



BACHELOR OF SCIENCE IN DATA SCIENCE

PROGRAMME CODE: DS

**CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)**

SCHEME OF EXAMINATION & SYLLABUS

(w.e.f 2026 - 27 onwards)

REGULATIONS 2026

SEMESTER I

Department of Data Science

Vision

- To empower women with strong foundations in computing, statistics, and data analytics, enabling them to transform complex data into valuable knowledge and innovative solutions that support informed decision-making and contribute responsibly to technological advancement and societal development in a data-driven world.

Mission

- To build competent graduates with strong foundations in Data Science and Statistics, emphasizing social responsibility and ethical values.
- To impart interdisciplinary education, strengthening analytical thinking, technological innovation, and industry-relevant skills in Data Analytics, Artificial Intelligence, and Machine Learning through modern tools.
- To promote research culture, internships, and experiential learning, enabling students to apply data-driven methods to solve real-world problems.
- To cultivate lifelong learning attitudes, helping graduates adapt to emerging technologies and contribute to local and global communities.

Bachelor of Science in Data Science
Programme Objectives, Outcomes and Mapping

Programme Educational Objectives (PEOs)

(Expected career and professional achievements of graduates within three to five years of completing the programme)

PEO1: Graduates will possess a solid foundation in computing, statistics, mathematics, and data science principles to analyze and interpret complex data effectively.

PEO2: Graduates will practice ethical data handling, ensure privacy in analytics, and contribute responsibly to societal and sustainable development goals in alignment with national priorities and global standards.

PEO3: Graduates will utilize modern data science tools, research methods, and industry practices to develop innovative solutions through projects, internships, and collaborations.

PEO4: Graduates will demonstrate leadership, teamwork, communication, and entrepreneurial skills in developing innovative data-driven solutions and adapting to emerging technologies.

PEO5: Graduates will engage in lifelong learning, interdisciplinary collaboration, and continuous skill enhancement to adapt to evolving technologies and contribute meaningfully to society.

Programme Learning Outcomes (PLOs)

(Specific abilities, knowledge, and skills that graduates are expected to demonstrate upon Graduation)

PLO1: Apply fundamental concepts of mathematics, statistics, programming, and core data science principles to solve basic computing and analytical problems.

PLO2: Analyse real-world problems by identifying, formulating, and modelling them using appropriate data science techniques and tools.

PLO3: Collect, clean, pre-process, and manage structured and unstructured data using modern tools and technologies.

PLO4: Apply statistical methods, probability models, and data analysis techniques to extract meaningful insights from data.

PLO5: Demonstrate proficiency in programming languages and data science tools for analysis, visualization, and model building.

PLO6: Conduct research-oriented projects by applying appropriate methodologies, critical thinking, and innovative approaches in data science.

PLO7: Understand and apply ethical principles, data privacy, and security considerations in handling data and deploying solutions.

PLO8: Work effectively as an individual and as a member in multidisciplinary teams and integrate interdisciplinary knowledge to address real-world challenges in industry and environmental contexts.

PLO9: Recognize the need for and engage in lifelong learning to adapt to rapidly evolving data science technologies.

PLO10: Apply domain knowledge, project management skills, and industry practices to deliver real-world data-driven solutions.

Programme Specific Outcomes (PSOs)

(Expected knowledge, skills, and competencies that graduates will acquire by the end of the programme)

PSO1: Able to apply programming concepts using languages such as C, Python, and Java, along with data structures and algorithms, to develop efficient computational solutions for real-world problems.

PSO2: Apply mathematical and statistical techniques to analyze, interpret, and visualize data using tools such as Python, Excel, and statistical software.

PSO3: Design, implement, and manage databases and data pipelines using database systems, big data technologies, and cloud computing platforms.

PSO4: Build and deploy machine learning and AI models, including deep learning, natural language processing, and computer vision, for solving domain-specific problems.

PSO5: Develop data-driven solutions with consideration for cybersecurity, data privacy, ethical standards, and business intelligence to support decision-making across domains.

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PSO Alignment with Core Courses and Skill Competencies

PSO No	Programme Specific Outcome	Supporting Core Courses	Skill Competency
PSO1	Able to apply programming concepts using languages such as C, Python, and Java, along with data structures and algorithms, to develop efficient computational solutions for real-world problems.	Problem Solving Techniques in C, Python Programming, Object Oriented Programming using Java, Data Structures, Programming in C Lab, Python Programming Lab, Java Programming Lab	Algorithmic thinking, programming proficiency, logical reasoning, debugging, and code optimization
PSO2	Apply mathematical and statistical techniques to analyze, interpret, and visualize data using tools such as Python, Excel, and statistical software.	Mathematics for Data Science, Statistics for Data Science, Advanced Mathematics and Statistics for Data Science, Statistical Analysis Lab, Data Analysis and Visualization, Excel Skills for Data Analytics and Visualization	Analytical thinking, statistical reasoning, data interpretation and visualization
PSO3	Design, implement, and manage databases and data pipelines using database systems, big data technologies, and cloud computing platforms.	Database Systems, Database Systems Lab, Data Engineering, Data Engineering Lab, Big Data Analytics, Big Data Analytics Lab, Cloud Computing	Data modeling, database design, data integration, big data handling and pipeline development
PSO4	Build and deploy machine learning and AI models, including deep learning, natural language processing, and computer vision, for solving domain-specific problems.	Machine Learning, Machine Learning Lab, Artificial Intelligence, Deep Learning, Reinforcement Learning, Natural Language Processing, Natural Language Processing Lab, Computer Vision	Intelligent model development, real-world problem solving, critical thinking, innovation.
PSO5	Develop data-driven solutions with consideration for cybersecurity, data privacy, ethical standards, and business intelligence to support decision-making across domains.	Cyber Security I, Data Privacy and Security, Business Intelligence, Digital Marketing, Optimization Techniques, Dashboard UX and Reporting	Analytical decision-making, ethical data handling, business insight generation, and effective communication.

SCHEME OF EXAMINATION

Semester	Part	Course Code	Course Title	Course Type	Hours/ Week	Credits	Examination			
							Duration in Hours	Maximum Marks		
								CA	ESE	TOTAL
I	I	TAM2601A	Tamil Paper I	AEC	4	3	3	25	75	100
		HIN2601A	Hindi Paper I							
		FRE2601A	French Paper I							
	II	ENG2601A	English Paper I	AEC	4	3	3	25	75	100
	III	CY26C01	Core I : Problem Solving Techniques in C	DSC	5	4	3	25	75	100
		DS26C02	Core II : Fundamentals of Data Science	DSC	5	4	3	25	75	100
		DS26CP1	Core Practical I : Programming in C Lab	DSC	4	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A08	Generic Elective I : Mathematics for Data Science	MDC	6	5	3	25	75	100
	IV	NME26B1	Basic Tamil I	AEC	2	2	-	100*	-	100
		NME26A1	Advanced Tamil I							
		NME26ES	Introduction to Entrepreneurship	VAC						
I - II	VI	NM26GAW	General Awareness	VAC	SS	-	-	-	-	-
I - II		COM26SER	Community Services 30 Hours	VAC	-	-	-	-	-	-
I - V		26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester I Total					30	23				650
II	I	TAM2602A	Tamil Paper II	AEC	4	3	3	25	75	100
		HIN2602A	Hindi Paper II							
		FRE2602A	French Paper II							
	II	ENG2602A	English Paper II	AEC	4	3	3	25	75	100
	III	DS26C03	Core III : Python Programming	DSC	4	3	3	25	75	100
		DS26C04	Core IV : Data Structures	DSC	3	3	3	25	75	100

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		DS26CP2	Core Practical II : Python Programming Lab	DSC	4	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		DS26CP3	Core Practical III : Statistical Analysis Lab	DSC	3	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A17	Generic Elective II : Statistics for Data Science	MDC	6	5	3	25	75	100
	IV	NME26B2	Basic Tamil II	AEC	2 [€]	Gr.	-	100*	-	100 [£]
		NME26A2	Advanced Tamil II							
		NM26UHR	Universal Human Values and Human Rights	VAC	2	2	-	100*	-	100
I - II	VI	NM26GAW	General Awareness	VAC	SS	Gr.	-	100*	-	100 [£]
I - II		COM26SER	Community Services 30 Hours	VAC	-	St.	-	-	-	-
I - V		26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester II Total					30	23				700
III	I	TAM2603A	Tamil Paper III	AEC	4	3	3	25	75	100
		HIN2603A	Hindi Paper III							
		FRE2603A	French Paper III							
	II	ENG2603A	English Paper III	AEC	4	3	3	25	75	100
	III	DS26C05	Core V : Object Oriented Programming using Java	DSC	4	3	3	25	75	100
		DS26C06	Core VI : Operating System	DSC	4	3	3	25	75	100
		DS26CP4	Core Practical IV : Java Programming Lab	DSC	4	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		DS26CP5	Core Practical V : Web Technology Lab	DSC	3	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A20	Generic Elective III : Optimization Techniques	MDC	4	3	3	25	75	100
	IV	NM26DRM	Disaster Risk Reduction and Management	SEC	3	3	-	100*	-	100
		NM26HAW	Health and Wellness	VAC	SS	1	-	100*	-	100

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I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester III Total					30	23				800
IV	I	TAM2604A	Tamil Paper IV	AEC	4	3	3	25	75	100
		HIN2604A	Hindi Paper IV							
		FRE2604A	French Paper IV							
	II	ENG2604A	English Paper IV	AEC	4	3	3	25	75	100
	III	DS26C07	Core VII : Data Engineering	DSC	4	3	3	25	75	100
		DS26C08	Core VIII : Database Systems	DSC	3	3	3	25	75	100
		DS26CP6	Core Practical VI : Data Engineering Lab	DSC	3	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		DS26CP7	Core Practical VII : Database Systems Lab	DSC	3	2	3	15 ^{\$\$}	35 ^{\$\$}	50
		TH26A27	Generic Elective IV : Advanced Mathematics and Statistics for Data Science	MDC	4	3	3	25	75	100
	IV	DS26SECE	Excel Skills for Data Analytics and Visualization	SEC	3	3	-	100*	-	100
		NM26EII	Entrepreneurship and Innovation (IgniteX)	VAC	2	2	-	100*	-	100
		NM26EVS	Environmental Studies	VAC	SS	Gr.	-	100*	-	100 [£]
	V	26COACT	Co-Curricular Activities	VAC	-	1	-	100*	-	100
I - V	VI	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-
Semester IV Total					30	25				900
V	III	DS26C09	Core IX : Machine Learning	DSC	5	4	3	25	75	100
		DS26C10	Core X : Big Data Analytics	DSC	5	4	3	25	75	100
		DS26CP8	Core Practical VIII : Machine Learning Lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50

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		DS26CP9	Core Practical IX : Big Data Analytics Lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50
		DS26E01	Elective I : Computer Networks (OR)	DSE	5	4	3	25	75	100
		DS26E02	Elective I : Cloud Computing (OR)							
		DS26E03	Elective I : Artificial Intelligence							
		DS26AC1	Advance Learner Course I : Business Intelligence (OR)	ACC	SS	5 [^]	3	25	75	100 [^]
		DS26AC2	Advance Learner Course I : Digital Marketing							
	IV	DS26SEP1	Data Analysis and Visualization	SEC	3	3		100*	-	100
		NM26CS1	Cyber Security I	VAC	2	Gr.	-	100*	-	100 [£]
		DS26INST	Field work/ Institutional Training (21 Days)	VAC	-	2	-	100*	-	100
	VI	DS26COM	Comprehensive Examination	DSC	-	Gr.	-	100*	-	100 [£]
	I - V	26BONL1 26BONL2 26BONL3	Online Course I Online Course II Online Course III	ACC	-	Cr. [^] /St.	-	-	-	-
Semester V Total					30	23				600
VI	III	DS26C11	Core XII : Natural Language Processing	DSC	5	4	3	25	75	100
		DS26C12	Core XII : Data Privacy and Security	DSC	5	4	3	25	75	100
		DS26CP10	Core Practical X : Natural Language Processing Lab	DSC	5	3	3	15 ^{\$\$}	35 ^{\$\$}	50
		DS26PROJ	Project and Viva- voce	DSE	7	5	-	20	80	100
		DS26E04	Elective II : Health Care Analytics (OR)	DSE	5	4	3	25	75	100
		DS26E05	Elective II Social Media Analytics (OR)							

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		DS26E06	Elective II : Computer Vision							
	IV	DS26SEP2	Dashboard UX and Reporting	SEC	3	3	-	100*	-	100
	III	DS26AC3	Advance Learner Course II : Deep Learning (OR)	ACC	SS	5^	3	25	75	100^
		DS26AC4	Advance Learner Course II : Reinforcement Learning							
Semester VI Total					30	23				550
I - VI	Total					140 + Addit ional Credi ts				4200 + Mar ks for Addi tiona l Cred it Cour ses

Hours of Instructions is inclusive of lectures, seminars, presentations, case-studies, etc

Symbols and Notations

Symbols	Notations
*	Course assessed through Internal Assessment (CIA) only
Gr.	Grade awarded based on CBCS grading system
St.	Course Status (Completed/Not Completed)
^	Advanced Learner Course, Online Courses – Additional Credit Courses
@	Course assessed through End Semester Examination (ESE) only
#	Open Book Examination
\$	Evaluation Pattern converted from 25:75:100 to 20:55:75 (CIA:ESE:Total) structure
\$\$	Evaluation Pattern converted from 25:75:100 to 15:35:50 (CIA:ESE:Total) structure
€	Hours per Week Outside Class Hours
£	Not Included for Total Marks

Abbreviation	Course Type
DSC	Discipline Specific Core Courses
DSE	Discipline Specific Elective Courses
MDC	Multidisciplinary Courses
AEC	Ability Enhancement Course
SEC	Skill Enhancement Course
VAC	Value Added Courses
ACC	Additional Credits Courses

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
CY26C01	CORE I: PROBLEM SOLVING TECHNIQUES IN C	75	70	5	4

Preamble

- Introduces fundamental problem-solving approaches and programming concepts using the C language.
- It emphasizes algorithmic thinking, logical reasoning, and structured programming techniques required for developing efficient programs.
- Students learn to translate computational problems into algorithms, flowcharts, and C programs using variables, control structures, arrays, functions, pointers, and file handling mechanisms.
- The course also develops analytical abilities required for debugging and optimizing programs. It provides a strong foundation for advanced programming and cyber security–related computing applications.

Prerequisite

Students should possess basic knowledge of computer fundamentals, logical reasoning, and elementary mathematical concepts to understand problem-solving approaches and programming logic.

Course Learning Outcomes (CLOs)

On the successful completion of the course, students will be able to,

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall fundamental concepts of problem solving, including algorithms, flowcharts, and basic C constructs such as arrays, functions, pointers, and file handling.	K1
CLO2	Explain key programming concepts in C, including data types, operators, control structures, arrays, pointers and structures and demonstrate problem solving using algorithms and flowcharts.	K2
CLO3	Apply structured programming techniques to develop C programs using control statements, arrays, functions, pointers and file handling mechanism.	K3
CLO4	Analyse problems and design suitable algorithms and modular programs using functions, structures, pointers, and file handling operations.	K4

CLO5	Evaluate and optimize programming solutions using Arrays, functions, pointers, structures, and dynamic memory management techniques.	K5
CLO6	Develop complete C-based solutions for real-world problems, incorporating modular design, file operations, and dynamic memory allocation.	K6

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Problem solving concepts, algorithms, flowcharts, pseudocode	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit II	C basics, data types, operators, input/output, decision and looping	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit III	Arrays, multidimensional arrays, strings, string functions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit IV	Functions, recursion, structures and unions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit V	Pointers, dynamic memory allocation, file handling	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	1	1	1	1	1	1	1	1	1
CLO2	3	2	1	1	2	1	1	1	1	1
CLO3	3	2	1	1	3	1	1	1	1	1
CLO4	3	3	1	1	3	2	1	1	1	1
CLO5	3	3	1	1	3	2	2	1	1	1
CLO6	3	3	2	1	3	3	2	2	2	2

CORE I: PROBLEM SOLVING TECHNIQUES IN C (CY26C01) (70 Hrs)

Unit I (14 Hrs.)

Introduction: Introduction to problem solving Concept – Steps for problem solving - Problem solving techniques — Algorithms – flowcharts – Types of Algorithms – Use flowcharts to represent algorithms – Pseudo code.

Unit II (14 Hrs.)

Overview of C - Constants, Variables and Data types - Operators and Expressions - Managing Input and Output Operations -Sulba Sutras-Decision Making and Branching - Decision Making and Looping.

Unit III (14 Hrs.)

Shloka Arrays: One-Dimensional - Two Dimensional - Multidimensional Arrays-Character Arrays and Strings: Declaring and Initializing String Variables - Reading Strings from Terminal - Writing Strings to Screen - String Handling Functions.

Unit IV (14 Hrs.)

Chandas -User-Defined Functions: Need - Return Values and Types - Function Calls – Function declaration - Category of Functions - No Arguments and No Return Values - Arguments but No Return Values - Arguments with Return Values - Recursion - Scope Visibility and Life time of Variables Structures and Unions - Definition: Structure Initialization - Comparison of Structure Variables - Arrays of Structures - Arrays within Structures - Unions.

Unit V (14 Hrs.)

Pointers: Understanding Pointers - Accessing the Address of a Variable - Declaring and Initializing Pointers - Accessing a Variable through its Pointers - Pointers and Arrays. File Management in C: Defining and Opening a File - Closing File - I/O Operations on Files - Dynamic Memory allocation MALLOC, CALLOC, REALLOC.

*** Course Alignment with SDGs: 4**

Text Books

S.No.	Authors	Title	Publisher	Year & Edition
1	Yashwvant Kanetkar	Let Us C: Authentic Guide To C Programming Language	BPB Publications	2020,17 th Edition

Reference Books

S.No.	Authors	Title	Publisher	Year & Edition
1	Byron Gottfried	Programming with C	Tata McGraw Hill	2018, 4 th Edition
2	E. Balagurusamy	Programming In ANSI C	Tata Mc Graw Hill	2019, 8 th Edition

Related Online References

1. Problem Solving techniques in C – studocu - <https://www.studocu.com/in/document/bengaluru-north-university/bca/problem-solving-techniques-using-c/16264070>

Pedagogy

The course will be delivered using a combination of traditional and learner-centered teaching methods, including:

- Lecture - Chalk and Talk
- PowerPoint presentations
- E-content and digital learning resources
- Numerical problem-solving exercises
- Group discussions
- Assignments
- Quizzes
- Peer learning activities
- Student seminars

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
DS26C02	CORE II : FUNDAMENTALS OF DATA SCIENCE	75	70	5	4

Preamble

- This course introduces the fundamental concepts of Data Science, including data understanding, data pre-processing, basic statistical analysis, machine learning concepts, big data analytics, and ethical considerations.
- It provides a foundation for analysing and interpreting data using appropriate tools and techniques, enabling learners to understand the complete data science lifecycle and its real-world applications.

Prerequisite

Students should have a basic understanding of mathematics, logical reasoning, and fundamental computer concepts

Course Learning Outcomes (CLOs)

On the successful completion of the course, students will be able to,

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall the fundamental concepts of computer systems, number systems, data science principles, data sources, database systems, data pre-processing, big data, and data ethics.	K1
CLO2	Explain the working of computer components, number system operations, data science processes, database models (SQL & NoSQL), data preparation techniques, big data characteristics, and ethical issues in data science.	K2
CLO3	Apply computational techniques such as number system conversions, binary operations, SQL queries, data pre-processing methods, and ethical practices in solving data science problems.	K3
CLO4	Analyse data structures, data generation methods, database systems, pre-processing techniques, and big data characteristics to interpret patterns and support decision-making while considering ethical implications.	K4
CLO5	Evaluate the effectiveness of data science tools, methodologies, database solutions, data pre-processing strategies, and ethical frameworks in real-world applications.	K5
CLO6	Design integrated data science solutions by combining computing fundamentals, data handling techniques, database systems, pre-processing pipelines, big data analytics, and ethical decision-making frameworks.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyse; K5 - Evaluate; K6 - Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Types of computers, Functional units of computers, Number system	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit II	Data Science Fundamentals, Importance of Data Science, Prerequisites for a Data Scientist.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit III	Data Sources and Generation, Databases for Data Science	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit IV	Data Preparation, Machine Learning Basics, Data Science Methodology.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
Unit V	Data Ethics, Accountability in data science, Ethical decision-making frameworks, Case studies.	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO / PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	1	1	1	1	1	1	1	2	1
CLO2	3	2	1	1	2	1	2	1	2	1
CLO3	3	3	2	2	3	2	2	1	2	2
CLO4	3	3	2	2	3	2	3	2	2	2
CLO5	2	3	2	3	2	2	3	2	2	2
CLO6	3	3	3	3	3	3	3	2	2	3

CORE II : FUNDAMENTALS OF DATA SCIENCE (DS26C02) (70 Hrs)**Unit I (13 Hrs.)**

Introduction: Generations of Computer, Types of Computers - Functional units of a computer system- Input Devices -Output devices – Memory – Storage Devices. Number Systems: Decimal, Binary, Octal and Hexadecimal – Conversion –Computer Codes- Binary Addition, Subtraction-Complements.

Unit II (14 Hrs.)

Data Science: Data, information, and Knowledge- Data Science: the art of data Exploration-Data Science tasks- Data Science objectives- Applications of Data Science. Importance of Data Science: Need for Data Science - Data Science Process – Business Intelligence and Data Science – Prerequisites for a Data Scientist – Components of Data Science -Tools and Skills Required.

Unit III (14 Hrs.)

Data, Sources, and Generation: Introduction-Data attributes -Data-storage Formats- Data Sources-Data generation. **Databases for Data Science:** Structured Query Language (SQL): Basic Statistics, Data Munging, Filtering, Joins, Aggregation. **No-SQL:** Document Databases, Wide-column Databases, and Graphical Databases – Real-time Examples.

Unit IV (15 Hrs.)

Data Preparation: Data preprocessing- Data cleaning- Handling missing values- Ignoring and discarding data- Data reduction- Sampling- Data transformation- Discretization- Data normalization - Min–max normalization- Z-score normalization- Decimal-scaling normalization- Data integration- Machine Learning Paradigm **Data Science Methodology:** Big Data analysis: Introduction- Characteristics of Big Data- Types of Big Data -Examples of Big Data.

Unit V (14 Hrs.)

Data Ethics: History and Evolution of Data Ethics – Data Privacy and Protection – Data Security and Anonymization – Bias and Fairness in Algorithms – Discrimination and Social Impact – Transparency and Explain ability – Accountability in Data Science – Ethical Decision-Making Frameworks – Legal and Regulatory Aspects – Ethical Challenges in Data Science - Responsible Use of Data - Illustrative case studies and practical scenarios on ethical issues in Data Science.

*** Course Alignment with SDGs: 4****Text Books**

S.No.	Authors	Title	Publisher	Year & Edition
1	Jugal K. Kalitha, Dhruba K. Bhattacharyaa, Swarup Roy	Fundamentals of Data Science: Theory and Practice	Academic Press	2023, 1st Edn.
2	Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare	Fundamentals of Data Science	CRC Press	2021, 1st Edn

Reference Books

S.No.	Authors	Title	Publisher	Year & Edition
1	Lillian Pierson	Data Science for Dummies	Wiley Publications	2021, 3rd Edn.
2	P K Sinha & Priti Sinha	Computer Fundamentals	BPB Publications	2020, 6th Edn.

Related Online References

1. Data Science - <https://www.ibm.com/think/topics/data-science>
2. MongoDB NoSQL Concepts - <https://www.mongodb.com/nosql-explained>
3. ML Evaluation Metrics (Confusion Matrix, Precision, Recall)
<https://developers.google.com/machine-learning/crash-course/classification/accuracy>
4. Big Data Characteristics (5Vs) - <https://www.ibm.com/topics/big-data>
5. "Data Science Ethics" by University of Michigan on Coursera -
<https://www.coursera.org/learn/data-science-ethics/home/>

Pedagogy

The course will be delivered using a combination of traditional and learner-centered teaching methods, including:

- Lecture - Chalk and Talk
- PowerPoint presentations
- E-content and digital learning resources
- Numerical problem-solving exercises
- Group discussions
- Assignments
- Quizzes
- Peer learning activities
- Student seminars

Course Code	Course Title	Hours			Credits
		Total	Practical	Examination	
DS26CP1	CORE PRACTICAL I : PROGRAMMING IN C LAB	60	57	3	2

Preamble

- This course provides practical training in C programming and enhances students' programming skills through hands-on experience.
- It enables students to develop logical solutions to computational problems.
- The course involves compiling, linking, debugging, and executing programs to solve real-world programming tasks

Prerequisite

Basic computer knowledge, logical and analytical thinking, basic mathematical knowledge, and familiarity with a programming environment.

Course Learning Outcomes (CLOs)

On the successful completion of the course, students will be able to,

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Recall the fundamental concepts of programming constructs, arrays, strings, functions, recursion, pointers, structures, file handling, and dynamic memory allocation.	K1
CLO2	Explain the working principles of programming constructs, array and string manipulations, function mechanisms, pointer operations, structured data types, and file processing techniques.	K2
CLO3	Apply programming constructs, arrays, strings, functions, recursion, pointers, structures, file handling, and dynamic memory allocation techniques to develop solutions for computational problems.	K3
CLO4	Analyse problems by selecting appropriate programming techniques such as arrays, recursion, pointers, structures, and file operations to optimize logic, memory usage, and performance.	K4
CLO5	Evaluate different programming approaches, memory management strategies, and data handling techniques (arrays, pointers, files) for efficiency, correctness, and maintainability.	K5
CLO6	Design, implement, and debug complete programs integrating programming constructs, data structures (arrays, strings, structures), functions, pointers, file handling, and dynamic memory allocation to solve real-world problems.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
I	Basic Programming Constructs	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
II	Arrays and Strings	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
III	Functions and Recursion	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
IV	Pointers, Structures and Unions	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6
V	File Handling and Dynamic Memory Allocation	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	1	1	1	1	2	1	1	1	1
CLO2	3	1	1	1	1	2	1	1	1	1
CLO3	3	2	1	1	1	2	2	1	1	1
CLO4	3	2	1	1	1	3	2	1	1	1
CLO5	3	2	1	1	1	3	2	1	1	1
CLO6	3	2	1	1	1	3	2	1	1	2

CORE PRACTICAL I: PROGRAMMING IN C LAB (DS26CP1)**(57 Hrs)****Exercises to understand and implement the following concepts:**

- **Basic Programming Constructs:** Constants, Variables and Data Types, Operators and Expressions, Input and Output Operations, Evaluation of Expressions, Decision Making Statements, Looping Constructs.
- **Arrays and Strings:** One-Dimensional and Multidimensional Arrays, Matrix-based Computations, Character Arrays, String Input/Output, String Handling Functions.

- **Functions and Recursion:** User-Defined Functions, Function Calls and Parameter Passing, Categories of Functions, Recursive Functions, Scope and Lifetime of Variables.
- **Pointers, Structures and Unions:** Pointers and Pointer Arithmetic, Pointers with Arrays and Functions, Structures and Unions, Arrays of Structures, Nested Structures.
- **File Handling and Dynamic Memory Allocation:** File Operations (Open, Read, Write, Close), Sequential File Processing, Dynamic Memory Allocation (malloc, calloc, realloc).

*** Course Alignment with SDGs: 4**

Pedagogy

Demonstration of programming environment, hands-on coding sessions, guided practice, and debugging exercises.

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
TH26A08	GENERIC ELECTIVE I : MATHEMATICS FOR DATA SCIENCE	90	85	5	5

Preamble

- This course introduces fundamental mathematical concepts essential for data science, including set theory, functions, calculus, linear algebra, and matrix theory.
- It equips students with analytical and problem-solving skills required for modelling and interpreting data-driven problems.

Prerequisite

Basic knowledge of higher secondary mathematics, including algebra and elementary functions.

Course Learning Outcomes (CLOs)

On the successful completion of the course, students will be able to

CLO Number	Course Learning Outcome	Bloom's Level
CLO1	Recall fundamental concepts of sets, relations, functions, limits, matrices, and determinants.	K1 (Remember)
CLO2	Explain the properties of functions, limits, continuity, and matrix operations.	K2 (Understand)
CLO3	Apply differentiation techniques, matrix algebra, and systems of equations to solve mathematical problems.	K3 (Apply)
CLO4	Analyze mathematical structures such as relations, matrices, and determinants to interpret problem scenarios.	K4 (Analyze)
CLO5	Evaluate solutions of linear systems and properties of eigenvalues and eigenvectors for correctness and efficiency.	K5 (Evaluate)
CLO6	Construct mathematical models using functions, matrices, and eigen concepts to represent real-world data problems.	K6 (Create)

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit I	Sets, Relations and Functions	CLO1, CLO2, CLO3,CLO4, CLO5, CLO6
Unit II	Calculus	CLO1, CLO2, CLO3,CLO4, CLO5, CLO6
Unit III	Linear Equations and Matrices	CLO1, CLO2, CLO3,CLO4, CLO5, CLO6
Unit IV	Determinants and LU Factorization	CLO1, CLO2, CLO3,CLO4, CLO5, CLO6
Unit V	Eigenvalues and Eigenvectors	CLO1, CLO2, CLO3,CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	1	1	2	1	1	1	1	1	1
CLO2	3	2	1	2	1	1	1	1	1	1
CLO3	3	3	1	3	2	2	1	1	1	2
CLO4	2	3	1	3	2	2	1	1	1	2
CLO5	2	3	1	3	2	3	1	1	1	2
CLO6	2	3	2	3	2	3	2	2	2	3

MATHEMATICS FOR DATA SCIENCE (TH26A08)**Unit I Sets, Relations and Functions****[17 Hrs.]**

Basic concepts of set Theory- Notation- Types of sets- Operations on Sets- Venn Diagrams-

Basic Set Identities- The Principle of Specification- Ordered pairs and n-tuples.

Relations: Properties of a set- Equivalence Relations- Composition of Relations-

Functions: Definition- Composition of functions- one - to-one, onto and inverse functions

Inverse Functions.

Unit II Calculus**[17 Hrs.]**

Functions and Limits- Classification of Functions- Variable tending to a limit – Limits and value of a function- Special Limits- Continuous and Discontinuous functions.

Differentiation: Standard forms – product rule- quotient rule- differential coefficients of trigonometric functions – function of function rule.

Unit III Linear Equations and Matrices**[17 Hrs.]**

Systems of Linear equations – types of solutions- Matrix Algebra – transpose and inverse of a matrix – inverse matrix method.

Unit IV Determinant of a Matrix**[17 Hrs.]**

Determinant of a Matrix – Determinants of other Matrices – Properties of Determinants- LU factorization.

Unit V Eigen values and Eigenvectors**[17 Hrs.]**

Introduction to Eigen values and Eigenvectors – Properties- Diagonalization, Diagonalization of symmetric matrices.

Text book

S. No	Author	Title of the book	Publishers	Year & Edition
1	J.P.Tremblay and R.Manohar	Discrete Mathematical Structures with Applications to Computer Science	McGraw Hill Publishing Company	Reprint 2016, 1997 th Edn
	Chapter 2: Sections 2.1.1-2.19,2.3.1-2.3.3,2.3.4,2.3.6,2.4.1-2.4.3			
2	S.Narayanan and T.K.Manicavachagom Pillay	Calculus Volume I	S.Viswanathan & Printers	2015 th Edn
	Chapter I : Section 1 to 12 Chapter II: Section 1,2.1-2.6, 3.1-3.8			
3	Kuldeep Singh	Linear Algebra Step by Step	Oxford University Press	2014
	Unit III : Chapter I Except 1.2-1.3 Unit-IV: Chapter VI - 6.1 -6.4 Unit V : Chapter VII -7.1-7.4			

Reference Books

S. No	Author	Title of the book	Publishers	Year of Publication
1	Gilbert Strang	Introduction to Linear Algebra	Wellesley-Cambridge Press	5 th Edition, 2016
2	David C. Lay, Steven R. Lay, Judi J. McDonald.	Linear Algebra and Its Applications,	Pearson Education	2014
3	H. Anton,	Elementary Linear Algebra	John Wiley	2014

Course Code	Course Title	Hours			Credits
		Total	Lecture	Examination	
NME26ES	INTRODUCTION TO ENTREPRENEURSHIP	30	30	-	2

Preamble

- To introduce the basic concepts and importance of entrepreneurship in economic and social development.
- To familiarize students with entrepreneurial traits, types of entrepreneurs, and the process of starting small enterprises.
- To provide awareness about entrepreneurship development programmes, institutional support, and financial assistance available for entrepreneurs.

Prerequisite

Basic awareness of business activities, economic environment, and interest in entrepreneurial initiatives.

Course Learning Outcomes (CLOs)

CLO No	Course Learning Outcome	Bloom's Level
CLO1	Define the fundamental concepts, characteristics, and types of entrepreneurship and entrepreneurs.	K1
CLO2	Explain the role of entrepreneurship development programmes, institutional support systems, and government incentives for entrepreneurs.	K2
CLO3	Apply creative thinking and innovation techniques to identify entrepreneurial opportunities and solve business problems.	K3
CLO4	Analyse the significance of intellectual property rights and institutional support in promoting entrepreneurial ventures.	K4
CLO5	Evaluate different project ideas and assess their feasibility using basic project appraisal concepts.	K5
CLO6	Develop a basic project report for a small entrepreneurial venture based on identified opportunities.	K6
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyse; K5 - Evaluate; K6 - Create		

Unit-wise CLO Mapping

Unit	Coverage	Mapped CLOs
Unit 1	Introduction to Entrepreneurship, factors, barriers, entrepreneurial traits and types, steps for starting small industries, MSMEs, social entrepreneurship	CLO1, CLO2
Unit 2	Entrepreneurship Development Programmes, institutional framework (IFCI, ICICI, IDBI, IRBI, EXIM Bank, NSIC, SIDBI, SFC, SIPCOT, TIIC), incentives and subsidies	CLO1, CLO2, CLO3, CLO4
Unit 3	Innovation, types of innovation, creative problem solving, incubators, angel investors, venture capital	CLO1, CLO2 CLO3, CLO4
Unit 4	Intellectual Property Rights – copyright, patents, trademarks, design and registration procedures	CLO1, CLO2, CLO3, CLO4
Unit 5	Project identification and classification, project formulation, project appraisal, project report presentation	CLO1, CLO2, CLO3, CLO4, CLO5, CLO6

Alignment of CLO with PLO

3 = High, 2 = Medium, 1 = Low, – = Not Applicable

CLO \ PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	1	1	1	1	1	1	2	2	2	1
CLO2	1	2	1	1	1	2	2	2	2	2
CLO3	2	3	2	2	2	3	2	3	2	3
CLO4	1	3	1	2	1	2	3	2	2	2
CLO5	2	3	2	2	2	3	2	2	2	3
CLO6	2	3	2	2	2	3	2	3	3	3

INTRODUCTION TO ENTREPRENEURSHIP - NME26ES (30 HRS)**Unit 1****(6hrs)**

Entrepreneurship-Introduction-Factors-Barriers-Entrepreneurial Traits and Types- Steps for starting a Small Industry- MSMEs – Social entrepreneurship.

Unit 2**(6hrs)**

Entrepreneurship Development Programmes-Institutional Framework (IFCI, ICICI, IDBI, IRBI, EXIM Bank, NSIC, SIDBI, SFC, SIPCOT AND TIIC) - Role of Incentives and Subsidies

Unit 3**(6hrs)**

Innovation - Types –Role- Creative Problem Solving -Incubators - Angel Investors - Venture Capital.

Unit 4

(6hrs)

Intellectual Property- Meaning- Copy Right Registration- Patents- Trademark- Design and Procedure for registration.

Unit 5

(6hrs)

Project Preparation

Project identification and Classification - Project Formulation- Project Appraisal- Project Report Presentation.

Text Books

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication & Edition
1.	Gupta. C.B and Srinivasan.N. P	Entrepreneurial Development	Sultan Chand and Sons	2020
2	Sauhari Vinnie and Bhushan Sudhashu	Innovation Management	Oxford	2014

Reference Books

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication & Edition
1.	KolbBonitaM	Entrepreneurship for the creative and cultural industries	Routledge	2015
2.	P.T.Vijayashree & M.Alagammai	Entrepreneurship and Small Business Management	Margham	2020