COURSE STRUCTURE AND SYLLABUS

[w.e.f. Session 2025-27]

Master of Science (MSC) in Data Science

DEPARTMENT OF MATHEMATICS
SARALA BIRLA UNIVERSITY
Birla Knowledge City, Mahilong, Purulia Road
Ranchi - 835103
Jharkhand, INDIA

2025-2027

Vision:

To build an egalitarian global society based on national integrity, equality, social justice, secularism, freedom & fraternity, international understanding and scientific approach to the problems of the society, as enshrined in the constitution of India through various modes of teaching-learning process and supported by curricular and co-curricular activities.

Mission:

To develop well-motivated global leaders who will be intellectually competent, morally upright, socially committed, spiritually inspired and 'स्वान्तःसुखाय'.To propagate the philosophy of 'वसुधैवकुटुम्बकम्'.

Vision and Mission of the Department

Vision

To be recognized internationally for quality education and research in Mechanical Engineering with excellence in fields of design, production, and thermal sciences.

Mission

To prepare professionally competent and broadly educated Mechanical Engineers by promoting creativity, developing analytical and research abilities, problem-solving, professional behaviour, adopting new technologies and continuous learning.

Programme Educational Objectives (PEOs)

PEO 1: Equip graduates with a strong foundation in mathematics, statistics, and computer science essential for data analysis.

PEO 2: Prepare graduates to proficiently use programming languages and tools for data manipulation, analysis, and visualization.

PEO 3: Develop graduates' ability to apply analytical and critical thinking skills to solve complex data-driven problems in various domains.

PEO 4: Foster practical experience through projects and internships, ensuring graduates are prepared for careers in data science and analytics.

Programme Outcomes (POs)

After completing the course, the students will be able to:

PO1: Graduates will demonstrate a solid understanding of fundamental mathematical, statistical, and computer science concepts essential for effective data analysis and interpretation.

PO2: Graduates will possess the analytical skills required to solve complex problems using statistical methods, linear algebra, and calculus, supporting data-driven decision-making.

PO3: Graduates will be proficient in programming languages such as Python and R, using them effectively for data manipulation, analysis, modelling, and visualization.

PO4: Graduates will be able to design, implement, and query both SQL and NoSQL databases, ensuring efficient data storage, retrieval, and management.

PO5: Graduates will apply machine learning algorithms including supervised and unsupervised techniques—to real-world datasets for predictive modeling and pattern recognition.

PO6: Graduates will utilize data mining techniques to uncover meaningful patterns and insights from large and complex datasets.

PO 7: Graduates will perform hypothesis testing, regression analysis, and related statistical methods to inform and support sound decision-making.

PO 8: Graduates will understand and implement deep learning models such as neural networks, convolutional neural networks (CNNs), and recurrent neural networks (RNNs) for advanced analytics tasks.

PO 9: Graduates will demonstrate knowledge and practical skills in big data technologies and frameworks (e.g., Hadoop, Spark) for efficient processing and analysis of massive datasets.

PO 10: Graduates will effectively visualize data and communicate insights clearly to stakeholders using appropriate tools and storytelling techniques.

PO 11: Graduates will recognize and uphold ethical standards related to data privacy, security, and fairness, ensuring responsible data science practices.

PO 12: Graduates will engage in continuous learning to stay updated with evolving data science technologies and methodologies, supporting long-term professional development.

Programme Specific Outcomes (PSOs)

PSO 1: Graduates will apply statistical techniques and data mining methods to analyze complex datasets, extract meaningful insights, and support informed decision-making.

PSO 2: Graduates will demonstrate expertise in programming languages such as Python and R, and effectively design, implement, and manage SQL and NoSQL databases for data manipulation, analysis, and storage.

PSO 3: Graduates will implement supervised and unsupervised machine learning algorithms to solve real-world problems and enhance data-driven analytical capabilities.

Sarala Birla University

Breakup of Credits		
Sl. No.	**Category**	**Credits**
1	Discipline Core Courses	59
2	Elective Courses	8
3	Skill Enhancement Courses	3
4	Project/ Internship	20
Total Credits:		**90**

Definition of Credit	Credit
1 Hr. Lecture (L) Per Week	1 Credit
1 Hr. Tutorial (T) Per Week	1 Credit
1 Hr. Practical (P) Per Week	0.5 Credit
2 Hr. Practical (P) Per Week	1 Credit

CREDITS DISTRIBUTION (SEMESTER-WISE AND COURSE-WISE)						
Semester	**Core Course**	**Elective**	**Ability Enhancement**	**Skill Enhancement**	**PROJECT**	**Total Credit Semester-wise**
1st	21	0	2	0	0	**23**
2nd	18	5	0	0	0	**23**
3rd	17	4	0	3	0	**24**
4th	0	0	0	0	20	**20**
Total Credit Course-wise	**56**	**9**	**2**	**3**	**20**	**90**
					Total Credit	**90**

Discipline Core Courses		L	T	P	C
Semester-I					
MSDS1IC01	Applied Linear Algebra and Calculus	4	1	0	5
MSDS1IC02	Probability Concepts and Applications	3	1	0	4
MSDS1IC03	Python Programming for Data Analytics	3	0	0	3
MSDS1IC04	Database Management Systems for Data Analytics	3	1	0	4
MSDS1IENV01	Environment and Climate Change	2	0	0	2
MSDS1IL01	Python Programming for Data Analytics Lab	0	0	4	2
MSDS1IL02	R Programming Lab	0	0	4	2
MSDS1IL03	Database Management Systems for Data Analytics Lab	0	0	2	1
Semester-II					
MSDS1IIC05	Statistical Decision Making	3	1	0	4
MSDS1IIC06	Regression Modelling	3	0	0	3
MSDS1IIC07	Data Mining Methods and Application	3	0	0	3
MSDS1IIC08	Machine Learning for Data Science	3	1	0	4
MSDS1IIE01	Time Series Analysis and Forecasting Techniques	3	1	0	4
MSDS1IIL04	Statistical Decision-Making Lab	0	0	2	1
MSDS1IIL05	Regression Modelling Lab	0	0	2	1
MSDS1IIL06	Data Mining and Machine Learning for Data Science Lab	0	0	4	2
MSDS1IIL07	Time Series Analysis and Forecasting Techniques Lab	0	0	2	1
Semester-III					
MSDS2IIIC09	Deep Learning	3	1	0	4
MSDS2IIIC10	Big Data Analytics	3	0	0	3
MSDS2IIIC11	Artificial Intelligence	3	1	0	4
MSDS2IIIC12	Optimization Techniques	3	0	0	3
MSDS2IIIE02	Natural Language Processing	3	1	0	4
MSDS2IIIL08	Deep Learning Lab	0	0	4	2
MSDS2IIIL09	Big Data Analytics Lab	0	0	2	1
MSDS2IIIPDP01	Qualitative Skills Practice	2	1	0	3

Open Elective Courses	CREDIT
Engineering Disciplines | Social Sciences	4+4

Skill Enhancement Courses	L	T	P	C
Qualitative Skills Practice	2	0	0	3

Internship and Dissertation	L	T	P	C
Internship/Dissertation/Project	0	0	0	20

SARALA BIRLA UNIVERSITY
COURSE STRUCTURE (Batch: 2024-2026)

SEMESTER-I (1st YEAR)

Master of Science (M.Sc.) in Data Science

Sl. No.	Category	Course Code	Course Title	Hours			Credit	Marks		
				L	T	P		IA	ESE	Total
Theory										
1	Discipline Core Course	MSDS1IC01	Applied Linear Algebra and Calculus	4	1	0	5	40	60	100
2	Discipline Core Course	MSDS1IC02	Probability Concepts and Applications	3	1	0	4	40	60	100
3	Discipline Core Course	MSDS1IC03	Python Programming for Data Analytics	3	0	0	3	40	60	100
4	Discipline Core Course	MSDS1IC04	Database Management Systems for Data Analytics	3	1		4	40	60	100
5	Ability Enhancement Course	MSDS1IENV01	Environment and Climate Change	2	0	0	2	40	60	100
						Total (A)	**18**	**200**	**300**	**500**
Practical										
6	Discipline Core Course	MSDS1IL01	Python Programming for Data Analytics Lab	0	0	4	2	30	20	50
7	Discipline Core Course	MSDS1IL02	R Programming Lab	0	0	4	2	30	20	50
8	Discipline Core Course	MSDS1IL03	Database Management Systems for Data Analytics Lab	0	0	2	1	30	20	50
						Total (B)	**5**	**90**	**60**	**150**
						Grand Total (A+B)	**23**	**290**	**360**	**650**

L-Lecture, T-Tutorial, P-Practical

IA- Internal Assessment, ESE-End Semester Examination

SARALA BIRLA UNIVERSITY
COURSE STRUCTURE (Batch: 2024-2026)

SEMESTER-II (1st YEAR)

Master of Science (M.Sc.) in Data Science

Sl. No.	Category	Course Code	Course Title	Hours			Credit	Marks		
				L	T	P		IA	ESE	Total
Theory										
1	Discipline Core Course	MSDS1IIC05	Statistical Decision Making	3	1	0	4	40	60	100
2	Discipline Core Course	MSDS1IIC06	Regression Modelling	3	0	0	3	40	60	100
3	Discipline Core Course	MSDS1IIC07	Data Mining Methods and Application	3	0	0	3	40	60	100
4	Discipline Core Course	MSDS1IIC08	Machine Learning for Data Science	3	1	0	4	40	60	100
5	Discipline Elective Course	MSDS1IIE01	Time Series Analysis and Forecasting Techniques (Elective- 01)	3	1	0	4	40	60	100
						Total(A)	**18**	**200**	**300**	**500**
Practical										
1	Discipline Core Course	MSDS1IIL04	Statistical Decision-Making Lab	0	0	2	1	30	20	50
2	Discipline Core Course	MSDS1IIL05	Regression Modelling Lab	0	0	2	1	30	20	50
3	Discipline Core Course	MSDS1IIL06	Data Mining and Machine Learning for Data Science Lab	0	0	4	2	30	20	50
4	Discipline Elective Course	MSDS1IIL07	Time Series Analysis and Forecasting Techniques Lab	0	0	2	1	30	20	50
						Total (B)	5	120	80	200
						Grand Total (A+B)	**23**	**320**	**380**	**700**

L-Lecture, T-Tutorial, P-Practical

IA- Internal Assessment, ESE-End Semester Examination

SARALA BIRLA UNIVERSITY
COURSE STRUCTURE (Batch: 2024-2026)

SEMESTER-III (2nd YEAR)

Master of Science (M.Sc.) in Data Science

Sl. No.	Category	Course Code	Course Title	Hours			Credit	Marks		
				L	T	P		IA	ESE	Total
Theory										
1	Discipline Core Course	MSDS2IIIC09	Deep Learning	3	1	0	4	40	60	100
2	Discipline Core Course	MSDS2IIIC10	Big Data Analytics	3	0	0	3	40	60	100
3	Discipline Core Course	MSDS2IIIC11	Artificial Intelligence	3	1	0	4	40	60	100
4	Discipline Core Course	MSDS2IIIC12	Optimization Techniques	3	0	0	3	40	60	100
5	Discipline Elective Course	MSDS2IIIE02	Natural Language Processing	3	1	0	4	40	60	100
						Total(A)	**18**	**200**	**300**	**500**
Practical										
1	Discipline Core Course	MSDS2IIIL08	Deep Learning Lab	0	0	4	2	30	20	50
2	Discipline Core Course	MSDS2IIIL09	Big Data Analytics Lab	0	0	2	1	30	20	50
3	Skill Enhancement Courses	MSDS2IIIPDP01	Qualitative Skills Practice	2	1	0	3	30	20	50
						Total (B)	6	90	60	150
						Grand Total (A+B)	**24**	**290**	**360**	**650**

L-Lecture, T-Tutorial, P-Practical

IA- Internal Assessment, ESE-End Semester Examination

SARALA BIRLA UNIVERSITY COURSE STRUCTURE (Batch: 2024-2026)										
SEMESTER-IV (2nd YEAR)										
Master of Science (M.Sc.) in Data Science										
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours**			**Credit**	**Marks**		
				L	**T**	**P**		**IA**	**ESE**	**Total**
Internship and Dissertation										
1	Project	**MSDS2IVP01**	Internship/Dissertation/Project	0	0	0	20			100
						Grand Total	**20**			**100**
L-Lecture, T-Tutorial, P-Practical										
IA- Internal Assessment, ESE-End Semester Examination										

SYLLABUS

Course Code	MSDS1IC01					
Category	Discipline Core Course					
Course Title	Applied Linear Algebra and Calculus					
Scheme & Credits		L	T	P	Credit	Semester
		4	1	0	5	I
Pre-requisites		Elementary Knowledge of Linear Algebra and Calculus				

Applied Linear Algebra and Calculus

60 Lectures

Course Objectives:

1. Understanding the matrix algebra and its applications.
2. Solving computational problems.
3. Provide an introduction to vectors-matrices-and least square methods –all basic topics in linear algebra - in the context of data science.
4. Application to various real-life data-driven problems.
5. Apply calculus and optimization to solving industrial problems

Course Outcomes:

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

CO1: Understand basic matrix properties like rank-determinant-inverse and special types of matrices.
CO2: Use computational techniques for singular value decomposition and g-inverses.
CO3: Understand the concepts of vector spaces, subspaces, and linear transformations.
CO4: Compute inner products on a real vector space and compute angle and orthogonality in inner product spaces.
CO5: Apply the methods of linear algebra and matrices in several important modern applications of research and industrial problems involving data science.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IC02						
Category	Discipline Core Course						
Course Title	Probability Concepts and Applications						
Scheme & Credits		L	T	P	Credit	Semester	
		3	1	0	4	I	
Pre-requisites		Elementary Knowledge of Probability					

Probability Concepts and Applications

Lectures: 50

Course Objectives:

1. To incorporate the concepts of probability theory and its applications as the core material in building theoretical ideas along with the practical notion.
2. To integrate the intrinsic ideas of preliminary and advanced distributions to correlate with real-world scenarios.
3. Develop the ability to model real-world scenarios using probability distributions, such as risk analysis, decision-making, and statistical inference
4. Teach students how to compute and interpret key statistical measures such as expectation, variance, and covariance for random variables and distributions.
5. Provide an understanding of important limit theorems, including the Law of Large Numbers and the Central Limit Theorem, which are fundamental in statistical theory and applications.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Develop the problem-solving techniques needed to calculate probability and conditional probability.
CO2: Describe and construct the probability distribution functions and illustrate the mathematical expectation.
CO3: Demonstrate the various types of generating functions used in statistics.
CO4: Apply the commonly used univariate discrete and continuous probability distributions.
CO5: Illustrate the sampling distributions and its importance in Inferential statistics.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, -: No correlation															

Course Code	MSDS1IC03						
Category	Discipline Core Course						
Course Title	Python Programming for Data Analytics						
Scheme & Credits		L	T	P	Credit	Semester	
		3	0	0	3	I	
Pre-requisites		Elementary Knowledge about Python Programming					

Python Programming for Data Analytics

Lectures: 45

Course Objectives:

1. To introduce the basic building blocks of algorithmic problem-solving.
2. To introduce core programming basics using Python language.
3. To introduce the data structures of Python and their applications.
4. To introduce the modules for data manipulation and visualization.
5. Guide students in applying Python programming to real-world data analytics projects, developing problem-solving skills for handling large datasets, extracting meaningful patterns, and making data-driven decisions.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Classify various algorithmic approaches and categorize the appropriate data representation,
CO2: Build programs using control structures,
CO3: Develop solutions to problems using ordered and un-ordered collection of data types.
CO4: Utilize the in-built functions and modules and develop user defined functions and modules.
CO5: Demonstrate array operations, mathematical analysis and graphical representation of data.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, 0 : No correlation															

Course Code	MSDS1IC04					
Category	Discipline Core Course					
Course Title	Database Management Systems for Data Analytics					
Scheme & Credits	L	T	P	Credit	Semester	
	3	1	0	4	I	
Pre-requisites	Elementary Knowledge of Database Management					

Database Management Systems for Data Analytics

Lectures: 50

Course Objectives:

1. To understand the basic concepts of database, ER Modelling, normalization and query optimization.
2. To comprehend the concepts concurrency control, recovery and indexing.
3. To explore the concepts of NoSQL and main types of NoSQL databases.
4. Connect databases with data analytics platforms for seamless analysis and reporting.
5. Focus on data security, integrity, and performance optimization for large datasets.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Describe the concepts of database, construct entity-relationship (ER) model for the real-world problems and transfer data model into database designs.
CO2: Analyze the fundamental concepts of normalization, transaction, concurrency control and recovery mechanisms.
CO3: Demonstrate the basic database storage structure and indexing techniques.
CO4: Organize the detailed architecture and primary benefits using NoSQL Databases.
CO5: Analyze the major types of NoSQL databases

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, -: No correlation															

Course Code	MSDS1IENV01					
Category	Ability Enhancement Course					
Course Title	Environment and Climate Change					
Scheme & Credits		L	T	P	Credit	Semester
		2	0	0	2	I
Pre-requisites		Basic knowledge of Algorithms & Real Analysis				

Environment and Climate Change

Lectures: 30

Course Objectives:

1. Understand environment and its various components
2. Explore the science of climate change, its causes, and its global impacts on ecosystems and human societies.
3. Examine key environmental challenges such as pollution, deforestation, and biodiversity loss.
4. Basic knowledge and concept of causes, effect and control of different type of environmental pollution.
5. Understand sustainable practices and policies to address environmental challenges and promote long-term ecological balance

Course Outcomes:

On completion of the course, student will be able to:

CO1: Acquire skills to understand environment and its various components, related issues and problems, identifying and solving them.
CO2: Participate and be actively involved at all levels in working towards the benefits of environment.
CO3: Gain knowledge about the conservation of biodiversity and its importance.
CO4: Aware students about problems of environmental pollution, its impact on human and ecosystem and control measures.
CO5: Students will be able to propose and advocate for sustainable practices and policies that promote environmental protection and climate resilience.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IL01					
Category	Discipline Core Course					
Course Title	Python Programming for Data Analytics Lab					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	4	2	I
Pre-requisites		Solving complex problem through Python				

Python Programming for Data Analytics Lab

Session: 25

Course Objectives:

1. Explore problem-solving skills using Python programming and find solutions for real-time problems.
2. Acquire object-oriented programming skills in Python.
3. Gain experience in creating informative visualizations with libraries like Matplotlib and Seaborn.
4. Implement basic statistical methods to analyze datasets and extract insights.
5. Apply simple machine learning models using Scikit-learn for predictive analytics tasks.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand and comprehend the basic programming constructs of Python programming.
CO2: Implement control statements for altering the sequential execution of programs in solving problems.
CO3: Solve real-time problems using modular programming concepts.
CO4: Develop programs for statistical processing of data using NumPy, Matplotlib, Scipy, and Pandas.
CO5: Students will be able to implement simple machine learning models to solve real-world predictive analytics problems.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IL02					
Category	Discipline Core Course					
Course Title	R Programming Lab					
Scheme & Credits	L	T	P	Credit	Semester	
	0	0	4	2	I	
Pre-requisites	Solving Problems Through R Programming					

R Programming Lab

Session: 25

Course Objectives:

1. The main objective of the course is to explore the power of R, statistical computing software for performing various tasks related to Data Science.
2. Master techniques for cleaning, transforming, and manipulating datasets using R packages like dplyr and tidyr.
3. Apply statistical methods and tests to analyze data and interpret results in R.
4. Gain proficiency in creating advanced visualizations using ggplot2 and other R visualization tools.
5. Implement basic machine learning models in R, focusing on data analysis and predictive modeling.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Perform calculations related to linear algebra.
CO2: Performing statistical calculations.
CO3: Creating charts/diagrams to visualize data.
CO4: Analyzing data frames using dplyr
CO5: Effectively use gg plot package.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IL03					
Category	Discipline Core Course					
Course Title	Database Management Systems for Data Analytics Lab					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	2	1	I
Pre-requisites		Elementary Knowledge About Database Management				

Database Management Systems for Data Analytics Lab

Session: 15

Course Objectives:

1. To understand the concepts of SQL commands.
2. To comprehend the concepts of PL/SQL.
3. To explore the concepts of NoSQL using MongoDB.
4. Train students in designing efficient database models for handling large datasets in analytics applications.
5. Equip students with skills to implement security measures and optimize database performance for large-scale data analytics tasks.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Perform SQL and PL/ SQL queries.
CO2: Implement the MongoDB methods, insert, update, delete operations in a NoSQL database.
CO3: Students will learn to integrate databases with data analytics tools and perform data analysis directly from the database.
CO4: Students will understand and apply database optimization techniques for improved query performance and scalability.
CO5: Students will learn to implement database security measures, ensuring data integrity, privacy, and security in data analytics applications

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IIC05						
Category	Discipline Core Course						
Course Title	Statistical Decision Making						
Scheme & Credits		L	T	P	Credit	Semester	
		3	1	0	4	II	
Pre-requisites		Basic knowledge of probability and Statistics					

Statistical Decision Making

Lectures: 50

Course Objectives:

1. Develop a strong foundation in probability theory, random variables, and probability distributions for statistical analysis
2. Understand data classification, representation, and statistical measures such as central tendency, dispersion, skewness, and kurtosis
3. Learn sampling techniques, estimation methods, and hypothesis testing (Z-test, t-test, Chi-Square test, F-test, and ANOVA) for data-driven decision-making.
4. Explore regression and correlation techniques, including linear regression, ridge regression, LASSO, and logistic regression, for predictive modelling
5. Apply statistical and machine learning techniques to solve real-world data science problems effectively.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Learn the fundamentals of probability theory and different probability distributions.
CO2: Implement various sampling, estimation, and testing methods on data from different population sections.
CO3: Analyze hypothesis testing procedures to draw conclusions about populations based on sample data.
CO4: Use estimation techniques to make inferences about population parameters from sample data.
CO5: Construct and perform correlation and regression models to analyze relationships between variables.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IIC06					
Category	Discipline Core Course					
Course Title	Regression Modelling					
Scheme & Credits		L	T	P	Credit	Semester
		3	0	0	3	II
Pre-requisites		Basic data science				

Regression Modelling

Lectures: 45

Course Objectives:

1. Gain a solid grasp of the foundational concepts and types of regression models (such as linear, logistic, and polynomial regression) and their applications in predicting outcomes based on independent variables.
2. Learn how regression models are applied across different fields, including economics, healthcare, finance, marketing, and social sciences, to make data-driven predictions and decisions.
3. Understand the importance of testing key assumptions in regression models, such as linearity, independence, homoscedasticity, and normality, to ensure valid results.
4. Master the step-by-step process of building regression models, from data collection and preprocessing to model selection, training, and evaluation.
5. Develop the skills to interpret regression model outputs, such as coefficients, p-values, and R-squared values, to draw meaningful conclusions and make informed predictions.

Module I: Simple Linear Regression **(Lecture 10)**

Simple Regression Models with One Independent Variable - Assumptions, Estimation of Parameters - Standard Error of Estimator - Testing the Significance of Regression Coefficients - Standard Error of Prediction.

Module II: Multiple Linear Regression **(Lecture 10)**

Multiple Regression: Standard Gauss Markov Setup, Least Square (LS) Estimation, Error and Estimation Spaces - Variance - Covariance of LS Estimators - Estimation of Error Variance - Case with Correlated Observations - LS Estimation with Restriction on Parameters - Multicollinearity.

Module III: Diagnostics **(Lecture 10)**

Diagnostic Checks and Correction: Graphical Techniques, Tests for Normality, Uncorrelatedness, Homoscedasticity, Lack of Fit - Polynomial Regression - Transformations on Y or X - Inverse Regression.

Module IV: Data Cleaning and Preparation **(Lecture 10)**

Data Cleaning and Preparation - Non-Linear Regression: Linearization Transforms, Advantages, Limitations, Non-Linear Least Squares, Parameter Estimation in a Non-Linear Systems.

Module V: Generalized Linear Models **(Lecture 05)**

Generalized Linear Models: Logistic Regression, Poisson Regression.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand the fundamentals of simple linear regression, focusing on modeling the relationship between a single independent variable and a dependent variable.

CO2: Apply tests to check for normality (e.g., Shapiro-Wilk test) and homoscedasticity (e.g., Breusch-Pagan test) to ensure the validity of regression results.

CO3: Learn how to extend simple linear regression to multiple linear regression by incorporating multiple independent variables to predict a dependent variable.

CO4: Explore non-linear regression techniques for modelling relationships where data doesn't fit a straight line, using models like polynomial regression or logarithmic regression.

CO5: Analyze real-world data using both linear and non-linear regression models, evaluating model fit and assumptions to draw reliable conclusions.

Course Outcome Mapping with Program Outcome & PSO

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3

The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:

3: High, 2: Medium, 1: Low, - : No correlation

Course Code	MSDS1IIC07					
Category	Discipline Core Course					
Course Title	Data Mining Methods and Application					
Scheme & Credits	L	T	P	Credit	Semester	
	3	0	0	3	II	
Pre-requisites	Basics of Database Management System					

Data Mining Methods and Application

Lectures: 45

Course Objectives:

1. Understand the Fundamentals of Data Mining
2. Master Data Preprocessing Techniques
3. Explore Data Warehousing and OLAP
4. Develop Skills in Frequent Pattern and Association Mining
5. Apply Data Mining in Real-World Scenarios

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand techniques for efficiently storing, mining, and retrieving data, ensuring scalability and accessibility.

CO2: Apply data processing methods like cleaning, transformation, and normalization to enhance system performance and ensure accuracy.

CO3: Evaluate various data patterns to identify correlations and associations between data items for deeper insights.

CO4: Develop data-mining solutions tailored to specific applications, such as business, healthcare, or marketing, to solve real-world problems.

CO5: Focus on optimizing mining algorithms and storage techniques to achieve fast and efficient data processing and retrieval.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IIC08					
Category	Discipline Core Course					
Course Title	Machine Learning for Data Science					
Scheme & Credits		L	T	P	Credit	Semester
		3	1	0	4	II
Pre-requisites		Basic data science				

Machine Learning for Data Science

Lectures: 50

Course Objectives:

1. Understand Machine Learning Fundamentals
2. Apply Clustering and Classification Techniques.
3. Develop and Optimize Machine Learning Models.
4. Design and Analyze Experiments.
5. Implement Generative and Probabilistic Models

Course Outcomes:

On completion of the course, student will be able to:

CO1: Learn various machine learning methods, including supervised, unsupervised, and reinforcement learning techniques for different types of problems.

CO2: Gain a deep understanding of popular machine learning models, such as decision trees, support vector machines, and neural networks.

CO3: Analyze different techniques for classifying data, such as logistic regression, k-nearest neighbors, and random forests, to categorize data effectively.

CO4: Implement machine learning algorithms to predict outcomes based on data, using tools like Python or R for model development.

CO5: Apply machine learning algorithms to predict results of experiments, improving decision-making and outcomes in real-world scenarios.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IIE01					
Category	Discipline Core Course					
Course Title	Time series and Forecasting Techniques					
Scheme & Credits		L	T	P	Credit	Semester
		3	1	0	4	II
Pre-requisites		Basic data science				

Time Series Analysis and Forecasting Techniques

Lectures: 50

Course Objectives:

1. Introduce the foundational concepts and techniques of algorithmic problem-solving.
2. Provide a solid foundation in core programming principles using Python language.
3. Introduce essential Python data structures and demonstrate their practical applications.
4. Teach the use of Python modules for efficient data manipulation and processing.
5. Equip students with skills to use Python libraries for effective data visualization and analysis.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Recognize and differentiate between linear, quadratic, Gompertz, and logistic models in various applications.

CO2: Describe and apply models that account for seasonal variations in data.

CO3: Understand and explain the methods used to study cyclic components in time series data.

CO4: Select the appropriate model based on the data type and context (e.g., linear vs. logistic).

CO5: Apply the identified models to analyze and interpret real-world data effectively.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IL04					
Category	Discipline Core Course					
Course Title	Statistical Decision-Making Lab					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	2	1	II
Pre-requisites		Basic concepts of programming				

Statistical Decision-Making Lab

Session-15

Course Objectives:

1. Understand the key types of questions statistical methods address, such as comparisons, relationships, and predictions for informed decision-making.
2. Apply statistical methods to perform hypothesis testing and make inferences based on sample data.
3. Interpret statistical results effectively to directly answer the research or business question at hand.
4. Clearly communicate the purpose, findings, and implications of statistical analyses to stakeholders.
5. Use statistical methods to support decision-making by providing evidence-based conclusions and actionable insights.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Apply hypothesis tests to common models (e.g., Normal distribution), including the construction of null and alternative hypotheses, test statistics, rejection regions, significance levels, power curves, and p-values.

CO2: Evaluate and perform hypothesis testing using parametric tests (Z, t, F, Chi-square), interpreting the results to make data-driven conclusions.

CO3: Understand and apply non-parametric tests when data doesn't meet parametric assumptions, interpreting results accordingly.

CO4: Develop and calculate test statistics for different hypothesis tests, ensuring accuracy in assessing the relationship between sample data and population parameters.

CO5: Interpret the outcomes of both parametric and non-parametric tests to draw meaningful conclusions and guide decision-making based on statistical evidence.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	**MSDS1IIL05**						
Category	**Discipline Core Course**						
Course Title	**Regression Modelling Lab**						
Scheme & Credits		**L**	**T**	**P**	**Credit**	**Semester**	
		0	**0**	**2**	**1**	**II**	
Pre-requisites		**Basic concepts of programming**					

Regression Modelling Lab

Session-15

Course Objectives:

1. Understand the fundamentals of building regression and time series models to analyse relationships between variables and forecast future trends.
2. Apply regression and time series models in fields like economics, finance, healthcare, and marketing for predictive analysis and decision-making.
3. Learn the methodologies to test assumptions in regression (linearity, independence, homoscedasticity) and time series models (stationarity, autocorrelation).
4. Gain practical knowledge on selecting, developing, and refining regression and time series models for real-world data analysis.
5. Evaluate model performance using diagnostic tests, ensuring the assumptions are met and that the models provide reliable predictions and insights.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand the concept and application of simple linear regression for modeling the relationship between one independent variable and a dependent variable.
CO2: Apply tests to check assumptions like normality (e.g., Shapiro-Wilk test) and homoscedasticity (e.g., Breusch-Pagan test) to validate the model.
CO3: Extend simple linear regression to multiple linear regression, incorporating multiple independent variables to predict a dependent variable.
CO4: Analyze and apply non-linear regression models when the relationship between variables is not linear, using techniques like polynomial or logistic regression.
CO5: Use both linear and non-linear regression models to analyze real-world data, ensuring accurate model fit and interpretation.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS1IIL06					
Category	Discipline Core Course					
Course Title	Data Mining and Machine Learning for Data Science Lab					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	4	2	II
Pre-requisites		Basic concepts of programming and data mining				

Data Mining and Machine Learning for Data Science Lab

Session-30

Course Objectives:

1. Implement the Locally Weighted Regression (LWR) algorithm on a suitable dataset and create visual graphs of the fitted model.
2. Implement linear regression in Python for data analysis and plot graphs to visualize the model's performance.
3. Design and write a Python program to construct Logistic Regression models for classification.
4. Implement Support Vector Machine (SVM) for classifying data based on given features.
5. Build and apply an ID3 decision tree using a dataset to classify and predict new samples.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Develop the ability to implement and apply Locally Weighted Regression (LWR) for fitting data and drawing graphical representations.

CO2: Gain expertise in implementing linear regression using Python and visualizing results with appropriate datasets.

CO3: Learn to construct and execute a Logistic Regression algorithm to classify data into distinct categories.

CO4: Acquire skills to implement Support Vector Machines (SVM) for classification tasks.

CO5: Demonstrate the working of the ID3 decision tree algorithm for classification and sample prediction.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	**MSDS1IIL07**					
Category	**Discipline Elective Course**					
Course Title	**Time Series Analysis and Farecasting Techniques Lab**					
Scheme & Credits		**L**	**T**	**P**	**Credit**	**Semester**
		0	**0**	**2**	**1**	**II**
Pre-requisites		**NA**				

Time Series Analysis and Forecasting TechniquesLab

Session-30

Course Objectives:

1. Learn the process of building time series models for forecasting and analysis.
2. Explore the use of time series models across various domains and industries.
3. Understand the methodology to test assumptions and conditions involved in time series modeling.
4. Gain skills in validating and evaluating the effectiveness of time series models.
5. Apply time series techniques to real-world datasets and scenarios in the laboratory setting.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Apply suitable time series forecasting methods to solve real-world problems.

CO: Choose the most appropriate forecasting model based on the characteristics of the data.

CO3: Analyze and evaluate the performance of different time series forecasting techniques.

CO4: Test and verify the assumptions underlying time series models to ensure their validity.

CO5: Assess and improve the accuracy of time series forecasts through model validation and refinement.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIC09					
Category	Discipline Core Course					
Course Title	Deep Learning					
Scheme & Credits	L	T	P	Credit	Semester	
	3	1	0	4	III	
Pre-requisites	Basic data science					

Deep Learning

Lectures: 50

Course Objectives:

1. To introduce the fundamentals of neural networks and types of neural networks.
2. To introduce Recurrent Neural Networks, Convolutional Neural Networks and its variants.
3. To develop and train deep neural networks.
4. To introduce complex learning models and deep learning models.
5. To introduce the internal structure of LSTM and GRU and the differences between them.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand the fundamentals of deep learning and build deep learning models.

CO2: Apply the most appropriate deep learning method in any given situation.

CO3: Analyse neural network models in data-intensive real-time problems.

CO4: Create efficient generative models.

CO5: Learn and apply convolutional and recurrent neural network techniques.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIC10					
Category	Discipline Core Course					
Course Title	Big Data Analytics					
Scheme & Credits	L	T	P	Credit	Semester	
	3	0	0	3	III	
Pre-requisites	NA					

Big Data Analytics

Lectures: 45

Course Objectives:

1. To have knowledge on accessing, storing and manipulating the huge data from different resources.
2. To learn map, reduce analytics using Hadoop and related tools.
3. To work with map, reduce applications
4. To understand the working environment of Pig and Hive for processing the structured and unstructured data.
5. To understand the usage of Hadoop-related tools for Big Data Analytics

Course Outcomes:

On completion of the course, student will be able to:

CO1: Describe big data and use cases from selected business domains.

CO2: Install, configure, and run Hadoop and HDFS..

CO3: Perform map-reduce analytics using Hadoop.

CO4: Demonstrate the Pig architecture and evaluation of pig scripts

CO5: Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIC11					
Category	Discipline Core Course					
Course Title	Artificial Intelligence					
Scheme & Credits		L	T	P	Credit	Semester
		3	1	0	4	III
Pre-requisites		Basic data science				

Artificial Intelligence

Lectures: 50

Course Objectives:

1. Gain a foundational understanding of core artificial intelligence principles and approaches.
2. Develop knowledge of key AI components such as intelligent agents, search algorithms, knowledge representation, inference, logic, and learning.
3. Learn how AI techniques are applied in real-world systems, including expert systems, intelligent agents, and machine learning models.
4. Understand the working mechanisms of artificial neural networks and other machine learning models.
5. Demonstrate the practical implementation and effectiveness of AI methods across different domains.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Gain knowledge of artificial intelligence principles and its foundations, representation and learning.

CO2: Illustrate the construction of learning and expert system.

CO3: Formalize a given problem in the language/framework of different AI methods.

CO4: Apply different search techniques for solving real world complex problems and select the most appropriate solution by comparative evaluation.

CO5: Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIC12					
Category	Discipline Core Course					
Course Title	Optimization Techniques					
Scheme & Credits	L	T	P	Credit	Semester	
	3	0	0	3	III	
Pre-requisites	NA					

Optimization Techniques

Lectures: 45

Course Objectives:

1. To familiarize the students with some basic concepts of optimization techniques and approaches.
2. To formulate a real-world problem as a mathematical programming model.
3. To develop the model formulation and applications are used in solving decision problems.
4. To introduce complex learning models and deep learning models.
5. To solve specialized linear programming problems like the transportation and assignment Problems.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand the operations research techniques like linear programming problem.

CO2: Apply the linear programming problem in industrial optimization problems.

CO3: Solve allocation problems using various operations research methods.

CO4: Understand the characteristics of different types of decision-making environment and the appropriate decision-making approaches and tools to be used in each type.

CO5: Recognize competitive forces in the marketplace and develop appropriate reactions based on existing constraints and resources.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	1
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	1
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	1
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	1
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	1
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIE02					
Category	Elective Course					
Course Title	Natural Language Processing					
Scheme & Credits		L	T	P	Credit	Semester
		3	1	0	4	III
Pre-requisites		NA				

Natural Language Processing

Lectures: 50

Course Objectives:

1. Introduce core concepts of NLP, focusing on morphology and corpus analysis.
2. Explore and interpret traditional and statistical NLP models for sentence classification.
3. Understand algorithms for morphology, syntax, semantics, and pragmatics.
4. Apply NLP for efficient information retrieval from text.
5. Learn the use of NLP techniques in machine translation applications.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Understand the core concepts of natural language processing.

CO2: Learn text pre-processing techniques and work with corpora.

CO3: Analyze words and perform Part-of-Speech tagging.

CO4: Distinguish between syntactic correctness in natural language.

CO5: Evaluate the semantic correctness of natural language.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIL08					
Category	Discipline Core Course					
Course Title	Deep Learning Lab					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	4	2	III
Pre-requisites		NA				

Deep Learning Lab

Session: 30

Course Objectives:

1. Enable students to gain experimental knowledge of implementing neural network algorithms using Python programming.
2. Equip students with the skills to classify images using deep learning algorithms.
3. Teach students to implement various deep learning networks such as Adaline and Madaline.
4. Develop hands-on experience with designing and training neural networks for different tasks.
5. Provide an in-depth understanding of how deep learning algorithms work and how to apply them effectively in real-world problems.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Do Feature Extraction from Image and Video Data

CO2: Implement Image segmentation and Instance segmentation in Images.

CO3: Implement image recognition and image classification using a pretrained network.

CO4: Implement Analysis on Traffic Information Dataset

CO5: Do classification and feature extraction using auto encoders.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIL09					
Category	Discipline Core Course					
Course Title	Big Data Analytics Lab					
Scheme & Credits	L	T	P	Credit	Semester	
	0	0	2	1	III	
Pre-requisites	NA					

Big Data Analytics Lab

Session: 15

Course Objectives:

1. To provide grounding in big data technology.
2. To learn map, reduce analytics using Hadoop / Spark and related tools.
3. To work with map, reduce applications.
4. To understand the working environment of Pig and Hive for processing the structured and unstructured data.
5. To understand the usage of Hadoop / Spark related tools for Big Data Analytics.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Analyze the Big Data framework like Hadoop to efficiently store and process

CO2: Big Data to generate analytics.

CO3: Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm.

CO4: Design and Implementation of Big Data Analytics using pig and spark to solve data intensive problems and to generate analytics.

CO5: Implement Big Data Activities using Hive.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	2	-	-	-	1	1	1	1	2	1	3
CO2	3	3	-	2	3	-	2	-	1	1	1	1	2	2	3
CO3	3	2	1	2	2	-	-	1	1	-	1	-	3	2	3
CO4	3	2	-	2	3	2	1	-	1	-	1	-	3	2	3
CO5	2	2	-	1	2	1	-	-	2	2	-	-	2	2	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IIIPDP01					
Category	Skill Enhancement Course					
Course Title	Qualitative Skills Practice					
Scheme & Credits		L	T	P	Credit	Semester
		2	1	0	3	III
Pre-requisites		NA				

Qualitative Skills Practice

Session: 30

Course Objectives:

1. Enable students to enhance their analytical and logical reasoning skills for solving statement-assumptions, puzzle tests, and syllogisms.
2. Equip students with strategies to efficiently tackle complex reasoning problems like clocks, calendars, series, and seating arrangements.
3. Teach students to interpret data and analyze logical sequences, classification problems, and coding-decoding exercises.
4. Prepare students to apply reasoning skills in real-world scenarios such as eligibility tests, blood relationships, and logical sequence of words.
5. To build confidence in applying reasoning skills under time constraints, preparing students for competitive exams and professional assessments.

Course Outcomes:

On completion of the course, student will be able to:

CO1: Demonstrate proficiency in solving reasoning problems related to statements, assumptions, conclusions, puzzle tests, and eligibility tests.
CO2: Analyze and solve problems involving clocks, calendars, and ranking analogies with improved logical data interpretation.
CO3: Effectively handle number series, coding-decoding exercises, and seating arrangements, showcasing data interpretation skills.
CO4: Confidently solve real-world reasoning problems, including blood relationships, direction and distance tests, and logical word sequences, ready for competitive exams and professional challenges.
CO5. Apply structured reasoning techniques and critical thinking strategies to make informed decisions and solve complex problems under time constraints.

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	-	-	-	-	-	1	2	2	1	1
CO2	2	2	1	1	1	-	-	-	-	-	1	2	2	1	1
CO3	2	2	1	1	1	-	-	-	-	-	1	2	2	1	1
CO4	2	2	1	1	1	-	-	-	-	1	2	2	2	1	1
CO5	2	2	1	1	1	-	-	-	1	1	2	3	2	1	2
The Mapping Level Contribution between COs- POs/PSOs are categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															

Course Code	MSDS2IVP01					
Category	Project					
Course Title	Internship/Dissertation/Project					
Scheme & Credits		L	T	P	Credit	Semester
		0	0	0	20	IV
Pre-requisites		Research Methodology				

Internship/Dissertation/Project

Course Objectives:

1. Develop Research Skills: To equip students with the ability to conduct independent research by formulating research questions, designing experiments, and analysing data.

2. Enhance Technical Writing: To improve students' proficiency in technical writing, enabling them to produce well-structured and coherent research documents.

3. Foster Critical Thinking: To cultivate students' critical thinking abilities, allowing them to evaluate existing literature, identify research gaps, and propose innovative solutions.

4. Promote Professional Presentation: To enhance students' presentation skills, ensuring they can effectively communicate their research findings to both technical and non-technical audiences.

5**.** To encourage ethical research practices, time management, and the ability to adapt methodologies in response to challenges during the research process.

Course Outcomes:

On completion of the course, student will be able to:

CO1. Independent Research Competence: Students will demonstrate the ability to independently conduct comprehensive research projects, including the formulation of research questions, data collection, and data analysis.

CO2. Proficient Technical Documentation: Students will produce detailed and well-structured research reports or dissertations that effectively communicate their research processes and findings.

CO3. Analytical and Critical Thinking: Students will exhibit strong analytical and critical thinking skills by evaluating literature, synthesizing information, and drawing insightful conclusions.

CO4. Effective Communication and Presentation: Students will present their research findings clearly and professionally in seminars and defences, demonstrating confidence and mastery of their subject matter.

CO5. Uphold academic integrity, manage research timelines responsibly, and demonstrate the ability to adapt research methods in response to feedback and challenges during the dissertation process

Course Outcome Mapping with Program Outcome & PSO															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	-	1	3	2	2	3	2	2	3
CO2	2	2	1	1	1	1	-	-	2	2	2	3	2	2	3
CO3	2	2	1	2	1	1	-	-	2	1	2	3	2	2	3
CO4	1	1	1	1	-	-	-	-	2	2	3	3	1	1	2
CO5	1	1	1	1	-	1	-	-	3	3	2	3	1	1	3
The Mapping Level Contribution between COs- POs/PSOs are Categorized as follows:															
3: High, 2: Medium, 1: Low, - : No correlation															