

DHANALAKSHMI SRINIVASAN INSTITUTE OF RESEARCH AND TECHNOLOGY

(Deemed to be University under section 3 of UGC Act, 1956.)

PERAMBALUR – 621 212, TAMIL NADU, INDIA.

SCHOOL OF ARTS AND SCIENCE

CURRICULUM AND SYLLABUS

B.Sc. COMPUTER SCIENCE

REGULATION 2026

PROGRAMME:

Vision:

To function as a dynamic foundation for computer science excellence, empowering enthusiastic young minds, proficient coders, and innovative problem-solvers who master core computing principles to enable technological progress, digital transformation, and societal benefit.

Mission:

- To offer inclusive, flexible, and interdisciplinary undergraduate programs in computer science that integrate programming fundamentals, algorithms, data structures, and modern technologies, developing graduates with strong technical, analytical, and logical skills for varied career opportunities and continuous learning.
- To promote practical inquiry and foundational research in software development, networking, databases, and computational applications, addressing important challenges in industry, education, healthcare, and daily life.
- To broaden access to quality computer science education for rural and underserved students by merging contemporary IT knowledge with local requirements, supporting digital preservation of cultural heritage, and building entrepreneurial competencies for self-reliant career growth.
- To cultivate ethical standards, social responsibility, and global perspective through hands-on coding projects, industry linkages, community engagements, and experiential learning that effectively connects theoretical concepts with real-world computing solutions.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO	PROGRAM EDUCATIONAL OBJECTIVES
PEO1	To equip graduates with a robust foundation in core computer science subjects including programming, computer architecture, algorithms, and database systems, preparing them for entry-level roles in the IT industry, software development, and higher education.
PEO2	To develop logical reasoning, analytical abilities, and programming proficiency so that graduates can design, implement, test, and maintain efficient software applications and systems for practical problems
PEO3	To foster professional ethics, effective communication, teamwork, and collaborative skills that enable graduates to work responsibly in multidisciplinary teams and contribute positively to the computing domain.
PEO4	To encourage lifelong learning and adaptability, empowering graduates to keep pace with evolving technologies and pursue advanced studies, certifications, or entrepreneurial initiatives in computer science.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	PROGRAM SPECIFIC OUTCOMES
PSO1	Graduates will be proficient in applying fundamental programming concepts, data structures, algorithms, and software development practices to create functional, reliable, and user-oriented applications.
PSO2	Graduates will demonstrate competence in database management, computer networks, web technologies, and basic system analysis, enabling them to contribute effectively to the IT industry, software projects, and technology-driven community initiatives.

PROGRAM OUTCOMES (POs)

PO	PROGRAM OUTCOMES
PO1	Disciplinary Knowledge Demonstrate comprehensive knowledge and understanding of the fundamental concepts, theories, principles, and applications in the chosen discipline and allied fields.
PO2	Critical Thinking and Problem Solving Identify, analyze, and solve complex academic, professional, and societal problems using logical reasoning, analytical skills, and evidence-based approaches.
PO3	Research and Inquiry Apply scientific methods, research techniques, and investigative skills to conduct studies, analyze data, interpret results, and draw meaningful conclusions.
PO4	Creativity and Innovation Develop innovative ideas, creative solutions, and entrepreneurial approaches to address contemporary challenges in academic, professional, and social contexts.
PO5	Digital and Technological Competence Utilize appropriate digital technologies, software tools, and information resources effectively and ethically for learning, research, communication, and problem-solving.
PO6	Environment and Sustainability Understand environmental issues and sustainable development goals and apply this knowledge to promote ecological balance and responsible resource utilization.
PO7	Ethics and Social Responsibility Demonstrate ethical values, integrity, inclusiveness, and social responsibility while contributing positively to society and professional environments.
PO8	Teamwork and Leadership Work effectively as an individual and as a member or leader of diverse and multidisciplinary teams, demonstrating leadership, collaboration, and interpersonal skills.
PO9	Communication Skills Communicate effectively through oral, written, visual, and digital means with diverse audiences in academic, professional, and societal settings.
PO10	Employability and Entrepreneurship Develop professional competencies, managerial abilities, and entrepreneurial skills required for employment, higher education, and self-employment opportunities.
PO11	Lifelong Learning Recognize the need for continuous learning, adaptability, and self-development to meet evolving personal, professional, and societal demands in a dynamic global environment.

SEMESTER-I

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
I	I	AEC	Tamil/Hindi/French-I	TA26C01/ HA26C01/ FA26C01	3	0	0	3	40	60	100
	II	AEC	English-I	EN26C01	3	0	0	3	40	60	100
	III	Core	Fundamentals of Programming with C and Python	UCS26101	3	0	0	3	40	60	100
		Core	Programming Lab using C and Python	UCS26102	0	0	4	2	40	60	100
		Core	Computer Organization and Architecture	UCS26103	4	0	0	4	40	60	100
		MDC	Multi-Disciplinary Course – I		3	0	0	3	40	60	100
	IV	VAC	Human Values	VAC26001	2	0	0	2	40	60	100
								20			700

SEMESTER-II

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
II	I	AEC	Tamil/Hindi/French-II	TA26C02/ HA26C02/ FA26C02	3	0	0	3	40	60	100
	II	AEC	English-II	EN26C02	3	0	0	3	40	60	100
	III	Core	Data Structures using Java	UCS26204	3	0	0	3	40	60	100
		Core	Data Structures using Java Lab	UCS26205	0	0	4	2	40	60	100
		Core	Operating Systems	UCS26206	3	1	0	4	40	60	100
		MDC	Multi-Disciplinary Course – II		3	0	0	3	40	60	100
	IV	VAC	Environmental Studies and Sustainability	VAC26002	2	0	0	2	40	60	100
								20			700

SEMESTER-III

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
III	I	AEC	Tamil/Hindi/French-III	TA26C03/ HA26C03/ FA26C03	3	0	0	3	40	60	100
	II	AEC	English-III	EN26C03	3	0	0	3	40	60	100
	III	Core	Database Management Systems and NoSQL Databases	UCS26307	3	0	0	3	40	60	100
		Core	Database Management Systems Lab	UCS26308	0	0	4	2	40	60	100
		MDC	Multi-Disciplinary Course – III		3	0	0	3	40	60	100
		DEC	Software Engineering	UCS26001	3	1	0	4	40	60	100
			Multimedia Systems	UCS26002							
			Linux Administration	UCS26003							
	IV	VAC	IKS	VAC26003	3	0	0	3	40	60	100
								21			700

SEMESTER-IV

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
IV	I	AEC	Tamil/Hindi/French-IV	TA26C04/ HA26C04/ FA26C04	3	0	0	3	40	60	100
	II	AEC	English-IV	EN26C04	3	0	0	3	40	60	100
	III	Core	Full Stack Development	UCS26409	3	0	0	3	40	60	100
		Core	Full Stack Development Lab	UCS26410	0	0	4	2	40	60	100
		MDC	Multi-Disciplinary Course – IV		3	0	0	3	40	60	100
		DEC	Cloud Computing	UCS26004	3	1	0	4	40	60	100
			Artificial Intelligence and Intelligent Systems	UCS26005							
			Mobile Application Development	UCS26006							
	IV	VAC	Ethics in AI	VAC26004	3	0	0	3	40	60	100
	V	EAA	Extra Academic Activity (NSS,NCC,YRC.....)					1*			
								21			700

SEMESTER-V

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
V	III	Core	Machine Learning Fundamentals	UCS26511	3	0	0	3	40	60	100
		Core	Machine Learning Fundamentals Lab	UCS26512	0	0	4	2	40	60	100
		Core	Computer Network	UCS26513	4	0	0	4	40	60	100
		DEC	Big Data Technologies	UCS26007	3	0	2	4	40	60	100
			Scripting Languages for Automation	UCS26008							
			Data Warehouse and Business Intelligence	UCS26009							
		DEC	Cloud Computing Fundamentals	UCS26010	4	0	0	4	40	60	100
			Blockchain Technology	UCS26011							
			Software Testing and Quality Assurance	UCS26012							
		SEC	Internet of Things and Smart Systems	UCS26S01	4	0	0	4	40	60	100
			Embedded Systems using Arduino	UCS26S02	3	0	2	4	40	60	100
	IV	EE	Experiential Elective (Internship)	UCSEE01	*			2	*	*	100
								27			800

SEMESTER-VI

Semester	Part	Course Category	Title of the Course	Course Code	L	T	P	Credits	Marks		
									CAT	ESE	Total
VI	III	Core	Data Science using R	UCS26614	3	0	0	3	40	60	100
		Core	Data Science using R Lab	UCS26615	0	0	4	2	40	60	100
		Core	Project	UCS26616	0	0	12	6	40	60	100
		DEC	DevOps Fundamentals	UCS26013	3	0	2	4	40	60	100
			Cyber Security and Ethical Hacking	UCS26014							
			Designing using GIMP	UCS26015							
		DEC	Internet Security and Digital Forensics	UCS26016	4	0	0	4	40	60	100
			Natural Language Processing	UCS26017							
			Computer Vision and Image Processing	UCS26018							
		SEC	UI/UX Design using Figma and Canva	UCS26S05	3	0	2	4	40	60	100
			Digital Content Creation and Graphic Design	UCS26S06	4	0	0	4	40	60	100
	IV	VAC	Gender Studies	VAC26005	2	0	0	2	40	60	100
								29			800

MDC offered to other Department

- | | | |
|-------------|---|---|
| 1. UCS26901 | - | Digital Literacy and Productivity Tools |
| 2. UCS26902 | - | Internet Technologies and Digital Communication |
| 3. UCS26903 | - | Multimedia Design and Digital Content Creation |
| 4. UCS26904 | - | Artificial Intelligence and Emerging Technologies |

DEC offered by the Department

- | | | |
|--------------|---|---|
| 1. UCS26001 | - | Software Engineering |
| 2. UCS26002 | - | Multimedia Systems |
| 3. UCS26003 | - | Linux Administration |
| 4. UCS26004 | - | Cloud Computing |
| 5. UCS26005 | - | Artificial Intelligence and Intelligent Systems |
| 6. UCS26006 | - | Mobile Application Development |
| 7. UCS26007 | - | Big Data Technologies |
| 8. UCS26008 | - | Scripting Language for Automation |
| 9. UCS26009 | - | Data Warehouse and Business Intelligence |
| 10. UCS26010 | - | Cloud Computing Fundamentals |
| 11. UCS26011 | - | Blockchain Technology |
| 12. UCS26012 | - | Software Testing and Quality Assurance |
| 13. UCS26013 | - | DevOps Fundamentals |
| 14. UCS26014 | - | Cyber Security and Ethical Hackings |
| 15. UCS26015 | - | Designing Using GIMP |
| 16. UCS26016 | - | Internet Security and Digital Forensics |
| 17. UCS26017 | - | Natural Language Processing |
| 18. UCS26018 | - | Computer Vision and Image Processing |

Semester-wise Categorization of Courses

COURSE CATEGORY	Semester						No of Courses	Total Credits
	I	II	III	IV	V	VI		
Ability Enhancement Course (Core Language Foundation)	2	2	2	2	-	-	8	24
Major Stream Core (MSC- Specialization focus)	3	3	2	2	3	3	16	48
Multi-Disciplinary Course (MDC – Allied fields)	1	1	1	1	-	-	4	12
Disciplinary Elective (DEC / Major Electives)	-	-	1	1	2	2	6	24
Skill Enhancement Course (SEC-Professional skills)	-	-	-	-	2	2	4	16
VAC–Value Added Course	1	1	1	1	-	1	5	12
EE–Experiential Elective	-	-	-	-	1	-	1	2
EAA–Extra Academic Activity	-	-	-	1	-	-	1	1*
Total Courses Per Semester	7	7	7	8	8	8	45 (Courses)	
Total Credits	20	20	21	21	27	29	138 (Credits)	

Unit-II	Structured Programming using C	9 Hrs.
Decision-Making Statements (if, if-else, nested if, switch) – Iterative Statements (while, do-while, for, break, continue) – One-Dimensional Arrays – Strings – User-Defined Functions – Function Declaration and Definition – Function Arguments – Return Statement – Introduction to Pointer Concepts.		
Unit-III	Fundamentals of Python Programming	9 Hrs.
Introduction to Python – Features of Python – Installation and Execution Environment – Python Syntax – Variables and Identifiers – Data Types – Type Conversion – Operators and Expressions – Input and Output Functions – Comments – Interactive Mode – Script Mode – Basic Python Programs.		
Unit-IV	Control Structures and Data Structures in Python	9 Hrs.
Conditional Statements: if – if-else – nested if – elif – Iterative Statements: for Loop – while Loop – break, continue and pass Statements – User-defined Functions – Function Arguments – Return Statement – Strings – Lists – Tuples – Dictionaries – Sets.		
Unit-V	File Handling and Exception Handling in Python	9 Hrs.
File Handling – Opening, Reading, Writing and Appending Files – File Modes – Working with Text Files – Exception Handling: try, except, else, and finally Blocks – Raising Exceptions – Modules – Introduction to Packages – Applications of Python in Data Science, Artificial Intelligence, Automation and Web Development.		

Text Book(s):

1. Programming in ANSI C, 9th Edition, McGraw Hill Education (India), 2024.
2. Let Us C, 18th Edition, Yashavant Kanetkar, BPB Publications, 2023.
3. Python Programming using Problem Solving Approach, Oxford University Press, 2023.
4. Python for Programmers, Paul Deitel and Harvey Deitel, Pearson Education, 2020.

Reference Book(s):

1. The C Programming Language, Brian W. Kernighan and Dennis M. Ritchie, 2nd Edition Pearson Education.
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, 3rd Edition, O'Reilly Media, 2024.
3. Python Programming: An Introduction to Computer Science, John M. Zelle, 3rd Edition, Franklin, Beedle & Associates.
4. Learning Python, Mark Lutz, 5th Edition, O'Reilly Media.

e Resources:

1. <https://eduguide.home.blog/wp-content/uploads/2019/02/programming-in-ansi-c-6th-edition-by-e.-balaguruswamy-pdf-free-download.pdf>
2. <https://docs.python.org/3/tutorial/index.html>
3. https://www.google.co.in/books/edition/Learn_Python_the_Fun_Way_A_Guide_for_Eve/82P6EAAAQBAJ?hl=en&gbpv=1&dq=learning+python&pg=PA2&printsec=frontcover

Relationship Matrix for COs, POs and PSOs

Semester	Course code		Title of the course										Hours	Credit
I	UCS26101		Fundamentals of Programming with C and Python										3	3
Course Outcomes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	1	1	2	-	-	-	2	2	2	3	1	2.00
CO2	3	3	2	2	3	-	-	-	2	2	2	3	3	2.38
CO3	3	3	2	2	3	-	-	-	2	2	2	3	3	2.38
CO4	3	3	2	2	3	-	-	1	2	2	2	3	3	2.46
CO5	3	3	3	3	3	-	-	1	2	3	3	3	3	2.77
Mean	3.00	3.00	2.00	2.00	2.80	-	-	1.00	2.00	2.20	2.20	3.00	2.60	2.40

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UCS26102	Programming Lab using C and Python	Core			4	2
Pre-Requisite: Nil			Co- Requisite: Fundamentals of Programming with C and Python	Progressive Course: Data Structures using Java Lab			
Course Objectives:							
1. Develop structured programming solutions using the C programming language.							
2. Apply programming constructs such as decision-making, looping, arrays, strings, functions and introductory pointer concepts in C.							
3. Develop Python programs using control structures, functions, and built-in data structures.							
4. Apply file handling and exception handling techniques in Python applications.							
5. Develop simple real-world applications using C and Python programming concepts.							
Course Outcomes:							
CO1: Develop C programs using variables, operators, input/output statements, and control structures.						(K3)	
CO2: Implement C programs using arrays, strings, functions, and introductory pointers to solve computational problems.						(K3)	
CO3: Develop Python programs using control structures, functions, and built-in data structures.						(K3)	
CO4: Apply file handling, modules, and exception handling techniques in Python applications						(K3)	
CO5: Develop simple real-world applications using C and Python programming concepts						(K3)	
List of Practical Exercises						60 Hrs	
C Programming							
1. Develop a Student Mark Sheet Generator to calculate total, average, percentage, and grade.						(4 hrs)	
2. Develop a Bus Fare Calculator to determine the ticket fare based on age and travel distance.						(4 hrs)	
3. Develop a Monthly Water Consumption Calculator to estimate household water usage over a month.						(4 hrs)	
4. Develop a Class Performance Analyzer to identify the highest, lowest, and average marks using arrays.						(5 hrs)	
5. Develop a Username Validator to check the validity of usernames using string handling functions.						(4 hrs)	
6. Develop a Unit Conversion Utility (Length, Weight, Temperature) using user-defined functions.						(5 hrs)	
7. Demonstrate Pointer Concepts by exchanging values and accessing array elements using pointers.						(4 hrs)	

Python Programming

8. Develop a Body Mass Index (BMI) Calculator with health category classification. (4 hrs)
9. Develop a Library Fine Calculator to compute overdue charges based on the number of delayed days. (4 hrs)
10. Develop a Shopping Bill Calculator with discount computation using user-defined functions. (4 hrs)
11. Develop a Sentence Analyzer to count words, vowels, digits, and special characters. (4 hrs)
12. Develop a Student Course Registration Manager using lists, tuples, dictionaries, and sets. (5 hrs)
13. Develop a Personal Expense Tracker to store and retrieve daily expenses using text files. (5 hrs)
14. Develop a User Input Validation System using exception handling techniques. (4 hrs)

Relationship Matrix for COs, POs and PSOs

Semest er	Course code			Title of the course								Hours		Credit
I	UCS26102			Programming Lab using C and Python								4		2
Course Outco mes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	2	1	3	-	-	1	2	2	2	3	2	2.23
CO2	3	3	2	3	3	-	-	2	2	2	2	3	3	2.54
CO3	3	3	2	3	3	-	-	2	2	2	2	3	3	2.54
CO4	3	3	3	3	3	-	-	2	2	3	2	3	3	2.77
CO5	3	3	3	3	3	-	-	2	3	3	3	3	3	2.92
Mean	3.00	3.00	2.40	2.60	3.00	-	-	1.80	2.20	2.40	2.20	3.00	2.80	2.60

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UCS26103	Computer Organization and Architecture	Core	4			4
Pre-Requisite: Nil			Co- Requisite: Nil	Progressive Course: Operating Systems.			
Course Objectives:							
1. Understand the fundamentals concepts of digital logic and data representation used in computer systems.							
2. Explain the organization and architecture of computer systems, including processor organization and instruction execution.							
3. Explain memory hierarchy and input/output organization in computer systems.							
4. Describe instruction set architecture, addressing modes, and processor performance enhancement techniques.							
5. Apply computer organization and architecture concepts to analyze the performance of modern computing systems.							
Course Outcomes:							
CO1: Explain digital logic concepts, number systems, Boolean algebra and data representation techniques. (K2)							
CO2: Describe CPU organization, register transfer operations, instruction formats, and addressing modes. (K2)							
CO3: Explain processor organization, instruction execution, and basic processor performance enhancement techniques. (K3)							
CO4: Explain memory hierarchy, cache memory, virtual memory, and input/output organization. (K2)							
CO5: Apply computer organization and architecture concepts to explain the operation of modern computing systems. (K3)							
Unit-I	Digital Logic Fundamentals and Data Representation						12 Hrs.
Digital Systems – Number Systems (Binary, Decimal, Octal and Hexadecimal) – Number System Conversions – Binary Arithmetic – Signed Number Representation (1's Complement, 2's Complement) – Character Representation (ASCII and Unicode) – Boolean Algebra – Boolean Laws – Logic Gates – Universal Gates – Simplification of Boolean Expressions – Karnaugh Maps – Introduction to Digital Circuits.							

Unit-II	Register Transfer and Processor Organization	12 Hrs.
Basic Structure of Computer Systems – Functional Units – Von Neumann Architecture – Bus Organization – Register Transfer Language (RTL) – Register Transfer Operations – Arithmetic Micro-Operations – Logic Micro-Operations – Shift Micro-Operations – CPU Organization – Arithmetic Logic Unit (ALU) – Control Unit – Register Organization.		
Unit-III	Instruction Set Architecture and Processor Design	12 Hrs.
Instruction Formats – Instruction Cycle – Fetch, Decode and Execute Cycle – Addressing Modes – Stack Organization – Subroutine Calls – Interrupts – RISC and CISC Architectures – Introduction to Instruction Pipelining.		
Unit-IV	Memory Organization	12 Hrs.
Memory Hierarchy – Main Memory – RAM – ROM – Cache Memory – Cache Mapping Techniques – Associative Memory – Virtual Memory – Secondary Storage Devices – Introduction to RAID Concepts – Memory Performance Measures.		
Unit-V	Input/Output Organization and Parallel Processing	12 Hrs.
Input/Output Interface – Programmed I/O – Interrupt-Driven I/O – Direct Memory Access (DMA) – I/O Processors – Introduction Parallel Processing Concepts – Flynn's Classification – Multi-core Processors – Introduction to GPU Architecture – Emerging Trends in Computer Architecture.		

Text Book(s):

1. Computer System Architecture, M.Morris Mano, 3rd Edition, Pearson Education.
2. Computer Organization and Embedded Systems, Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Natraig Manjikian, 6th Edition, McGraw-Hill Education.
3. Computer Organization and Architecture: Designing for Performance, William Stallings, 11th Edition, Pearson Education.

Reference Book(s):

1. Computer Architecture and Organization, John P. Hayes, McGraw-Hill.
2. Computer Organization, V.Carl Hamacher, McGraw-Hill
3. Computer Organization and Architecture: Designing for Performance, 11th Edition, Pearson Education.

e Resources:

1. <https://openlibrary.org/search?q=Computer+Organization+Architecture>
2. <https://www.javatpoint.com/computer-organization-and-architecture>
3. <https://www.cs.cmu.edu/~213/>

Relationship Matrix for COs, POs and PSOs

Semester	Course code	Title of the course											Hours	Credit
I	UCS26103	Computer Organization and Architecture											4	4
Course Outcomes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	1	1	2	-	-	-	2	1	2	2	2	1.92
CO2	3	3	2	2	3	-	-	-	2	2	2	3	3	2.38
CO3	3	3	3	2	3	-	-	-	2	2	2	3	3	2.54
CO4	3	3	2	2	3	-	-	-	2	2	2	3	3	2.38
CO5	3	3	3	3	3	-	-	1	2	3	3	3	3	2.77
Mean	3.00	3.00	2.20	2.00	2.80	-	-	1.00	2.00	2.00	2.20	2.80	2.80	2.46

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UCS26204	Data Structures Using Java	Core	3			3
Pre-Requisite: Fundamentals of Programming with C and Python			Co- Requisite: Data Structures using Java Lab	Progressive Course: Database Management Systems and NoSQL Databases.			
Course Objectives:							
1. Understanding the principles of object-oriented programming and Java Programming concepts.							
2. Develop Java programs using control structures, classes, objects, inheritance, polymorphism, exception handling and packages.							
3. Understand the concepts and operations of linear and non-linear data structures.							
4. Analyze searching, sorting and fundamental data structures for efficient problem solving.							
5. Develop Java applications by selecting appropriate data structures to solve computational problems.							
Course Outcomes:							
CO1: Explain the fundamental concepts of Java programming, including program structure, data types, operators, control statements, arrays and strings. (K2)							
CO2: Develop Java programs using classes, objects, methods, constructors, inheritance, polymorphism, packages, and exception handling. (K3)							
CO3: Implement linear data structures such as arrays, linked lists, stacks, and queues using Java. (K3)							
CO4: Analyze searching and sorting techniques and implement appropriate algorithms using Java. (K4)							
CO5: Implement tree and graph data structures using Java to solve simple computational problems. (K3)							
Unit-I	Fundamentals of Java Programming						9 Hrs.
Introduction to Java – Features of Java – Java Virtual Machine (JVM) – Java Development Kit (JDK) – Structure of Java Program – Java Tokens – Keywords – Identifiers – Variables – Constants – Data Types – Operators and Expressions – Type Conversion – Command Line Arguments – Input and Output – Control Statements – Arrays – Strings.							
Unit-II	Object Oriented Programming using Java						9 Hrs.
Classes and Objects – Methods – Constructors – Method Overloading – Static Members – Inheritance – Method Overriding – Polymorphism – Abstract Classes – Interfaces – Packages – Exception Handling.							

Unit-III	Linear Data Structures using Java	9 Hrs.
Introduction to Data Structures – Characteristics and Classification of Data Structures – Time and Space Complexity (Basic Concepts) – Arrays and Applications – Linked Lists (Singly, Doubly, and Circular) – Stacks – Stack Operations – Array and Linked Representations – Applications of Stacks.		
Unit-IV	Queues and Searching Techniques	9 Hrs.
Queues – Queue Operations – Array and Linked Representations – Linear Queue – Circular Queue – Priority Queue – Applications of Queues – Recursion – Linear Search – Binary Search.		
Unit-V	Sorting, Trees and Graphs	15 Hrs.
Sorting Techniques – Bubble Sort – Selection Sort – Insertion Sort – Merge Sort Introduction to Trees – Terminology – Binary Trees – Binary Tree Traversals: Preorder, Inorder, and Postorder – Graph Terminology – Graph Representation – Breadth First Search (BFS) – Depth First Search (DFS) – Applications of Trees and Graphs.		

Text Book(s):

1. Java: The Complete Reference, Herbert Schildt, 13th Edition, McGraw-Hill Education, 2024.
2. Introduction to Java Programming and Data Structures, Y. Daniel Liang, 12th Edition, Pearson Education, 2023.
3. Data Structures using Java, Reema Thareja, Oxford University Press, 2022.
4. Data Structures and Algorithm Analysis in Java, Mark Allen Weiss, 3rd Edition, Pearson Education.

Reference Book(s):

1. Core Java: Fundamentals, Cay S. Horstmann, 12th Edition, Pearson Education.
2. Data Structures and Algorithms in Java, Robert Lafore, 2nd Edition, Pearson Education.
3. Data Structures and Algorithms Made Easy, Narasimha Karumanchi, CareerMonk Publications.

e Resources:

1. <https://docs.oracle.com/javase/tutorial/>
2. <https://openjdk.org/>
3. <https://www.geeksforgeeks.org/dsa/dsa-tutorial-learn-data-structures-and-algorithms/>
4. <https://dev.java/>

Relationship Matrix for COs, POs and PSOs

Seme ster	Course code			Title of the course								Hours		Credit
I	UCS26204			Data Structures using Java								3		3
Course Outco mes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	-	-	2	-	-	-	2	-	2	3	2	1.92
CO2	3	3	1	2	3	-	-	1	2	2	2	3	2	2.00
CO3	3	3	2	2	3	-	-	1	2	2	2	3	3	2.31
CO4	3	3	3	2	3	-	-	1	2	2	2	3	3	2.46
CO5	3	3	3	3	3	-	-	1	2	3	3	3	3	2.62
Mean	3.00	2.80	2.25	2.25	2.80	-	-	1.00	2.00	2.25	2.25	3.00	2.60	2.39

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UCS26205	Data Structures using Java Lab	Core			4	2
Pre-Requisite: Fundamentals of Programming with C and Python			Co- Requisite: Data Structures using Java	Progressive Course: Database Management Systems and NoSQL Databases.			
Course Objectives:							
1. Develop Java program using fundamental programming constructs and object-oriented programming concepts.							
2. Implement linear data structures using Java.							
3. Apply searching and sorting techniques to solve computational problems.							
4. Implement tree and graph traversal algorithms using Java.							
5. Develop Java applications using suitable data structures to solve real-world problems.							
Course Outcomes:							
CO1: Develop Java programs using fundamental programming constructs and object-oriented programming concepts. (K3)							
CO2: Implement linear data structures such as arrays, linked lists, stacks, and queues using Java. (K3)							
CO3: Apply searching and sorting algorithms using Java to solve computational problems. (K3)							
CO4: Implement tree and graph traversal algorithms using Java. (K4)							
CO5: Design and develop Java applications using suitable data structures to solve real-world problems. (K5)							
List of Programs							60 Hrs.
Java Programming:							
1. Develop a Student Grade Calculator using operators and control statements. (4 Hrs)							
2. Develop a Monthly Expense Tracker using arrays and strings. (4 Hrs)							
3. Develop a Library Book Management System using classes, objects, methods, and constructors. (5 Hrs)							
4. Develop an Employee Payroll System using inheritance and method overloading. (5 Hrs)							
5. Develop a Bank Account Management System using exception handling. (5 Hrs)							
Data Structures using Java:							
6. Develop a Student Mark Management System using arrays. (5 Hrs)							

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|---|---------|
| 7. Develop a Music Playlist Management System using a singly linked list. | (5 Hrs) |
| 8. Develop a Browser Back Navigation System using a stack. | (5 Hrs) |
| 9. Develop a Token Queue Management System using a queue. | (5 Hrs) |
| 10. Develop a Student Record Search System using linear search and binary search. | (4 Hrs) |
| 11. Develop a Product Price Sorting System using bubble sort and selection sort. | (4 Hrs) |
| 12. Develop a Course Hierarchy Management System using binary tree traversals. | (5 Hrs) |
| 13. Develop a Campus Route Navigation System using graph traversal (BFS or DFS). | (4 Hrs) |

Relationship Matrix for COs, POs and PSOs

Seme ster	Course code		Title of the course										Hours	Credit
I	UCS26205		Data Structures using Java Lab										4	2
Course Outco mes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	-	-	3	-	-	1	2	-	2	3	2	2.00
CO2	3	3	2	2	3	-	-	2	2	3	2	3	3	2.54
CO3	2	3	2	2	3	-	-	2	2	2	2	3	3	2.46
CO4	2	3	3	3	3	-	-	2	2	2	2	3	3	2.46
CO5	3	3	3	3	3	-	-	2	2	3	3	3	3	2.62
Mean	2.60	2.80	2.50	2.50	3.00	-	-	1.80	2.00	2.50	2.20	3.00	2.80	2.42

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UCS26206	Operating Systems	Core	3	1		4
Pre-Requisite: Computer Organization and Architecture			Co- Requisite: NII	Progressive Course: Computer Network			
Course Objectives:							
1. Understand the fundamental concepts, architecture, and services of operating systems.							
2. Analyze process management techniques, threads, and CPU scheduling algorithms.							
3. Apply synchronization mechanisms and deadlock handling techniques in concurrent computing environments.							
4. Examine memory management, virtual memory, and file system organization in operating systems.							
5. Analyze storage management, input/output management, and security mechanisms employed in modern operating systems.							
Course Outcomes:							
CO1: Explain the Architecture, functions, and services and types of operating systems. (K2)							
CO2: Analyze process management concepts, threads, and CPU scheduling algorithms used in operating systems. (K4)							
CO3: Apply process synchronization mechanisms and deadlock handling techniques for concurrent process execution. (K3)							
CO4: Analyze memory management, virtual memory, and file system organization in operating systems. (K4)							
CO5: Evaluate storage management, input/output management, and security mechanisms in modern operating systems. (K4)							
Unit-I	Introduction to Operating Systems						12 Hrs.
Introduction to Operating Systems – Evolution of Operating Systems – Objectives and Functions of Operating Systems – Architecture of Operating Systems – Types of Operating Systems (Batch, Multiprogramming, Multitasking, Time Sharing, Real-Time, Distributed and Mobile Operating Systems) – Operating System Services – System Calls – Operating System Structures – Kernel and Shell – Booting Process – Virtual Machines.							

Unit-II	Process Management and CPU Scheduling	12 Hrs.
Process Concept – Process States – Process Control Block (PCB) – Process Scheduling – Threads and Multithreading – Context Switching – CPU Scheduling Criteria – Scheduling Algorithms (FCFS, SJF, Priority Scheduling and Round Robin) – Inter-Process Communication (IPC).		
Unit-III	Process Synchronization and Deadlocks	12 Hrs.
Critical Section Problem – Synchronization Hardware – Mutex Locks – Semaphores – Classical Synchronization Problems: Producer–Consumer, Readers–Writers and Dining Philosophers – Deadlock Concepts – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection and Recovery.		
Unit-IV	Memory Management	12 Hrs.
Memory Management Concepts – Contiguous Memory Allocation – Paging – Segmentation – Virtual Memory – Demand Paging – Thrashing – Page Replacement Algorithms: FIFO, LRU and Optimal – Memory Management in Modern Operating Systems.		
Unit-V	File Systems and I/O Management	12 Hrs.
File System Concepts – File Organization – File Access Methods – Directory Structures – File Allocation Methods – Free Space Management – Disk Scheduling Algorithms – Overview of Secondary Storage Devices – Input/Output Management – Interrupts – Device Management – Protection Mechanisms.		

Text Book(s):

1. Operating Systems Concepts, Abraham Silberschatz, Peter.B Galvin and Greg Gagne, 10th Edition, Wiley India, 2023.
2. Modern Operating Systems, Andrew S. Tanenbaum and Herbert Bos, 5th Edition, Pearson Education, 2022.
3. Operating Systems: Internals and Design Principles, William Stallings, 10th Edition Pearson Education, 2023

Reference Book(s):

1. An Introduction to Operating Systems, Pramod Chandra P, Bhatt, PHI Learning,
2. Operating Systems, Harvey M. Deitel, Paul J. Deitel and David R. Choffnes, Pearson Education.
3. Understanding Operating Systems: A Modern Perspective, Gary Nutt, Pearson Education

e Resources:

1. <https://open.umn.edu/opentextbooks/textbooks/operating-systems-and-middleware-supporting-controlled-interaction>
2. <https://pages.cs.wisc.edu/~remzi/OSTEP/>
3. <https://ocw.mit.edu/courses/6-1810-operating-system-engineering-fall-2023/>

Relationship Matrix for COs, POs and PSOs

Seme ster	Course code	Title of the course											Hours	Credit
II	UCS26206	Operating Systems											4	4
Course Outco mes (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	2	-	-	3	-	-	1	2	-	2	3	2	2.15
CO2	3	3	2	2	3	-	-	1	2	2	2	3	2	2.38
CO3	3	3	2	2	3	-	1	1	2	2	2	3	3	2.46
CO4	3	3	3	2	3	-	-	1	2	2	2	3	3	2.54
CO5	3	3	3	3	3	-	2	1	2	3	3	3	3	2.77
Mean	3.00	2.80	2.50	2.25	3.00	-	1.50	1.00	2.00	2.25	2.20	3.00	2.60	2.46

MDC

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
I	UCS26901	Digital Literacy and Productivity Tools	MDC	3			3
Pre-Requisite: Nil			Co- Requisite: Nil	Progressive Course: Internet Technologies and Digital Communication			
Course Objectives:							
1. Understand the fundamentals of computer systems, digital technologies and operating systems.							
2. Develop proficiency in office productivity applications for academic and professional purposes							
3. Create and manage digital documents, spreadsheets, and presentations using productivity tools.							
4. Utilize cloud-based collaboration tools and digital communication platforms for effective teamwork							
5. Practice cyber safety, responsible digital citizenship and ethical use of digital technologies							
Course Outcomes:							
CO1: Explain the fundamentals of computer systems, operating systems and digital technologies.						(K2)	
CO2: Apply word processing tools to create professional documents and reports.						(K3)	
CO3: Utilize spreadsheet applications for data organization, calculations and visualization.						(K3)	
CO4: Develop effective multimedia presentations by applying presentation design principles using presentation software.						(K5)	
CO5: Demonstrate safe and responsible use of digital communication and collaboration technologies.						(K3)	
Unit-I	Introduction to Digital Systems						9 Hrs.
Introduction to Digital Literacy – Evolution of Computers – Characteristics of Computers – Hardware and Software – Input, Output and Storage Devices – Operating Systems and Their Functions – Mobile Computing Devices – Cloud Computing Basics – Digital Transformation in Everyday Life.							
Unit-II	Word Processing and Documentation						9 Hrs.
Introduction to Word Processing Software – Creating and Managing Documents – Text Formatting – Page Layout – Headers and Footers – Tables – Images – SmartArt – Mail Merge – Templates – Academic and Professional Documentation.							
Unit-III	Spreadsheet Applications						9 Hrs.

Introduction to Spreadsheets – Worksheets and Workbooks – Data Entry and Formatting – Formulae and Functions – Mathematical and Statistical Functions – Data Sorting and Filtering – Charts and Graphs – Budget Preparation – Academic and Personal Data Management.

Unit-IV	Presentation Technologies	9 Hrs.
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Introduction to Presentation Software – Slide Creation and Formatting – Themes and Templates – SmartArt – Multimedia Integration – Animations and Transitions – Presentation Design Principles – Infographics – Delivering Effective Presentations – Academic and Business Presentation Development.

Unit-V	Digital Collaboration and Cyber Awareness	9 Hrs.
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Electronic Communication Tools – E-mail Management – Cloud Storage Services – Online Collaboration Platforms – Virtual Meeting Technologies – Digital Citizenship and Digital Footprint – Cyber Security Fundamentals – Malware and Phishing Attacks – Password Security – Safe Internet Practices.

Text Book(s):

1. Digital Literacy Fundamentals, Douglas E. Comer, 2nd Edition, Pearson Education, 2023.
2. Microsoft Office 365 Complete, Shelley Gaskin, Alicia Vargas and Nancy Graviett, 2023 Edition, Pearson Education.
3. Discovering Computers and Digital Technology, Misty Vermaat, 2024 Edition, Cengage Learning.

Reference Book(s):

1. Computer Fundamentals, P.K. Sinha and Priti Sinha, 8th Edition, BPB Publications, 2023.
2. Using Information Technology, Brian K. Williams and Stacey Sawyer, 12th Edition, McGraw Hill.
3. Digital Skills for the Modern Workplace, Steven Freund, Cengage Learning, 2023.

e Resources:

1. https://www.tutorialspoint.com/computer_fundamentals/index.htm
2. <https://support.microsoft.com/en-us/excel>
3. <https://support.microsoft.com/en-us/word>

Relationship Matrix for COs, POs and PSOs

Semester	Course code			Title of the course								Hours		Credit
I	UCS26901			Digital Literacy and Productivity Tools								3		3
Course Outcome s (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	1	1	3	1	2	2	2	2	2	2	2	2.00
CO2	3	3	2	2	3	1	2	2	3	3	2	2	2	2.31
CO3	3	3	2	3	3	1	2	2	3	3	2	2	2	2.38
CO4	3	3	2	3	3	1	3	3	3	3	2	2	2	2.46
CO5	3	3	2	2	3	2	3	3	3	3	3	2	2	2.62
Mean	3.00	3.00	1.80	2.20	3.00	1.20	2.40	2.40	2.80	2.80	2.20	2.00	2.00	2.35

Sem	Course Code	Title of the Course	Course Category	L	T	P	Credits
II	UCS26902	Internet Technologies and Digital Communication	MDC	3			3
Pre-Requisite: Digital Literacy and Productivity Tools			Co- Requisite: Nil	Progressive Course: Nil			
Course Objectives:							
1. Understand the fundamentals of Internet Technologies, web services, and digital communications systems							
2. Develop effective digital communication and online collaboration skills using modern Internet based tools.							
3. Create basic web pages and digital portfolios using web technologies and online publishing platforms							
4. Utilize digital tools for data collection, management, visualization and information sharing							
5. Practice ethical, secure and responsible use of Internet technologies in academic professional and social environments							
Course Outcomes:							
CO1: Explain the architecture, services and applications of internet technologies.						(K2)	
CO2: Utilize digital communication and collaboration platforms effectively.						(K3)	
CO3: Develop basic web pages and digital portfolios using web technologies.						(K3)	
CO4: Apply data management and visualization techniques using digital tools.						(K3)	
CO5: Demonstrate ethical, secure and responsible practices in online environments.						(K3)	
Unit-I	Internet Fundamentals and Web Services						9 Hrs.
Evolution of the Internet – Internet Architecture – TCP/IP Concepts – World Wide Web – Web Browsers and Search Engines – Uniform Resource Locator (URL) – Domain Names – Web Servers – Internet Services – Cloud-Based Internet Applications – Future Trends in Internet Technologies.							
Unit-II	Digital Communication and Collaboration						9 Hrs.
Electronic Mail Systems – Professional E-mail Communication – Netiquette – Social Media Platforms – Video Conferencing Technologies – Virtual Learning Environments – Online Collaboration Tools – Shared Documents and Workspaces – Digital Communities – Applications of Digital Communication in Education and Business.							
Unit-III	Web Technologies and Online Publishing						9 Hrs.
Introduction to Websites – Introduction to Static and Dynamic Websites – HTML Fundamentals – Structure of Web Pages – Text Formatting – Hyperlinks – Lists and Tables – Images and Multimedia – Blogs – Personal Digital Portfolios – Publishing Personal Web Pages using Online Platforms.							
Unit-IV	Data Management and Visualization						9 Hrs.

Data and Information – Data Collection Methods – Online Forms and Surveys – Data Organization – Cloud-Based Data Storage – Basic Data Visualization Concepts – Charts – Simple Dashboards – Information Presentation Techniques – Applications in Science, Commerce, and Social Sciences.

Unit-V

Digital Ethics, Privacy and Cyber Security

9 Hrs.

Digital Ethics – Intellectual Property Rights – Copyright and Plagiarism – Data Privacy – Digital Footprints – Cyber Threats – Malware and Ransomware – Identity Theft – Secure Online Transactions – Responsible Use of Internet Technologies.

Text Book(s):

1. Internet and World Wide Web: How to Program, Paul Deitel and Harvey Deitel, 6th Edition, Pearson Education, 2022.
2. Discovering Computers and Digital Technology, Misty Vermaat, Cengage Learning, 2024.
3. The Internet Book: Everything You Need to Know About Computer Networking and How the Internet Works, Douglas Comer, 6th Edition, CRC Press, 2021.

Reference Book(s):

1. Data Communications and Networking, Behrouz A. Forouzan, 6th Edition, McGraw Hill Education
2. Web Technologies, Uttam K. Roy, Oxford University Press.
3. Digital Communication and Networking, B.A. Forouzan and Fegan, McGraw Hill Education

e Resources:

1. https://developer.mozilla.org/en-US/docs/Learn_web_development/Howto/Web_mechanics/How_does_the_Internet_work
2. <https://internetingishard.netlify.app/>

Relationship Matrix for COs, POs and PSOs

Semester	Course code		Title of the course										Hours	Credit
II	UCS26901		Internet Technologies and Digital Communication										3	3
Course Outcome s (COs)	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	3	3	1	1	3	1	2	2	2	2	2	2	2	2.00
CO2	3	3	2	2	3	1	2	3	3	3	2	2	2	2.38
CO3	3	3	2	2	3	1	2	3	3	3	3	2	2	2.46
CO4	3	3	2	2	3	1	2	3	3	3	3	2	2	2.46
CO5	3	3	2	2	3	2	3	3	3	3	3	2	2	2.62
Mean	3.00	2.80	1.80	1.80	3.00	1.20	2.20	2.80	2.80	2.80	2.60	2.00	2.00	2.38