PSGR Krishnammal College for Women

DEPARTMENT OF DATA SCIENCE

CHOICE BASED CREDIT SYSTEM (CBCS)

&

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK (LOCF)

B.Sc. DATA SCIENCE

2024-2027 BATCH

Programme Learning Outcomes (PLO's)

After Completion of the programme, the student will be able to

PLO1: Apply analytical and critical thinking skills to solve complex real-world problems by implementing different tools in the fields of Data Science, Mathematics and Statistics

PLO2: Develop and implement data analysis strategies based on theoretical principles and problem-solving techniques to meet industry standards.

PLO3: Design solutions by applying analytical skills for socio-economic problems with appropriate ethical considerations.

PLO4: Promote life-long learning to meet the demands of changing trends and the workplace.

PLO5: Articulate the principles of Data Science and its impact on innovation and progress within the local or global context.

Programme Specific Outcomes (PSO)

The students at the time of graduation will

PSO1: Apply technical skills attained through laboratory exercises, projects, internships and value-added programmes to develop and implement customized data analysis methodologies in data science.

PSO2: Apply tools and techniques using Statistical, Machine Learning techniques and Decision Support Systems to support business processes and functions.

PSO3: Excel independently and as a collaborative team member or leader, showcasing strong communication and teamwork by applying programming and technical skills to solve multi-disciplinary problems.

PSGR Krishnammal College for Women

Bachelor of Science (Data Science)
Choice Based Credit System (CBCS) &
Learning Outcomes-Based Curriculum Framework (LOCF)
Syllabus and Scheme of Examinations
2024 -2027 Batch

Semester	Part	Course Code	Title of the Course	Course Type	Instruction Hours/Week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
I	I	TAM2301A/ HIN2301A/ FRE2301A	Language I – Tamil Paper I/ Hindi Paper I/ French Paper I	L	4	58	2	3	25	75	100	3
	II	ENG2301A	English Paper I	E	4	58	2	3	25	75	100	3
	III	CY24C01	Programming in C	CC	4	58	2	3	25	75	100	3
	III	PP22C02	Computational and Algorithmic Thinking for Problem Solving	CC	3	45	-	-	100	-	100	3
	III	DS24C03	Fundamentals of Data Science	CC	4	58	2	3	25	75	100	3
	III	TH24A08	Mathematics for Data Science	GE	6	88	2	3	25	75	100	5
	III	DS24CP1	Programming in C Lab	CC	3	45	-	3	15	35	50*	2
		Non-Tamil Students										2
	IV	NME23A1 / NME23B1	Advanced Tamil I/ Basic Tamil I	AEC	2	28	2	-	100	-	100	
		Students with Tamil as Language										
	IV	NME23ES	Introduction to Entrepreneurship	AEC	2	30	-	-	100	-	100	
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course 1 Online Course 2 Online Course 3	ACC	-	-	-	-	-	-	-	-
II	I	TAM2302A/ HIN2302A/ FRE2302A	Tamil Paper II/ Hindi Paper II/ French Paper II	L	4	58	2	3	25	75	100	3
	II	ENG2302A	English Paper II	E	4	58	2	3	25	75	100	3
	III	DS24C04	Python Programming for Data Science	CC	4	58	2	3	25	75	100	3

Semester	Part	Course Code	Title of the Course	Course Type	Instruction Hours/Week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
	III	DS24C05	Operating System	CC	4	58	2	3	25	75	100	3
II	III	DS24CP2	Python Programming Lab	CC	3	45	-	3	15	35	50*	2
	III	DS24CP3	Statistical Analysis Lab	CC	3	45	-	3	15	35	50*	2
	III	TH24A17	Statistics for Data Science	GE	6	88	2	3	25	75	100	5
	IV	NM24UHR	Universal Human Values and Human Rights	AECC	2	30	-	-	100	-	100	2
	IV	NME23A2/ NME23B2	Advanced Tamil II/ Basic Tamil II	AEC	-	-	-	-	100	-	100**	Gr.
	VI	NM23GAW	General Awareness	AEC	SS	-	-	-	100	-	100	Gr.
I-IV	VI	COM15SER	Community Services 30 Hours	GC	-	-	-	-	-	-	-	-
I-V	VI	24BONL1 24BONL2 24BONL3	Online Course 1 Online Course 2 Online Course 3	ACC	-	-	-	-	-	-	-	-
III	I	TAM2303A/ HIN2303A/ FRE2303A	Tamil Paper III/ Hindi Paper III/ French Paper III	L	4	58	2	3	25	75	100	3
	II	ENG2403A	English Paper III	E	4	58	2	3	25	75	100	3
	III	DS24C06	Object Oriented Programming	CC	4	58	2	3	25	75	100	3
	III	DS24C07	Data Structures	CC	3	43	2	3	25	75	100	3
	III	DS24CP4	Object Oriented Programming Lab	CC	3	45	-	3	15	35	50*	2
	III	DS24CP5	Data Structures Lab	CC	3	45	-	3	15	35	50*	2
	III	TH24A20	Optimization Techniques	GE	4	58	2	3	25	75	100	3
	III	CS23SBGP	Gen-AI	SEC	3	44	1	-	100	-	100	3
	IV	NM23DTG	Design Thinking	AEC	2	30	-	-	100	-	100	2
I - III	VI	COM15SER	Community Services 30 Hours	GC	-	-	-	-	-	-	-	-
I -V	VI	24BONL 1 24BONL 2 24BONL 3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-	-	-
IV	I	TAM2304A/ HIN2304A/ FRE2304A	Tamil Paper IV / Hindi Paper IV / French Paper IV	L	4	58	2	3	25	75	100	3

Semester	Part	Course Code	Title of the Course	Course Type	Instruction Hours/Week	Contact Hours	Tutorial Hours	Duration of Examination	Examination Marks			Credits
									CA	ESE	Total	
	II	ENG2404A	English Paper IV	E	4	58	2	3	25	75	100	3
	III	DS24C08	Data Engineering	CC	4	58	2	3	25	75	100	3
	III	DS24C09	Database Systems	CC	3	43	2	3	25	75	100	3
	III	DS24CP6	Data Engineering Lab	CC	3	45	-	3	15	35	50*	2
	III	DS24CP7	Database Systems Lab	CC	3	45	-	3	15	35	50*	2
	III	TH24A27	Advanced Mathematics & Statistics for Data Science	GE	4	58	2	3	25	75	100	3
	III	DS24SCE1	Excel Skills for Data Analytics and Visualization	SEC	3	45	-	-	100	-	100	3
	IV	NM23EII	Entrepreneurship and Innovation (Ignite X)	AECC	2	30	-	-	100	-	100	2
	IV	NM24EVS	Environmental Studies	AECC	SS	-	-	-	100	-	100	Gr.
	V	COCOACT	Co-Curricular Activities	GC	-	-	-	-	100	-	100	1
I-V	VI	24BONL 1 24BONL 2 24BONL 3	Online Course I Online Course II Online Course III	ACC	-	-	-	-	-	-	-	-

L: Language

E: English

CC: Core Course

AEC: Ability Enhancement Course

SEC: Skill Enhancement Course

SS: Self Study

CA: Continuous Assessment

ESE: End Semester Examination

GE: Generic Elective

ACC: Additional Credit Courses

GC: General Course

AECC: Ability Enhancement Compulsory Course

***CA conducted for 25 and converted into 15, ESE conducted for 75 and converted into 35**

****After class hours**

Evaluation Pattern 2024-2027 Batch

CA Question Paper Pattern and distribution of marks

Language and English			
Section A	5 x 1 (No choice)	:	5 Marks
Section B	4 x 5 (4 out of 6)	:	20 Marks (250 words)
Section C	2 x 10 (2 out of 3)	:	20 Marks (500 words)
			Total : 45 Marks
Core and Allied - (First 3 Units)			
CA Question from each unit comprising of			
One question with a weightage of 2 Marks			:2 x 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level)			:5 x 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level)			:8 x 3 =24
			Total :45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Language and English			
Section A	10 x 1 (10 out of 12)	:	10 Marks
Section B	5 x 5 (5 out of 7)	:	25 Marks (250 words)
Section A	4 x 10 (4 out of 6)	:	40 Marks (600 - 700 words)
			Total : 75 Marks
Core and Allied courses			
Question from each unit comprising of			
One question with a weightage of 2 Marks			: 2 x 5=10
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25			
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40			
			Total: 75 marks
Practical			
The End Semester Examination will be conducted for a maximum of 75 marks respectively with a maximum 15 marks for the record and other submissions if any.			

Continuous Internal Assessment Pattern

Theory		
CIA Test: 5 Marks (Conducted for 45marks after 50 days		
MODEL Exam: 7 marks (Conducted for 75 marks after 85 days (each Unit 15 Marks))		
Seminar/Assignment/Quiz	:	5 Marks
Class participation	:	5 Marks
Attendance	:	3 Marks
		Total: 25 Marks
Practical		
Lab Performance	:	7 Marks
Regularity	:	5 Marks
Model Exam	:	10 Marks
Attendance	:	3 Marks
		Total : 25 marks

Gen AI		
Quiz	:	50 Marks (5 Quizzes with each 10 Marks)
Case Study	:	25 Marks
Online Exam	:	25 Marks (Department to Plan and Conduct the Exam)
		Total: 100 Marks

Part IV Design Thinking		
Quiz	:	50 Marks
Assignment	:	25 Marks
Project / Case study	:	25 Marks
		Total: 100 Marks

Question paper pattern for Skill Based courses

Skill Based Practical courses

Test I	30 Marks (Conducted for 50 marks and converted to 30 Marks)
Test II	50 Marks
Lab Performance	10 Marks
Regularity	10 Marks
Total	100 Marks

Students securing very low marks in internal assessment, only ESE marks will be considered as passing criteria from the third attempt and onwards.

Mapping Course Learning Outcomes with Programme Learning Outcomes

CY24C01 PROGRAMMING IN C

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

PP22C02 COMPUTATIONAL AND ALGORITHMIC THINKING FOR PROBLEM SOLVING

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	S	S	S
CLO2	S	S	S	M	S
CLO3	S	M	S	S	S
CLO4	S	S	M	S	S

DS24C03 FUNDAMENTALS OF DATA SCIENCE

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

DS24CP1 PROGRAMMING IN C LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	S
CLO3	S	S	S	S	M
CLO4	S	S	S	M	S

DS24C04 PYTHON PROGRAMMING FOR DATA SCIENCE

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

DS24C05 OPERATING SYSTEM

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	M	S	S
CLO3	S	S	S	S	M
CLO4	S	S	M	S	M

DS24CP2 PYTHON PROGRAMMING LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

DS24CP3 STATISTICAL ANALYSIS LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	M	S

DS24C06 OBJECT ORIENTED PROGRAMMING

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	M	M
CLO4	S	S	M	S	M

DS24C07 DATA STRUCTURES

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	M	M
CLO4	S	S	S	S	M

DS24CP4 OBJECT ORIENTED PROGRAMMING LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

DS24CP5 DATA STRUCTURES LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

DS24C08 DATA ENGINEERING

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

DS24C09 DATABASE SYSTEMS

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

DS24CP6 DATA ENGINEERING LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

DS24CP7 DATABASE SYSTEMS LAB

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

SEMESTER I

Course Number	Course Name	Category	L	T	P	Credit
CY24C01	**PROGRAMMING IN C**	Theory	58	2	-	3

Preamble

This course introduces fundamental programming constructs in C. It covers the concepts such as arrays, functions, structures, pointers and file handling. It provides comprehensive coverage on industry 4.0.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the programming constructs and structure of C programming and Industry 4.0 technologies	K1
CLO2	Understand the purpose of arrays, strings, structures, pointers and files to solve problems	K2
CLO3	Apply functions to solve problems using procedure-oriented approach	K3
CLO4	Analyze the problems and solve it by applying appropriate logic	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong; M-Medium

Syllabus

Unit I **(12 Hrs)**

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

Unit II **(12 Hrs)**

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 III **(12 Hrs)**

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 Structure Definition: Structure Initialization - Comparison of Structure Variables - Arrays of Structures - Arrays within Structures

Unit IV **(12 Hrs)**

Pointers: Understanding Pointers - Accessing the Address of a Variable - Declaring and Initializing Pointers - Accessing a Variable through its Pointers - Pointers and Arrays - Pointers and Character Strings - Pointers and Functions. File Management in C: Defining and Opening a File - Closing File - **I**/O Operations on Files - Error Handling during I/O Operations - Command Line Arguments.

Unit V **(10 Hrs)**

Introduction to Industry 4.0 - Need - Reasons for Adopting Industry 4.0 - Definition - Goals and Design Principles - **Technologies of Industry 4.0** - Skills required for Industry 4.0 - Advancements in Industry - **Impact of Industry 4.0 on Society, Business, Government and People - Introduction to 5.0.**

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	E. Balagurusamy	Programming In ANSI C	Tata Mc Graw Hill	2019, 8th Edition
2	P. Kaliraj, T. Devi	Higher Education for Industry 4.0 and Transformation to Education 5.0	CRC Press - Taylor & Francis Group	2021, 1st Edition

Reference Books

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	Byron Gottfried	Programming with C	Tata McGraw Hill	2018, 4th Edition
2	Yashwant Kanetkar	Let Us C: Authentic Guide to C Programming Language	BPB Publications	2020, 17th Edition

Pedagogy

- Lectures, Group discussions, Demonstrations

Course Designer

Dr. Sabitha Banu A

Course Number	Course Name	Category	L	T	P	Credit
PP22C02	**COMPUTATIONAL AND ALGORITHMIC THINKING FOR PROBLEM SOLVING**	Theory	45	-	-	3

Preamble

This course aims to kindle young minds to think like a computer scientist, with the idea that Computing and computers will enable the spread of computational thinking. Computational thinking is thinking recursively, reformulating a seemingly difficult problem into one which we know how to solve and taking an approach to solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Define the basic principles of logical reasoning, problem solving in computational thinking	K1
CLO2	Understanding the applications of propositional logic, problem representation and techniques	K2
CLO3	Apply algorithmic thinking to problem solving using tools	K3
CLO4	Apply and analyze to solve domain specific problems using computational thinking concepts	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	M	S	S	S	S
CLO2	S	S	S	M	S
CLO3	S	M	S	S	S
CLO4	S	S	M	S	S

S – Strong, M - Medium

Syllabus

Unit I **(7 Hrs)**

Basics: Introduction to Computational Thinking- Data Logic - History of Computational Thinking- Applications of Computational Thinking.

Unit II **(8 Hrs)**

Data- Information and Data - Data Encoding - Logic - Boolean logic - Applications of simple Propositional Logic. Tool: Flow algorithm and Scratch.

Unit III **(10 Hrs)**

Problem Solving and Algorithmic Thinking: Problem definition- Logical reasoning- Problem decomposition- Abstraction- Problem representation via Algorithmic thinking: Name binding- Selection- Repetition and Control Abstraction- Simple Algorithms – Comparison of performance of Algorithms.

Unit IV **(8 Hrs)**

Activities in Class: Sudoku -Towers of Hanoi- Graph Coloring - Geographical Map reading- Poem reading - Novel reading - Data analysis on news.

Unit V **(12 Hrs)**

Problem Solving Techniques- Factoring and Recursion Techniques- Greedy Techniques-Divide and Conquer- Search and Sort Algorithms- Text Processing and Pattern matching. Tool: iPython

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	David Riley and Kenny Hunt	Computational Thinking for Modern Solver	Chapman & Hall/CRC	2014, 1st Edition
2	Paolo Ferragina, FabrizioLuccio	Computational Thinking First Algorithms	Springer International Publishing	2018
3	Karl Beecher	Computational Thinking – A beginner's guide to problem solving	BSC publication	2017

Pedagogy

Lectures, Simulation exercises, Demonstration, PPT, Case Study

Evaluation Pattern:

Assessment	Number	Marks
Quiz (online or offline)	5	50
Class Activity	5	25
Group Project (Domain Specific)	1	25
Total		100

Course Number	Course Name	Category	L	T	P	Credit
DS24C03	**FUNDAMENTALS OF DATA SCIENCE**	Theory	58	2	-	3

Preamble

The course introduces learners with a solid foundation in essential concepts and techniques in Data Science. Students will have the knowledge and skills to effectively analyze data, handle heterogeneous datasets through preprocessing and visualization methods, and utilize common data science tools to address real-world challenges.

Prerequisite

- NIL

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Remembering the concepts of Data, information, and Database.	**K1**
CLO2	Understanding the basic concepts of Data Science, databases, data preparation and methods.	**K2**
CLO3	Applying the analysis concepts in SQL, visualization tools, and Python.	**K3**
CLO4	Analyzing the Methodology of Data Science	**K4**

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

S- Strong; M-Medium

Syllabus

Unit I **(11 Hrs)**

Introduction: 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 – **Tools and Skills required.**

Unit II **(12 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.

Unit III **(12 Hrs)**

Data Preparation: Data cleaning-Data reduction-Data transformation-Data normalization-Data integration

Basics Concepts:

Machine Learning Paradigm - Evaluating a classifier: Evaluation steps-Handling unbalanced classes-Model generalization-Evaluation metrics: **confusion matrix**-accuracy-precision and recall-F-measure.

Unit IV **(12 Hrs)**

Data Science Methodology: Big Data analysis: Introduction-Characteristics of Big Data-Types of Big Data-Big Data analysis problems – techniques - Big Data analytics platforms-MapReduce architecture. Examples of Data Analytics – Data Analytics Lifecycle: Data Discovery, Data Preparation, Model Planning, Model Building, Communicate Results.

Unit V **(11 Hrs)**

Data Visualizing using Tableau: Introduction-Dimensions and Measures, Descriptive statistics-Basic Charts-Dashboard design & principles-**Special chart types**

Data Science in Practice: Need of Data Science in the real world-**Hands-on Data Science with Python**-Necessary Python libraries-loading the dataset-**Dataset preprocessing**-Feature selection and normalization.

Text Books:

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

Reference Books:

S. No	Author	Title of the Book	Publisher	Year of Publication / Edition
1	Joel Grus	Data Science from Scratch: First Principles with Python	O'Reilly Publications	2019, 2nd Edition
2	Lillian Pierson	Data Science for Dummies	Wiley	2021, 3rd Edition

Pedagogy

- Chalk and talk PPT, Discussion, Assignment, Demo, Quiz

Course Designer

Dr. S. Poongodi

Course Number	Course Name	Category	L	T	P	Credit
DS24CP1	**Programming in C Lab**	PRACTICAL	-	-	45	2

Preamble

This course offers practical training in C Programming, enhances the skill set through hands-on experience. By completing the course, learners will gain the ability to craft logical solutions for various problems. The course involved in compiling, linking, and debugging code, as well as tackling more intricate programming tasks.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Outline the logic using flowchart for a given problem and develop Programs using conditional and looping statements.	K1
CLO2	Differentiate built-in functions and apply user defined functions to solve problems	K2
CLO3	Construct programs with features of Arrays, Structures and Pointers.	K3
CLO4	Design and develop the programs to solve real-world problems.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	S
CLO3	S	S	S	S	M
CLO4	S	S	S	M	S

S- Strong, M-Medium

Programs List

- Exercise using different data types
- Exercise using operators
- Exercise to implement control structures
- Exercise using loop statements
- Exercise to implement arrays
- Exercise using built-in functions
- Exercise to generate user-defined function

- Exercise using structures
- Exercise using pointers
- Exercise to work with files

Pedagogy

- Demonstration of working environment / Tools / Software/Program

Course Designer

Dr. M. Sasikala

SEMESTER II

Course Code	Course Name	Category	L	T	P	Credit
DS24C04	**PYTHON PROGRAMMING FOR DATA SCIENCE**	Theory	58	2	-	3

Preamble

This course comprehensively introduces Python programming and its applications in data analysis, covering fundamental programming concepts, data manipulation techniques, and visualization tools.

Pre-requisite

- Programming Fundamentals
- Problem Solving Silks

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall Python programming basics, including syntax, data types, operators, and control structures.	K1
CLO2	Understand Python's concepts of functions, strings, lists, tuples, sets, and dictionaries.	K2
CLO3	Apply Python programming concepts to work with data structures such as strings, lists, tuples, sets, and dictionaries to solve computational problems.	K3
CLO4	Analyse and utilize advanced Python libraries, including NumPy, Pandas, and Matplotlib, for efficient data manipulation and visualization.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	M	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong, M-Medium

Syllabus

UNIT I **(11 Hrs.)**

Introduction: History, Executing Python programs, Commenting in Python, Basics of Python Programming: Character Set, Tokens, data Types, Variables, Print, Input and Eval Function, Formatting number and Strings. Operators and Expressions: Arithmetic Operators, Operator Precedence and Associativity, Bitwise Operators, Boolean Operators.

UNIT II **(11 Hrs.)**

Decision Statements: Conditional (if), Alternative (if-else), Chained Conditional (if-elif-else). Loop Control Structures: While, For, Break, Continue, Range Function. Functions: Introduction, Inbuilt Functions, User-Defined functions, passing Parameters, Return Values, Recursion.

UNIT III **(12 Hrs.)**

Strings: Basic Inbuilt Python Functions for String, Index Operator, Immutability, String Methods and Operations**.** Lists: Creating Lists, Accessing Lists, List Slicing, List Comprehension. Sets: Creating Sets, Set Operations

UNIT IV **(12 Hrs.)**

Tuples: Creating Tuples, Inbuilt Functions for Tuples, Operations on Tuples. Dictionaries: Need, Basics of Dictionaries, Creation, Adding and Replacing Values, Operations and Methods, Nested Dictionaries. Introduction to NumPy: NumPy Standard Data Types, Basics of NumPy Arrays, Aggregations.

UNIT V **(12 Hrs.)**

Data Manipulation with Pandas: Introduction to Pandas, Installation and Usage**,** Data Indexing and Selection, Operating on Data, Handling Missing Data. Visualization with Matplotlib: Introduction to Matplotlib, Simple Line Plots, Simple Scatter Plots, Histogram

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Ashok N. Kamthane, Amit Ashok Kamthane	Programming and Problem Solving with Python	McGraw-Hill	2018, 2nd Edition
2	Jake VanderPlas	Python Data Science Handbook - Essential Tools for Working with Data	O'Reilly	2017, 1st Edition

Reference Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Allen B. Downey	Think Python: How to Think like a Computer Scientist	O'Reilly Publishers	2016, 2nd Edition
2	Wesley J Chun	Core Python Applications Programming	Prentice Hall	2012, 3rd Edition

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala

Course Code	Course Name	Category	L	T	P	Credit
DS24C05	OPERATING SYSTEM	Theory	58	2	-	3

Preamble

This course introduces the fundamental structure of operating systems, focusing on essential concepts such as process management, synchronization, and CPU scheduling. It examines the core components of an operating system and provides an overview of file system interfaces and implementations.

Prerequisite

- Basic knowledge of Computer Architecture
- Programming Fundamentals

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the various elements and principles of Operating systems	K1
CLO2	Understand the concepts of process, thread, CPU scheduling, synchronization tools and memory management	K2
CLO3	Apply page replacement policies, deadlock avoidance and detection algorithms and file concepts & organization for dynamic memory management	K3
CLO4	Analyse various CPU scheduling algorithms and different methods for communication between processors	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	S
CLO2	S	S	M	S	S
CLO3	S	S	S	S	M
CLO4	S	S	M	S	M

S- Strong; M-Medium

Unit I **(12 Hrs.)**

Overview: OS's Role in Computer Systems, Computer System Organization and Architecture, Operating-System Operations, Resource Management, Security and Protection, Virtualization, Distributed Systems. Operating Systems Structures: Operating System Services, System calls, Systems Services, Linkers and Loaders.

Unit II **(12 Hrs.)**

Processes: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication. Threads and Concurrency: Multicore Programing, Multithreading Models. CPU Scheduling: Basic Concepts - CPU Scheduler, Preemptive and Nonpreemptive Scheduling and Dispatcher, Scheduling Criteria, Scheduling Algorithms - FIFO, SJF and RR

Unit III **(12 Hrs.)**

Synchronization Tools: Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores. Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Unraveling the Garuda-Naga knot - Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit IV **(11 Hrs.)**

Main Memory: Contiguous Memory Allocation, Paging, Structure of Page Table, Swapping**.** Virtual Memory – Akasha effect: Demand Paging, Page Replacement algorithms, FIFO, Optimal Page and LRU, Page-Buffering Algorithms, Applications and Page Replacement**.**

Unit V **(11 Hrs.)**

File System Interface: File Concept, Access Methods, Directory Structure, protection**,** Memory-Mapped Files. File System Internals: File Systems, Partitions and Mounting, File Sharing, Virtual File Systems, Remote File Systems.

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Abraham Silberschatz, Greg Gagne, Peter B. Galvin	Operating System Concepts	Wiley Publisher	2023, Global Edition

Reference Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Andrew S. Tanenbaum, Herbert Bos	Modern Operating Systems	Pearson Educations	2023, 5th Edition
2	William Stallings	Operating Systems: Internals and Design Principles	Pearson Educations	2017, 9th Edition

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. M. Sasikala
2. Dr. S. Poongodi

Course Code	Course Name	Category	L	T	P	Credit
DS24CP2	**PYTHON PROGRAMMING LAB**	Practical	-	-	45	2

Preamble

This Course emphasizes Python programming fundamentals integrated with problem-solving skills. Key areas covered include Basics of Python syntax and programming constructs, Data structures like lists, tuples, dictionaries, and sets, Libraries like NumPy, Pandas, and Matplotlib.

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic Python syntax, data types, variables, and control structures like if-statements and loops.	K1
CLO2	Understand arithmetic operations, logical operators, and precedence rules to solve real-world problems using Python.	K2
CLO3	Apply data structures such as lists, tuples, dictionaries, and sets in Python to organize and process data.	K3
CLO4	Analyze Python libraries like NumPy, Pandas, and Matplotlib to manipulate data and create visualizations for analysis.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

S- Strong, M-Medium

Syllabus

- Program to understand and implement the concepts of Data Types, Variables, Operators, and Operator Precedence.
- Program to understand and develop Decision-making statements and Control structures.
- Program to create and invoke Built-in & User-defined functions and perform String

Operations.

- Program to explore and perform operations on Data structures such as lists, tuples, dictionaries, and sets.
- Program to understand and implement basic operations using NumPy, Pandas, and Matplotlib.

Pedagogy

Demonstration of working environment / Tools / Software/Program

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala

Course Code	Course Name	Category	L	T	P	Credit
DS24CP3	**STATISTICAL ANALYSIS LAB**	Practical	-	-	45	2

Preamble

This course provides practical experience in using PSPP to apply statistical techniques. Students will learn to analyze data, create visualizations, and interpret results. They will work with concepts such as frequency distributions, central tendency, regression analysis, and probability. The course helps students develop the skills to analyze real-world data and make data-driven decisions.

Prerequisite

- Basic Knowledge of Statistics

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall and describe key statistical concepts such as frequency distribution, measures of central tendency, variance, correlation, and regression.	K1
CLO2	Understand the principles of statistical techniques and their significance in data analysis.	K2
CLO3	Apply various statistical methods and techniques, including frequency distribution, regression analysis, and probability calculations.	K3
CLO4	Analyze data sets using statistical tools to identify patterns and relationships.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	M	S

S- Strong, M-Medium

Syllabus

- Program to find the Frequency Distribution of given data.
- Program to plot Graphs and Charts for data visualization.
- Program to calculate Measures of Central Tendency (Mean, Median, Mode).
- Program to compute Standard Deviation and Variance for a dataset.
- Program to analyze and compute Correlation between two datasets.
- Program to perform Simple Linear Regression on a given dataset.
- Program to calculate the Probability of events in a dataset.
- Program to simulate and analyze Theoretical Distributions.

Pedagogy

Demonstration of working environment / Tools

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Deepa

SEMESTER III

Course Code	Course Title	Category	L	T	P	Credit
DS24C06	OBJECT ORIENTED PROGRAMMING	Theory	58	2	-	3

Preamble

This course introduces object-oriented programming concepts and also java programming. It covers the concept of loops, arrays, input/output structures, events, exceptions and threads using Java.

Prerequisites

- Programming Language
- Basics of computers

Course learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Remember the principles of object-oriented programming, Java language syntax and semantics	K1
CLO2	Understand the concepts of object-oriented programming and java	K2
CLO3	Apply the principles of inheritance, packages and interfaces in simple java applications.	K3
CLO4	Analyse the working features of java language	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	M	M
CLO4	S	S	M	S	M

S- Strong; M-Medium; L-Low

UNIT I **11 Hrs.**

Fundamentals of Object-Oriented Programming: Object-Oriented Paradigm, Basic Concepts of Object-Oriented Programming, **Benefits and application of Object-Oriented Programming**. Java Evolution, - Overview of Java: Simple Java program, Structure, Java Tokens, Statements, Java Virtual Machine, Command line Arguments.

UNIT II **12 Hrs.**

Constants, Variables, Data Types: Constants, Variables, Data Types, Declaration of Variables, Scope of Variables, Symbolic Constants. - **Operators and Expressions:** Types of Operators, Arithmetic Expression, Evaluation of Expression - Decision Making and Branching - **Decision Making and Looping.**

UNIT III **12 Hrs.**

Classes, objects and methods - Arrays and Strings: One Dimensional Arrays, Array creation, **Two–Dimensional Arrays** – Strings - Interfaces: Multiple Inheritance: Defining Interfaces - Extending interfaces-implementing interfaces - Accessing interface variables.

UNIT IV **11 Hrs.**

Packages: Using system packages, Java API packages, creating packages, Accessing a package. Multithreaded Programming: Creating Thread, Life cycle of a Thread, **Thread Methods** - Managing Errors and Exceptions.

UNIT V **12 Hrs.**

Managing Input and Output files: Creation of files, Reading /Writing character- Reading/Writing bytes, Concatenating and Buffering Files, **Random Access File** – Java Database Connectivity.

TEXTBOOKS

S.No.	Author	Title of the book	Publisher	Year of Publication & Edition
1.	E. Balaguruswamy	Programming with JAVA	A Primer, Mc-Graw Hill Professional	2019, 6th Edn.

REFERENCE BOOKS

S.No.	Author	Title of the book	Publisher	Year of Publication & Edition
1	Walter Savitch,	Java: An Introduction to Problem Solving and Programming	Pearson Education	2019, 8th Edn.
2.	Cay.S.Horstmann	Core Java Volume I—Fundamentals	Pearson Education	2018, 11th Edn.
3.	Herbert Schildt	Java: A Beginner's Guide	McGraw Hill Education	2018, 8th Edn.

PEDAGOGY

- Chalk and talk PPT, Discussion, Assignment, Demo, Quiz

COURSE DESIGNERS

1. Dr. S. Poongodi
2. Dr. M. Sasikala

Course Code	Course Title	Category	L	T	P	Credit
DS24C07	DATA STRUCTURES	Theory	43	2	-	3

Preamble

This course introduces the concepts of Abstract data type (ADTs), linear data structures which includes lists, stacks, and queues. The course covers various sorting, searching and hashing algorithms and applications of linear data structures

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall fundamental concepts of data structures, types, and their real-life applications.	K1
CLO2	Understand the working and applications of linear and non-linear data structures.	K2
CLO3	Apply appropriate data structures to solve computational problems using algorithms.	K3
CLO4	Analyse algorithm efficiency and the suitability of data structures for optimization..	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	M	M	M	S
CLO2	S	S	M	M	S
CLO3	S	S	S	M	M
CLO4	S	S	S	S	M

S- Strong; M-Medium

Unit I **08 Hrs.**

Data Structures: Need of Data Structure –Different Types of Data Structures –Selecting and implementing a Data Structure **–** Real-life scenarios for Data Structures – **Difference between Data Structures and Database Management Systems**. Abstract Data Types and Analysis: Complexity – Asymptotic Notation - Working of Recursion.

Unit II **09 Hrs.**

Linear Data Structures: Arrays - Declaration of Arrays – Implementation of arrays - Applications of Arrays - Stack – Working of Stack - Applications of Stacks - Queues - Single Ended Queues – Enqueue – Dequeue – Front Operation – Implementation of Single Ended Queues using lists – **Applications of Queues**.

Unit III **09 Hrs.**

Linked Lists: Singly Linked List - Insert Node – Delete Node – Value at Operation – Implementation of Singly Linked List – Doubly Linked List - Insert Node – Delete Node – Value at Operation – Implementation of Doubly Linked List - **Applications of Linked List**.

Unit IV **09 Hrs.**

Non-Linear Data Structures: Trees - Definitions – Types of Binary Trees – Implementation of Binary Trees - Pointer-based - Array-based – Linked List based – Traversal - In Order – Pre Order – Post Order – Level Ordered – Basic Operations - **Application of Trees** – Graphs - Components of a Graph - Graph Representation - Types of Graphs –Working – Traversal.

Unit V **08 Hrs.**

Sorting and Searching: Importance of Sorting Algorithm – Exchange Sort - Selection Sort - Insertion Sort – Divide and conquer – Linear Search - **Binary Search**.

Text Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Shriram K Vasudevan, Abhishek S Nagarajan, Karthick Nanmaran .	Data Structures Using Python	Oxford University Press	2021, 1st Edn.

Reference Books

S. No	Author	Title of the Book	Publisher	Year of Publication and Edition
1	Rance D Necaise	Data Structures and Algorithms using Python	John willey &sons	2011, 1st Edn.
2	Ellis Horowitz & Sartaj Sahani	Fundamentals of Data Structure	Galghotia Book Source	2003, 1st Edn.

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. M. Sasikala
2. Dr. S. Poongodi

Course Code	Course Title	Category	L	T	P	Credit
DS24CP4	OBJECT ORIENTED PROGRAMMING LAB	Practical	-	-	45	2

Preamble

This Course emphasizes Object oriented programming fundamentals integrated with problem-solving skills. It demonstrates inheritance, interfaces and packages It also explores different exception handling mechanisms and concept of multithreading

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Apply the concepts of classes, objects, inheritance, and interfaces to **d**evelop Object-Oriented Programs	K1
CLO2	Implement control statements and exception handling techniques to create robust and error-free programs.	K2
CLO3	Develop applications that respond to mouse events and manage concurrent execution using thread methods**.**	K3
CLO4	Manipulate data efficiently using string functions and implement file handling operations for reading and writing data.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

S- Strong, M-Medium

Programs to understand and implement the concepts:

1. Classes and Objects
2. Control Statements
3. Inheritance
4. Interfaces
5. Packages
6. String Functions

7. Mouse Events
8. Thread Methods
9. Exception Handling
10. Files Programming

Pedagogy Demonstration of working environment / Tools / Software/Program

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala.

Course Code	Course Title	Category	L	T	P	Credit
DS24CP5	DATA STRUCTURES LAB	Practical	-	-	45	2

Preamble

This course is designed to provide practical exposure to fundamental and advanced data structures and their applications. Through hands-on implementation, students will gain a strong foundation in organizing and managing data efficiently.

Course Learning Outcome

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Develop and manipulate basic data structures such as arrays, linked lists, stacks, and queues.	K1
CLO2	Implement and analyse searching algorithms and sorting techniques to efficiently process data.	K2
CLO3	Design and implement advanced data structures, including Binary Search Trees (BST) and graph traversal techniques (DFS, BFS), for efficient data organization and retrieval.	K3
CLO4	Analyse the performance of data structures and algorithms in terms of time and space complexity to optimize problem-solving approaches.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	M
CLO4	S	S	S	S	S

S- Strong, M-Medium

Programs to understand and implement the concepts in Python:

1. Linear Data Structures – Arrays - creation, insertion, deletion, update, Concatenation
2. Memory-based Linear Data Structures – Stacks and Queues - Stack: Operations, infix and postfix Expression - Queues: Single Ended and Double Ended queue operations
3. Pointer-based Linear Data Structures –Singly and Doubly Linked List – creation, insertion, deletion

4. Non-Linear Data Structures – Trees and Graphs –Trees Implementation, Tree Traversal, Graphs Representation, Graph traversal
5. Searching and Sorting Techniques – Linear Search, Binary Search., Bubble Sort, Insertion Sort, Quick Sort.

Pedagogy :
Demonstration of working environment / Tools / Software/Program

Course Designers

1. Dr. M. Sasikala
2. Dr. S. Poongodi

Course Code	Course Title	Category	L	T	P	Credit
CS23SBGP	Gen-AI	practical	44	1	-	3

Preamble

The objective of this course is to understand the breadth and depth of Generative Artificial Intelligence (Gen AI) and to impart knowledge on its ethical implications, practical applications, and emerging trends.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the fundamental concepts and ethical considerations of Generative AI.	K1
CLO2	Apply AI principles in practical settings using basic AI tools and platforms.	K2
CLO3	Develop advanced skills in specialized AI applications such as text analysis, natural language processing, and image recognition.	K3
CLO4	Explore emerging trends in AI, integrating advanced AI tools into diverse professional practices.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	S
CLO3	S	S	M	S	S
CLO4	S	M	S	M	S

S- Strong; M-Medium

UNIT I: Introduction to Gen AI **9 Hrs.**

Understanding Gen AI: Definition and scope of Gen AI - Overview of its applications in various fields - Introduction to essential skills needed for Gen AI. Ethical Considerations: Discussion on ethical guidelines and responsible use of AI - Understanding the impact of AI on society and individuals.

Hands-on Activity: Exploring AI Tools

- Working with appropriate content creation Gen-AI tools to engage with ChatGPT to explore various subjects, simulate interviews, or create imaginative written content.
- Working with appropriate writing and rephrasing Gen-AI tools to drafting essays on designated topics and refining the content with improved clarity, coherence, and correctness.

UNIT II: Basic AI Concepts **8 Hrs.**

Introduction to AI: Basic concepts and terminology of artificial intelligence - Examples of AI in everyday life - Real-world examples of AI applications in different domains. Machine Learning Basics: Understanding the principles of machine learning - Overview of supervised and unsupervised learning.

Hands-on Activity: Simple AI Projects

- Working with appropriate educational content creation Gen-AI tools to generate quizzes and flashcards based on classroom material.
- Working with appropriate language learning Gen-AI tools to practice and enhance language skills through interactive exercises and games across multiple languages.

UNIT III: AI in Practice **9 Hrs.**

Text Analysis and Natural Language Processing (NLP): Introduction to NLP concepts and techniques - Hands-on exercises analyzing text data and extracting insights. Image Recognition and Processing: Basics of image recognition algorithms and techniques - AI Tools for Text and Image Processing.

Hands-on Activity: Text and Image Projects

- Working with appropriate image processing Gen-AI tools to experiment with AI-generated images.
- Working with appropriate object recognition Gen-AI tools to identify various objects such as text, images, products, plants, animals, artworks, barcodes, and QR codes

UNIT IV: AI for Productivity and Creativity **9 Hrs.**

AI-enhanced Productivity and creativity Tools: Overview of productivity and creativity tools enhanced with AI capabilities - Tips for integrating AI into daily tasks and workflows. AI and Jobs: Exploring how AI impacts jobs and industries - Discussion on opportunities and challenges - Exploration of AI- powered creative tools and applications.

Hands-on Activity: Productivity and Creativity

- Working with appropriate content creation Gen-AI tools to generate interactive videos / blog posts / art / drawing / music and storytelling experience.
- Working with appropriate resume generation Gen-AI tools to create professional resumes efficiently.

UNIT V: Future of Gen AI and Final Project **9 Hrs.**

Emerging Trends in Gen AI - Applications of Generative AI - Ethical and Societal Impact of Gen AI - Future Directions and Challenges - Case Studies in Generative AI.

Hands-on Activity: Trends in Gen AI

- Working with appropriate speech generation Gen-AI tools to customize synthetic speech for virtual assistance across different applications.
- Working with appropriate data analysis Gen-AI tools to perform data analysis, visualization, and predictive modeling tasks.
- Working with appropriate Gen-AI design tools to simplify the creation of visually appealing presentations.

- Working with appropriate website builder Gen-AI tools to develop professional websites with AI assistance.

Pedagogy

- Demonstration of AI Tools, Lectures and Case studies.

Course Designers

1. Mrs. S. Ponmalar

Evaluation Pattern for Gen-AI

Quiz	: 50 Marks (5 quizzes with each 10 marks)
Case study	: 25 Marks
Online Exam	: 25 Marks
Total	**: 100 Marks**

JOB ORIENTED COURSE

Title: Microsoft Power BI **Duration: 60 Hrs**

Introduction to Power BI and Data Analysis: Introduction to Power BI: Overview of Power BI features and capabilities- Importance of data visualization in decision-making - Fundamentals of Data Analysis - Roles in Data Analysis - Tasks of a Data Analyst: Data collection, cleaning, and transformation - Creation of meaningful visualizations and reports - Extracting actionable insights from data. CRISP DM FRAMEWORK. Using Power BI - Building Blocks of Power BI- Understanding Power BI Desktop and Power BI Service - Differentiating between datasets, reports, and dashboards Collaborative aspects of Power BI, including sharing and collaboration.

Data Cleaning and Transformation in Power BI: Data Acquisition in Power BI - Importing data from various sources - Data transformation and cleaning techniques - Connecting Power BI to relational databases - Importing and querying data from SQL Server and other relational databases.

Data Modelling and DAX Functions: Creating Calculated Columns - Understanding the need for calculated columns - Hands-on exercises on creating and using calculated columns - Exploring Time-Based Data - Handling date and time data in Power BI - Time-based calculations and analysis. DAX Calculations in Data Analysis - Guidelines for choosing and implementing DAX calculations - Practical applications and examples. Star Schema Design - Understanding star schema and its advantages - Implementing star schema in Power BI data models.

Data Visualization in Power BI: Writing DAX Formulas - In-depth exploration of DAX syntax and functions - Advanced DAX calculations for complex data analysis. Designing Detailed Reports - Advanced report design techniques - Utilizing features like tooltips and drill-throughs. Statistical Analysis in Power BI- Advanced statistical functions in DAX - Use of advanced visuals for statistical insights. Creating Dashboards in Power BI - Detailed steps for creating interactive dashboards.

Power BI Services vs Desktop: Configuring Row-Level Security - Implementing security measures at the row level - Best practices for securing sensitive data. Setting Up Data Alerts - Configuring alerts for monitoring changes - Troubleshooting common alert issues. Preparing for PL-300 - Model the Data - Overview of PL-300 exam and key concepts - Practical exercises and scenarios for data modelling.

SEMESTER IV

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24C08	DATA ENGINEERING	THEORY	58	2	-	3

Preamble

This course introduces the principles and practices of data engineering and mining with applications in data science. Students will learn to design and implement data pipelines, perform data pre-processing and warehousing, and apply data mining techniques. Emphasis is placed on developing practical skills for end-to-end data workflows, from data extraction to model evaluation.

Pre-requisites

- Basic knowledge of Programming in Python
- Introductory concepts in Statistics and Probability

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the concepts of data pipelines, ETL, data preprocessing, and data mining fundamentals.	K1
CLO2	Understand data quality measures, OLAP operations, and basic algorithms in association, classification, and clustering.	K2
CLO3	Apply data extraction, preprocessing, and mining techniques	K3
CLO4	Analyze the effectiveness of different data pipelines, preprocessing methods, and mining models in solving real-world data science problems.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

S-Strong, M-Medium

Unit I **(11 Hrs.)**

Data Pipeline - Understanding Data - Design Planning: Workflow Design -Architecture Development - Project Diagrams - ETL Data Pipeline - Batch Processing -Streaming Methods - Cloud-Native Pipelines - Automating Pipelines -ETL Pipeline Use Cases.

Unit II **(11 Hrs.)**

Data Sourcing- Accessibility of Data - Types of Data Sources - Extracting Data From - CSV and Excel Files, Parquet Files, API Connections, Databases (SQL/NoSQL), Web Pages -Data Cleaning and Transformation: Data scrubbing - Data transformation in ETL pipelines – Loading Transformed Data: Data loading – types of load destinations – optimizing data loading.

Unit III **(12 Hrs.)**

Data Mining - KDD Process - Knowledge Mined - Data Preprocessing: Data quality measures – Data cleaning - Data integration – Data transformation: Normalization – Discretization – Data Compression – Sampling -Dimensionality reduction: PCA – Attribute subset selection

Unit IV **(12 Hrs.)**

Data Warehouse - Modeling: Data Cube – Schemas – Concept Hierarchies – Typical OLAP operations. Market basket analysis- Frequent itemset, closed itemset and association rules – Frequent Itemset mining methods: Apriori algorithm – Generating association rules.

Unit V **(12 Hrs.)**

Decision Tree Induction – Baye's theorem – Naïve Bayesian classification – Cluster Analysis– Partitioning Methods - Hierarchical Methods: Basic concepts – Agglomerative – Divisive.

Text Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Jiawei Han, Jian Pie and Hanghang Tong	Data Mining Concept and Techniques	Morgan and Kaufmann	2022, 4th Edn.
2	Brij Kishore Pandey, Emily Ro Schoof	Building ETL Pipelines with Python	O'Reilly	2023, 2nd Edn.

Reference Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Parteek Bhatia	Data Mining and Data Warehousing - Principles and Practical Techniques	Cambridge University Press	2019, 2nd Edn
2	Joe Reis & Matt Housley .	Fundamentals of Data Engineering	O'Reilly	2022, 1st Edn.

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24C09	DATABASE SYSTEMS	THEORY	43	2	-	3

Preamble

This course introduces the fundamental principles of database systems with emphasis on relational models. The course also covers PL/SQL constructs, transactions, and triggers, enabling students to develop and manage relational databases effectively for real-world applications.

Pre-requisite

- Introductory concepts in data structures

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall fundamental concepts of database systems, architectures, and data models.	K1
CLO2	Understand data modeling, relational algebra, and normalization principles for designing relational databases and NoSQL databases.	K2
CLO3	Apply SQL and PL/SQL constructs to create, query, and manipulate relational databases.	K3
CLO4	Analyze database transactions, triggers, and procedures to ensure consistency, integrity, and performance.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	M	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	M	M
CLO4	M	S	S	S	M

S- Strong, M-Medium

Unit I (8 Hrs.)

Databases and Database Users - Characteristics of the Database Approach - Database System Concepts and Architecture: Data models, Schemas and Instances – Three-Schema Architecture and Data Independence – DBMS Component Modules.

Unit II (8 Hrs.)

Data Modeling using ER Model – Entity Types, Entity sets, Attributes and Keys – Relationship Types, Sets, Roles and Structural Constraints – Weak Entity Types. Relational Model concepts: Domains, Attributes, Tuples and Relations - Relational Notations. Normalization: Functional Dependencies – 1NF – 2NF – 3NF – BCNF – 4NF and 5NF.

Unit III **(8 Hrs.)**

SQL: Data Definition and Data types – Constraints – Basic Retrieval Queries – INSERT, DELETE and UPDATE statements - Aggregate functions – Grouping - Views – Schema Change Statements.

Unit IV **(10 Hrs.)**

PL/SQL: Block Structure – Data Types – Control Structures - SQL in PL/SQL - Data Manipulation – Transaction Control Statements - Cursor Types - Exceptions - Procedures - Functions - Packages – Triggers.

Unit V **(9 Hrs.)**

Introduction to NOSQL Systems: Emergence of NOSQL, Characteristics of NOSQL, Categories of NOSQL– CAP theorem– Document-based NOSQL systems and Mongo DB– NOSQL Key value-Neo4j.

Text Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Ramez Elmasri, Shamkant B. Navathe	Fundamentals of Database Systems	Pearson Education	2021, 7th Edn.
2	Nilesh Shah	Database System using Oracle	Pearson Publication	2016, 2nd Edn.

Reference Books

S. No.	Author	Title of the Book	Publisher	Year and Edition
1	Abraham Silberschatz, Henry F.Korth and S.Sudarshan	Database System Concepts	McGraw Hill	2020, 7th Edn.
2	Peter Rob, Carlos Coronel	Database Systems: Design, Implementation, and Management	Cengage Learning	2019, 13th Edn.
3	Ranjeet Jha	MongoDB Essentials	Notion Press	2025, 1st Edn.

Pedagogy

Lectures, Demonstrations, Case studies.

Course Designers

1. Dr. M. Sasikala

2. Dr. S. Poongodi

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24CP6	DATA ENGINEERING LAB	PRACTICAL	-	-	45	2

Preamble

This course provides practical exposure to the processes of data engineering and data mining. Students will gain hands-on experience in data extraction, cleaning, pre-processing, dimensionality reduction, and building data pipelines.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic concepts of data engineering and mining, including extraction, preprocessing, and storage.	K1
CLO2	Apply preprocessing techniques and dimensionality reduction methods to prepare data for analysis.	K3
CLO3	Implement data mining algorithms for association, classification, regression, and clustering using suitable tools.	K3
CLO4	Analyze results of mining techniques to evaluate performance and extract meaningful insights.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong, M-Medium

Exercises to understand and implement the following concepts:

- Data Pipeline & ETL
- Data Extraction
- Data Pre-processing
- Data Warehousing and OLAP

- Association Rule Mining.
- Classification Techniques
- Clustering Methods

Pedagogy

Demonstration of working environment / Tools / Software/Program

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24CP7	DATABASE SYSTEMS LAB	PRACTICAL	-	-	45	2

Preamble

This course provides practical training in designing, creating, and managing relational databases using SQL and PL/SQL. Students will gain hands-on experience with table creation, data manipulation, queries, joins, and subqueries. The course also introduces advanced features in PL/SQL to develop robust database applications.

Course Learning Outcomes

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

CLO Number	CLO Statement	Knowledge Level
CLO1	Recall the basic concepts of SQL including DDL, DML, and query operations.	K1
CLO2	Apply SQL commands to create tables, manipulate data, and retrieve information using joins and subqueries.	K3
CLO3	Implement PL/SQL constructs such as triggers, cursors, procedures, functions, and packages.	K3
CLO4	Analyze database solutions for correctness, efficiency, and integrity through advanced SQL and PL/SQL features, including CRUD operations.	K4

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	S	S	S	S	M
CLO2	S	S	S	S	M
CLO3	S	S	S	S	S
CLO4	S	S	S	S	S

S- Strong, M-Medium

Exercises to understand and implement the following concepts:

1. Table Creation (DDL)
2. Data Manipulation (DML)
3. Joins and Subqueries

4. Aggregate Functions and Grouping
5. Creating and Using Views, Triggers
6. PL/SQL Block Structure
7. Exception Handling in PL/SQL
8. Cursors – Implicit and Explicit
9. Procedures and Functions
10. CRUD operations using NOSQL DB

Pedagogy

Demonstration of working environment / Tools / Software/Program

Course Designers

1. Dr. S. Poongodi
2. Dr. M. Sasikala

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDIT
DS24SCE1	**EXCEL SKILLS FOR DATA ANALYTICS AND VISUALIZATION**	**PRACTICAL**	**45**	**-**	**-**	**3**

Excel Skills for Data Analytics and Visualization Specialization

(https://www.coursera.org/specializations/excel-data-analytics-visualization#courses)

S.NO.	COURSE TITLE	COURSE LINK
1	Excel Fundamentals for Data Analysis	https://www.coursera.org/learn/excel-data-analysis-fundamentals?specialization=excel-data-analytics-visualization
2	Data Visualization in Excel	https://www.coursera.org/learn/excel-data-visualization?specialization=excel-data-analytics-visualization
3	Excel Power Tools for Data Analysis	https://www.coursera.org/learn/excel-power-tools?specialization=excel-data-analytics-visualization