,PO4,PO5,PO7,PO8,PO10,PO11
CO6	Evaluate the effectiveness of different data structures and algorithms through case studies, program testing, technical documentation, viva-voce, and seminar presentations.	PO2,PO4,PO6,PO8,PO9,PO10,PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3				3							3	2	1
CO2		3		3						2	2	3	2	2
CO3		3	3		3		2	3	2		3	3	3	2
CO4			3		3			2	2		2	3	3	3
CO5			3	3	3		2	3		2	3	3	3	3
CO6		3		3		3		2	3	2	2	2	3	3
22SCP304	3	3	3	3	3	3	2	3	2	2	2	3	3	2

22SPC512 COMPUTER NETWORKS		Sem: 5
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Explain the fundamentals of computer networks including Internet architecture, layered communication models, transmission media, physical layer concepts, network devices, switching techniques, performance metrics, and the functionalities of each network layer.	-
CO2	Apply error detection and recovery techniques, IP addressing, subnetting and routing mechanisms to solve networking problems.	PO1, PO11
CO3	Analyze network performance using throughput, delay, jitter, packet loss, Little's Law, router performance, traffic characteristics, congestion control, flow control, transport protocols (TCP/UDP), and Quality of Service (QoS) for different networking scenarios.	PO2, PO11
CO4	Design efficient LAN and WAN solutions by selecting appropriate network topology, transmission media, switching techniques, VLAN configuration, IP addressing schemes, routing protocols (RIP, OSPF, BGP), and transport layer services to satisfy application requirements.	PO3, PO11
CO5	Develop networking solutions using suitable application layer protocols (HTTP, SMTP, SNMP, DNS), transport protocols, routing strategies, congestion control mechanisms, and network security techniques to address real-world communication requirements.	PO4, PO5, PO11
CO6	Evaluate real-world networking case studies involving campus networks, enterprise networks, ISP architectures, network attacks and defenses, cloud networking, IoT applications, and multimedia streaming through technical reports, seminar presentations, and discussions beyond the syllabus.	PO7, PO9, PO10, PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3											3	2	2
CO3		3										2	2	2
CO4			3									3	2	2
CO5				3	3							3	2	2
CO6							3		3	3	3	3	2	2
22SPC512	3	3	3	3	3		3		3	3	3	3	2	2

22SPC513 ARTIFICIAL INTELLIGENCE		Sem: 5
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Apply the fundamental concepts of artificial intelligence, intelligent agents and state-space representations to formulate solutions for computational problems.	PO1, PO2, PO3, PO5, PO11
CO2	Analyze artificial intelligence problem-solving approaches using search, optimization and decision-making techniques to solve complex problems.	PO1, PO2, PO3, PO4, PO5, PO11
CO3	Analyze knowledge representation, logical reasoning and inference techniques for developing intelligent systems.	PO2, PO3, PO4, PO5, PO8, PO11
CO4	Evaluate probabilistic models and reasoning techniques for intelligent decision-making under uncertainty.	PO2, PO4, PO5, PO6, PO11
CO5	Create intelligent solutions by integrating search, reasoning and probabilistic techniques for real-world applications.	PO3, PO4, PO5, PO6, PO11
CO6	Evaluate Generative AI models and formulate effective prompts for diverse application domains.	PO2, PO5, PO8, PO10, PO11

ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	2	-	-	-	-	-	1	3	2	1
CO2	3	3	3	2	2	-	-	-	1	-	1	3	3	2
CO3	-	3	2	3	2	-	-	1	-	-	1	3	2	2
CO4	-	3	-	3	3	1	-	-	1	-	2	2	3	3
CO5	-	-	3	3	3	2	-	-	1	-	2	3	3	3
CO6	-	3	-	-	3	-	-	2	-	2	3	2	2	2
22SPC513	1	3	2	2	3	1	-	1	1	1	2	3	3	2

22SPC514 WEB PROGRAMMING		Sem: 5
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Design responsive web pages using HTML, CSS, JavaScript, and TypeScript.	--
CO2	Develop basic server-side applications using the Node.js runtime environment.	PO1,PO2,PO3, PO11
CO3	Build web applications using the Express.js framework by implementing routing and middleware.	PO2,PO3, PO11
CO4	Develop database-driven web applications by integrating MongoDB with Node.js applications.	PO2,PO3,PO11
CO5	Design and develop web applications using the MEAN (MongoDB, Express.js, Angular, Node.js) framework.	PO3,PO4,PO5, PO11
CO6	Develop, integrate, and deploy complete full-stack web applications using the MEAN framework to solve real-world problems while following industry-standard web development practices.	PO1, PO2, PO3, PO5, PO10, PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	1	2	2	
CO3	-	3	2	-	-	-	-	-	-	-	1	2	2	-
CO4	-	2	3	-	-	-	-	-	-	-	1	3	2	-
CO5	-	-	3	2	2	-	-	-	-	-	2	2	2	1
CO6	2	2	3	-	3	-	-	-	-	2	2	2	2	1
22SPC514	2	2	3	2	3	-	-	-	-	2	2	2	2	1

22SPC515 SOFTWARE ENGINEERING METHODOLOGIES		Sem: 5
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Apply software engineering principles, process models, requirements engineering practices, software design concepts, testing strategies and project management techniques for software development.	PO1,PO2,PO3
CO2	Apply software engineering methodologies to develop requirement models, software designs, testing plans and project management artifacts for software systems.	PO2,PO3,PO4
CO3	Analyze software processes, design alternatives, quality assurance practices and project management approaches to select appropriate methodologies for software development.	PO2,PO3,PO4,PO5
CO4	Evaluate software engineering practices, estimation models, testing strategies and project management techniques to improve software quality and project success.	PO3,PO4,PO5,PO6, PO10
CO5	Evaluate software engineering solutions considering quality, maintainability, agility, risk, customer requirements and project constraints.	PO4,PO5,PO6,PO7,PO9,PO10
CO6	Design and develop software engineering solutions by integrating software processes, design principles, testing methodologies and project management practices to address real-world software problems.	PO5,PO6,PO7,PO9, PO10,PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									3	2	1
CO2		3	2	1								2	3	2
CO3		1	3	2	1							2	2	3
CO4			1	3	2	1				2		1	2	3
CO5				1	3	2	2		1	2		1	2	3
CO6					1	2	2	2	3	2	3	2	3	3
22SPC515	3	2	2	2	2	2	2	2	2	2	3	2	2	3

22SPC516 COMPUTER NETWORKS LABORATORY		Sem: 7
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Apply Linux networking tools, web-based utilities and network configuration techniques to analyze computer networks.	PO1,PO2,PO3
CO2	Apply socket programming concepts to develop TCP and UDP client-server applications.	PO2,PO3,PO4
CO3	Analyze routing algorithms, switching techniques, and protocol behavior using packet analyzers and network simulation tools.	PO2,PO3,PO4,PO5
CO4	Analyze network performance metrics, congestion control mechanisms, and Quality of Service (QoS) using experimental and simulation results.	PO2,PO4,PO5
CO5	Evaluate wired and wireless network protocols, security mechanisms, and communication performance for different networking environments.	PO3, PO4, PO5, PO6, PO10
CO6	Design and implement network-based applications and simulated communication systems to solve real-world networking problems.	PO5,PO6,PO7,PO9,PO10,PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									3	2	
CO2		3	2	1								2	3	
CO3		1	3	2	1							2	3	1
CO4			1	3	2	1				2		2	3	2
CO5					3	2	2		1	2	3	2	3	3
CO6			3		3	2	2		2	2	2	3	3	2
22SPC516	3	2	2	2	2	2	2		1	2	3	2	3	2

22SPC721 DIGITAL IMAGE PROCESSING		Sem: 7
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Explain the fundamentals of digital image processing, image acquisition, color models, image representation, and basic image operations.	--
CO2	Apply image transformation and enhancement techniques in the spatial and frequency domains to improve image quality.	PO1,PO11
CO3	Analyze image degradation models and apply appropriate image restoration techniques to recover degraded images.	PO2,PO11
CO4	Design and implement image segmentation and morphological operations for extracting meaningful objects and features from digital images.	PO3, PO8, PO11
CO5	Evaluate various image compression techniques and recognition methods to design efficient image processing solutions for practical applications.	PO4, PO6, PO9, PO11
CO6	Develop an image processing solution by integrating enhancement, restoration, segmentation, compression, and recognition techniques for a real-world application.	PO3, PO6, PO8

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2	3										2	3	2	
CO3		3									2	3	2	2
CO4			3					2			2	3	3	2
CO5				3		2			2		2	3	3	3
CO6			3			2		2				3	3	3
22SPC721	3	3	3	3		2		2	1		2	3	3	2

22SPC722 CLOUD ESSENTIALS		Sem: 7
COURSE OUTCOMES:		POs Mapped
At the end of the course students will be able to.		
CO1	Apply cloud computing concepts, service models, deployment models and cloud characteristics to solve basic computing problems.	PO1,PO2,PO3
CO2	Apply virtualization technologies, cloud infrastructure mechanisms and containerization techniques to deploy cloud-based applications.	PO2,PO3,PO4
CO3	Analyze cloud infrastructure, security mechanisms and virtualization solutions to select suitable cloud architectures for different application requirements.	PO2,PO3,PO4,PO5
CO4	Analyze various cloud security mechanisms, cloud platforms and resource management strategies for secure, scalable and efficient cloud solutions.	PO3,PO4,PO5,PO6,PO10
CO5	Design and develop cloud-based solutions by integrating virtualization, cloud infrastructure, security mechanisms and cloud platforms to address real-world computing problems.	PO5,PO6,PO7,PO9,PO10,PO11
CO6	Analyze and recommend appropriate cloud deployment models, virtualization technologies, security mechanisms, and cloud platform services for diverse organizational and application requirements.	PO2, PO3, PO4, PO5,PO6 , PO10,PO11

COURSE ARTICULATION MATRIX:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1									3	2	
CO2		3	2	1								2	3	
CO3		1	3	2	1							2	3	1
CO4			1	3	2	1				2		2	3	2
CO5					3	2	2		1	2	3	2	3	3
CO6		3	2	3	2	2				1	2	2	3	2
22SPC722	3	2	2	2	2	2	2		1	2	2	2	3	2