Programme Structure

Sharda School of Engineering and Sciences

Department of Mathematics and Data Science

M.Sc. (Data Science & Analytics)

Programme Code: SBR0309

Batch: 2025-27

1.1 Vision, Mission, and Core Values of the University

Vision of the University

To serve the society by being a global University of higher learning in pursuit of academic excellence, innovation and nurturing entrepreneurship.

Mission of the University

1. **Transformative educational experience**
2. **Enrichment by educational initiatives that encourage global outlook**
3. **Develop research, support disruptive innovations and accelerate entrepreneurship**
4. **Seeking beyond boundaries**

Core Values

1. **Integrity**
2. **Leadership**
3. **Diversity**
4. **Community**

1.2 Vision and Mission of the School

Vision of the School

Achieving academic excellence in the realm of basic and engineering sciences to address the global challenges and to become global leaders.

Mission of the School

1. To impart basic, advanced and transformative knowledge and skills in science and technology.
2. To strengthen capacity and capabilities in cutting-edge technology and research.
3. To nurture multidisciplinary research and entrepreneurship temperament for developing innovative solutions to global, societal and environmental challenges.
4. To foster multi-dimensional partnerships and collaborations for skill development

Core Values

1. Integrity
2. Leadership
3. Diversity
4. Community

1.3 Vision and Mission Department of Mathematics

Vision of the Department

To become a globally recognized destination for education in Mathematical Sciences and Research.

Mission of the Department

1. To develop the mathematical skills in students and make them employable across a wide range of professions and promote interest in research.
2. To develop entrepreneurial skills in students by encouraging critical thinking, innovation, and interdisciplinary applications of mathematics, data science and statistics.
3. To develop skills for the application of mathematics, data science and statistics in various fields.

Core Values

1. Integrity
2. Leadership
3. Diversity
4. Community

1.4 Programme Educational Objectives (PEOs)

PEO1: The graduates will achieve deep subject knowledge in the courses of study to enable employed in industry, government, and entrepreneurial endeavors to have a successful professional career.
PEO2: The graduates will develop a positive attitude and skills to enable a multi-facet personality.
PEO3: The graduates will prepare to pursue higher education and research.
PEO4: The graduates will develop to contribute to society and human well-being by applying ethical principles.

1.4.1 Programme Outcomes (POs)

PO1: Data Science knowledge: Engage in continuous reflective learning in the context of technology and scientific advancement.
PO2: Modern software tool usage: Acquire the skills in handling data science programming tools for problem-solving and solution analysis for domain-specific problems.
PO3: Critical thinking: Ability to understand the abstract concepts that lead to various data science theories in Mathematics, Statistics, and Computer science.
PO4: Problem analysis: Problem analysis and design ability to identify analyze and design solutions for data science problems using fundamental principles of mathematics, Statistics, computing sciences, and relevant domain disciplines.
PO5: Innovation and Entrepreneurship: Produce innovative IT solutions and services based on global needs and trends.

1.4.2 Programme Specific Outcomes (PSOs)

PSO1: Utilize data science theories for societal and environmental concerns.
PSO2: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
PSO3: Use research-based knowledge and research methods including design of experiments, analysis, interpretation of data, and synthesis of the information to provide valid conclusions.
PSO4: Understand the role of statistical approaches and apply the same to solve real-life problems in the fields of data science and apply the research-based knowledge to analyze and solve advanced problems in data science.

1.4.2 Mapping of PEOs with Mission Statements:

PEO Statements	School Mission 1	School Mission 2	School Mission 3	School Mission 4	School Mission 5	School Mission 6
PEO1:	3	2	3	1	2	3
PEO2:	3	2	3	1	2	3
PEO3:	3	3	3	3	3	3
PEO4:	3	2	3	1	3	3

1.4.3 Mapping of Programme Outcome (PO's)Vs Programme Educational Objectives (PEO's)

	PEO1	PEO2	PEO3	PEO4
PO1	3	3	3	2
PO2	3	3	3	2
PO3	3	3	3	2
PO4	3	2	3	2
PO5	2	3	2	3
PSO1	2	2	3	2
PSO2	3	2	2	3
PSO3	3	3	2	3
PSO4	3	2	3	3

1. Slight (Low) ***2. Moderate (Medium)*** ***3. Substantial (High)***

CURRICULUM & CREDIT FRAMEWORK FOR POSTGRADUATE PROGRAMMES (Academic Session 2025-26)

V.1.0 | 04.03.2025

Year	Sem.	Core Courses (CC)	Discipline Specific Electives (DSE) / Multi disciplinary Courses	Skill Enhancement Courses (SEC)	Research Projects / Dissertation	Course Level	Minimum Credits for the year	(Cummulative Minimum Credits) Required for Award of Diploma / Degree	
1-YEAR PG PROGRAMME (AFTER 4-YEAR UG PROGRAMME)									
Through Coursework (CW) + Research Work (RW)									
1	I	Th-2(5) or Th-2(4) + Pract-2(1) [10]	*Th-1(3) or Th-1(2) + Pract-1(1) [3]	RM&IPR-1(1) [1]	Dissertation I-1(6) (RBL-1) [6]	500	40	1 Year PG degree by CW+RW	
	II	Th-1(6) or Th-1(5) + Pract-1(1) [6]			Dissertation II-1(14) (RBL-2) [14]				
Through Coursework (CW)									
1	I	Th-2(5) or Th-2(4) + Pract-2(1) [10]	Th-1(5) or Th-1(4) + Pract-1(1) [5]	1(2)+ RM&IPR-1(1) [3]	Dissertation I-1(2) (RBL-1) [2]	500	40	1 Year PG degree by CW	
	II	Th-1(6)+Th-1(5) or Th-1(5)+Th-1(4)+ Pract-2(1) [11]	Th-1(6) or Th-1(5) + Pract-1(1) [6]		Dissertation II-1(3) (RBL-2) [3]				
Through Research Work (RW)									
1	I		*Th-1(3) or Th-1(2) + Pract-1(1) [3]	RM&IPR-1(1) [1]	Dissertation I-1(16) (RBL-1) [16]	-	40	1 Year PG degree by RW * Research Based Applied Courses	
	II		*Th-1(4) or Th-1(3) + Pract-1(1) [4]		Dissertation II-1(16) (RBL-2) [16]				
2-YEAR PG PROGRAMME (AFTER 3-YEAR UG PROGRAMME)									
1	I	Th-4(5) or Th-4(4) + Pract-4(1) [20]		CC-1(0) (Audit) [0]		400	40	PG Diploma after exit from 1st Year (Entry & Exit Option)	
	II		Th-2(4) or Th-2(3) + Pract-2(1) & (OE) Th-1(4) [12]	1(4) [4]	Project - 1(4) [4]				
OR									
1	I	Th-4(4)+Pract-4(1) [20]		1(4) [4]		400	40	PG Diploma after exit from 1st Year (Entry & Exit Option)	
	II		Th-2(4) or Th-2(3) + Pract-2(1) & (OE) Th-1(4) [12]	1(4) [4]		500			
Studetns who exit at the end of 1st year shall be awarded a Postgraduate Diploma									
2	III	Th-2(5) or Th-2(4) + Pract-2(1) [10]	*Th-1(3) or Th-1(2) + Pract-1(1) [3]	RM&IPR-1(1) [1]	Dissertation I-1(6) (RBL-1) [6]	500	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by CW + RW
	IV	Th-1(6) or Th-1(5) + Pract-1(1) [6]			Dissertation II-1(14) (RBL-2) [14]				
2	III	Th-2(5) or Th-2(4) + Pract-2(1) [10]	Th-1(5) or Th-1(4) + Pract-1(1) [5]	1(2)+ RM&IPR-1(1) [3]	Dissertation I-1(2) (RBL-1) [2]	500	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by CW
	IV	Th-1(6)+Th-1(5) or Th-1(5)+Th-1(4)+ Pract-2(1) [11]	Th-1(6) or Th-1(5) + Pract-1(1) [6]		Dissertation II-1(3) (RBL-2) [3]				
2	III		*Th-1(3) or Th-1(2) + Pract-1(1) [3]	RM&IPR-1(1) [1]	Dissertation I-1(16) (RBL-1) [16]	-	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by RW * Research Based Applied Courses
	IV		*Th-1(4) or Th-1(3) + Pract-1(1) [4]		Dissertation II-1(16) (RBL-2) [16]				

*Courses shall be Research based / Lab based Training / Hands on Training Evaluation will be made as per Rubrics made by the Department/School and duly approved by the Dean Academic Affairs / Committee constituted for the purpose.

No. of Courses | No. of Credits | Total Credits in Block

Dean Academic Affairs
Sharda University, Greater Noida

Vice Chancellor
Sharda University
Plot No.-32-34, Knowledge Park-III
201310 (U.P.)

CURRICULUM & CREDIT FRAMEWORK FOR POSTGRADUATE PROGRAMMES (Academic Session 2025-26)

V.1.0 | 04.04.2025

Year	Sem.	Core Courses (CC)	Discipline Specific Electives (DSE) / Multi disciplinary Courses	Skill Enhancement Courses (SEC)	Research Projects / Dissertation	Course Level	Minimum Credits for the year	(Cummulative Minimum Credits) Required for Award of Diploma / Degree	
1-YEAR PG PROGRAMME (AFTER 4-YEAR UG PROGRAMME)									
Through Coursework (CW) + Research Work (RW)									
1	I	MDA201 Inferencal Statistics(4) + MDA202 Multivariate Data Analysis (4) + STP5351-Inference Lab (1) + STP5352-Multivariate Analysis Lab (1) [10]	DAT5303-Introduction of Deep Learning (3) [3]	STT5305-RM&IPR-1(1) [1]	DAR5356-Capstone Project I-1(6) [6]	500	40	1 Year PG degree by CW+RW	
	II	STT5403-Relaibility and Survival Analysis-1(5) + STP5454-Reliability and Survival Lab1(1) [10]			DAR5457-Capstone Project II-1(14) [14]				
Through Coursework (CW)									
1	I	MDA201 Inferencal Statistics(4) + MDA202 Multivariate Data Analysis (4) + STP5351-Inference Lab (1) + STP5352-Multivariate Analysis Lab (1) [10]	MDA215-Advances in Design of Experiment (4) + STP5454-Design of Experiments Lab(1) [5]	DAP505 Exploratory Data Analysis with Tableau & Power BI (2)+ STT5305-RM&IPR-1(1) [3]	STR555 Dissertation-I-1(2) [2]	500	40	1 Year PG degree by CW	
	II	STT5403-Relaibility and Survival Analysis1(5) + STP5454-Reliability and Survival Lab1(1) + STT5401 Statistical Quality Conrol(4) +STP5455-Quality Control Lab(1)	DAT5404-Deep Learning and Neural Network (5) + DAP5358-Deep Learning Lab(1) [6]		STR5356 Dissertation-II-1(3)				
Through Research Work (RW)									
1	I		DAT5303-Introduction of Deep Learning (3) [3]	STT5305-RM&IPR-1(1) [1]	DAR559-Dissertation-I-1(16) [16]	-	40	1 Year PG degree by RW * Research Based Applied Courses	
	II		MDA202 Multivariate data Analysis(4) [4]		DAR5360-Dissertation-II-1(16) [16]				
2-YEAR PG PROGRAMME (AFTER 3-YEAR UG PROGRAMME)									
1	I	MDA101-Foundations of Data Science (4) + MDA102-Mathematics for Machine Learning (4) + STT4701-Distributions Theory (4) + STT4704-Probability & Statistical Methods (4) + DAP4754-Data Science Lab(1) + DAP4755-Mathematics for Machine Learning Lab (1) + STP4753-Distributions Theory Lab (1) + STP4752-Statistical Methods Lab(1) [20]		CCP4001-1(0) (Audit) [0]		400	40	PG Diploma after exit from 1st Year (Entry & Exit Option)	
	II		MDA105-Regression Analysis and Predictive Models(4) + MDA107-Advanced Big Data and Text Analytics(4) & STT4803-Time Series Analysis & Vital Statistics(3) + STP4854-Time Series Analysis Lab(1) [12]	MDA108-Data Mining & Artificial Intelligence (4) [4]	DAR4856-Project -1(4) [4]				
OR									
1	I	MDA101-Foundations of Data Science (4) + MDA102-Mathematics for Machine Learning (4) + STT4701-Distributions Theory (4) + STT4704-Probability & Statistical Methods (4) + DAP4754-Data Science Lab(1) + DAP4755-Mathematics for Machine Learning Lab (1) + STP4753-Distributions Theory Lab (1) + STP4752-Statistical Methods Lab(1) [20]		MDA104-Next Generation Databases (4) [4]		400	40	PG Diploma after exit from 1st Year (Entry & Exit Option)	
	II		MDA105-Regression Analysis and Predictive Models(4) + MDA107-Advanced Big Data and Text Analytics(4) & STT4803-Time Series Analysis & Vital Statistics(3) + STP4854-Time Series Analysis Lab(1) [12]	MDA108-Data Mining & Artificial Intelligence (4) [4]		500			
Studetns who exit at the end of 1st year shall be awarded a Postgraduate Diploma									
2	III	MDA201 Inferencal Statistics(4) + MDA202 Multivariate Data Analysis (4) + STP5351-Inference Lab (1) + STP5352-Multivariate Analysis Lab (1) [10]	DAT5303-Introduction of Deep Learning (3) [3]	DAT505-RM&IPR-1(1) [1]	DAR5356-Capstone Project I-1(6) [6]	500	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by CW + RW
	IV	STT5403-Relaibility and Survival Analysis-1(5) + STP5454-Reliability and Survival Lab1(1) [6]			DAR5457-Capstone Project II-1(14) [14]				
OR									
2	III	MDA201 Inferencal Statistics(4) + MDA202 Multivariate Data Analysis (4) + STP5351-Inference Lab (1) + STP5352-Multivariate Analysis Lab (1) [10]	MDA215-Advances in Design of Experiment (4) + STP5454-Design of Experiments Lab(1) [5]	DAP258 Exploratory Data Analysis with Tableau & Power BI (2)+ DAT505-RM&IPR-1(1) [3]	STR555 Dissertation-I-1(2) [2]	500	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by CW
	IV	STT5403-Relaibility and Survival Analysis1(5) + STP5454-Reliability and Survival Lab1(1) + STT5401 Statistical Quality Conrol(4) +STP5455-Quality Control Lab(1) [11]	DAT5404-Deep Learning and Neural Network (5) + DAP5459-Deep Learning Lab(1) [6]		STR5356 Dissertation-II-1(3) [3]				
OR									
2	III		DAT5303-Introduction of Deep Learning (3) [3]	STT5305-RM&IPR-1(1) [1]	DAR5360-Dissertation-I-1(16) [16]	-	40	2nd Year (3rd & 4th Semester)	2 Year PG degree by RW *** Research Based Applied Courses**
	IV		MDA202 Multivariate data Analysis(4) [4]		DAR5461-Dissertation-II-1(16) [16]				

*Courses shall be Research based / Lab based Training / Hands on Training Evaluation will be made as per Rubrics made by the Department/School and duly approved by the Dean Academic Affairs / Committee constituted for the purpose.

No. of Courses | No. of Credits | Total Credits in Block

Department of Mathematics and Data Science
Sharda School of Engineering and Science
M. Sc. (Data Science & Analytics)
Batch: 2025-27
TERM: 2501 (Semester-I)

2-Year PG Programme (After 3-Year UG Programme)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[1]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY								
			L	**T**	**P**	**TOTAL**			
1.	MDA101	Foundations of Data Science	4	0	0	4	4	**CO-REQUISITE**	CC
2.	MDA102	Mathematics for Machine Learning	4	0	0	4	4	**CO-REQUISITE**	CC
3.	STT4701	Distributions Theory	4	0	0	4	4	**CO-REQUISITE**	CC
4.	STT4704	Probability & Statistical Methods	4	0	0	4	4	**CO-REQUISITE**	CC
	PRACTICALS								
5.	DAP4754	Data Science Lab	0	0	2	2	1	**CO-REQUISITE**	CC
6.	DAP4755	Mathematics for Machine Learning Lab	0	0	2	2	1	**CO-REQUISITE**	CC
7.	STP4753	Distributions Theory Lab	0	0	2	2	1	**CO-REQUISITE**	CC
8.	STP4752	Statistical Methods Lab	0	0	2	2	1	**CO-REQUISITE**	CC
9.	CCP4001	Community Connect	-	-	4	2	0	**CO-REQUISITE**	SEC
TOTAL							**20**		

[1] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2502 (Semester-II)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course2: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY								
			L	**T**	**P**	**TOTAL**			
1.	MDA105	Regression Analysis and Predictive Models	4	0		4	4		DSE
2.	MDA107	Advanced Big Data and Text Analytics	4	0		4	4		DSE
3.	STT4803	Time Series Analysis & Vital Statistics	3	0		3	3		DSE (OE)
4.	MDA108	Data Mining & Artificial Intelligence	4	0		4	4		SEC
	PRACTICALS								
5.	STP4854	Time Series Analysis Lab	0	0	2	2	1		DSE (OE)
6.	DAR4856	Project	0	0	8	8	4		Project
TOTAL							**20**		

[2] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2601 (Semester-III)

(2 Year PG degree by CW+RW)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[3]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL**			
1.	MDA201	Inferential Statistics	4	0	0	4	4		CC
2.	MDA202	Multivariate Data Analysis	4	0	0	4	4		CC
3.	DAT5303	Introduction of Deep Learning	3	0	0	3	3		DSE
4.	STT5305	RM & IPR	1	0	0	1	1	**CO-REQUISITE**	SEC
	Practical								
5.	STP5351	Inference Lab	0	0	2	2	1		CC
6.	STP5352	Multivariate Analysis Lab	0	0	2	2	1		CC
7.	DAR5356	Capstone Project I	0	0	12	12	6		Project
TOTAL							**20**		

[3] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
TERM: 2602 (Semester-IV)

(2 Year PG degree by CW+RW)

S. No.	SUBJECT CODE	Title of Paper	HOURS				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[4]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY								
			L	**T**	**P**	**TOTAL**			
1.	STT5403	Reliability and Survival Analysis	5	0	0	5	5		CC
	PRACTICAL								
2.	STP5454	Reliability and Survival Lab	0	0	2	2	1		CC
	DISSERTATION								
3.	DAR5457	Capstone project II	**0**	**0**	28	28	14		Project
TOTAL							**20**		

[4] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2601 (Semester-III)

(2 Year PG degree by CW)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[5]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL**			
1.	MDA201	Inferential Statistics	4	0	0	4	4		CC
2.	MDA202	Multivariate Data Analysis	4	0	0	4	4		CC
3.	MDA215	Advances in Design of Experiment	4	0	0	4	4		DSE
4.	STT5305	RM & IPR	1	0	0	1	1		SEC
	PRACTICAL								
5.	STP5351	Inference Lab	0	0	2	2	1		CC
6.	STP5352	Multivariate Analysis Lab	0	0	2	2	1		CC
7.	STP5454	Design of Experiments Lab	0	0	2	2	1		DSE
8.	DAP5358	Exploratory Data Analysis with Tableau & Power BI	0	0	4	4	2		SEC
	DISSERTATION								
9.	STR5356	**DISSERTATION-I**	0	0	4	4	2		Project
TOTAL							**20**		

[5] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2602 (Semester-IV)
(2 Year PG degree by CW)

S. No.	SUBJECT CODE	Title of Paper	HOURS				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[6]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY								
			L	**T**	**P**	**TOTAL**			
1.	STT5403	Reliability and Survival Analysis	5	0	0	5	5		CC
2.	STT5401	Statistical Quality Control	4	0	0	4	4		CC
3.	DAT5404	Deep Learning and Neural Network	5	0	0	5	5		DSE
	PRACTICAL								
4.	STP5454	Reliability and Survival Lab	0	0	2	2	1		CC
5.	STP5455	Quality Control Lab	0	0	2	1	1	**CO-REQUISITE**	CC
6.	DAP5459	Deep Learning Lab	0	0	2	1	1		DSE
	DISSERTATION								
7.	STR5457	**DISSERTATION-2**	0	0	6	6	3	**CO-REQUISITE**	RBL-2
TOTAL							**20**		

[6] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2601 (Semester-III)

(2 Year PG degree by RW)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[7]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL**			
1.	DAT5303	Introduction of Deep Learning	3	0	0	3	3	**CO-REQUISITE**	DSE
2.	STT5305	RM & IPR	1	0	0	1	1		SEC
	DISSERTATION								
3.	DAR5360	**DISSERTATION-I**	0	0	32	32	16		Project
TOTAL							**20**		

[7] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

Department of Mathematics and Data Science
Sharda School of Engineering and Sciences
M. Sc. (Data Science & analytics)
Batch: 2025-27
TERM: 2602 (Semester-IV)

(2 Year PG degree by RW)

S. No.	SUBJECT CODE	Title of Paper	Teaching Load				CREDITS	PRE-REQUISITE/CO-REQUISITE	Type of Course[8]: 1. CC 2. AECC 3. SEC 4. DSE
	THEORY		**L**	**T**	**P**	**TOTAL**			
1.	MDA502	Multivariate data Analysis	4	0	0	4	4	**CO-REQUISITE**	DSE
	DISSERTATION								
2.	DAR5461	**DISSERTATION-II**	0	0	32	32	16		Project
TOTAL							**20**		

[8] CC: Core Course, AECC: Ability Enhancement Compulsory Courses, SEC: Skill Enhancement Courses, DSE: Discipline Specific Courses

COURSE STRUCTURE

School: SSES	**Batch: 2025-27**	
Program: M.Sc.	**Academic Year: 2025-26**	
Branch: Data Science & Analytics	**Semester: I**	
Course Code	**MDA101**	
Course Title	**Foundations of Data Science**	
Credits	4	
Contact Hours(L-T-P)	4-0-0	
Course Status	Compulsory	
Course Objective	The course is aimed at building the fundamentals of data science. Imparting design thinking capability to build big data and developing design skills of models for big data problems. Gaining practical experience in programming tools for data sciences and also empowering students with tools and techniques used in data science.	
Course Outcomes	CO1: Explain data evolution and application on the data. (K1, K2) CO2: Discuss the basic concepts of data science. (K2, K3) CO3: Apply Matrix decomposition techniques to perform data analysis.(K3, K4) CO4: Explain the concept of a real-life solution. (K3, K4) CO5: Apply and develop basic Machine Learning Algorithms. (K5, K6) CO6: Apply the statistical measures of Python in a real-time environment.(K5, K6)	
Course Description	A PG-level course in the foundation of data science intended to versestudents in the techniques necessary to understand and carry out methods in the foundation of data science.	
Outline syllabus		**CO Mapping**
Unit 1	**Introduction**	
A	Introduction-What is Data Science?	CO1
B	The steps in Doing Data Science-Skills needed to do DataScience storing data-combining bits into larger structures	CO1
C	The steps in Doing Data Science-Skills needed to identify Data Problems.	CO1
Unit 2	**EDA**	
A	Big Data and Data Science - Big Data Analytics,Business intelligence vs big data, big data frameworks,	CO2
B	Exploratory Data Analysis (EDA), statistical measures,	CO2
C	Basic tools (plots, graphs, and summary statistics) of EDA, Data Analytics Lifecycle, Discovery	CO2
Unit 3	**Data Pre-processing and Feature Selection**	
A	Data cleaning - Data integration - Data Reduction - Data Transformation and Data Discretization.	CO3
B	Feature Generation and Feature Selection, Feature Selection algorithms: Filters- Wrappers - Decision Trees -Random Forests	CO3
C	Descriptive statistics-Using Histograms to understand a distribution-Normal Distribution.	CO3, CO6
Unit 4	**Basics of Python for Data Science**	
A	Introduction to Python: Installation, syntax, data structures (lists, tuples, dictionaries).	CO4
B	Data manipulation using Pandas: Data Frames, handling missing values, basic operations.	CO4
C	Importing and working with data sources: CSV, Excel, Databases.	CO4, CO6
Unit 5	**Basic Data Mining**	
A	Data Mining Overview-Association Rule Mining.	CO5
B	Text Mining-Supervised and Unsupervised Learning.	CO5
C	Supervised Learning via Support Vector Machines- Support	CO5, CO6

Mode of examination	**Theory**			
Weightage Distribution	CA	MTE	ETE	
	25%	25%	50%	
Text book/s*	1. Jeffrey S. Saltz, Jeffre M. Stanton, "AnIntroduction to Data Science", Sage Publications.			
Other References	1. Nina Zumal, John Mount (2014). Practical Data science in R, Managing Publication Company 2. Bernard Kolman, Robert C. Busby and Sharon Ross (2004). Discrete Mathematical Structures, New Delhi: Prentice Hall 3. V. Bhuvaneswari, T. Devi, (2016). Big Data Analytics: A Practitioner's Approach, Bharathiar University 4. V. Bhuvaneswari (2016). Data Analytics with R, Bharathiar University.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA101.1	**3**	**2**	**3**	**3**	**0**	**3**	**3**	**2**	**1**
MDA101.2	**3**	**1**	**3**	**3**	**0**	**3**	**2**	**1**	**1**
MDA101.3	**2**	**2**	**2**	**3**	**0**	**2**	**2**	**1**	**1**
MDA101.4	**2**	**2**	**3**	**3**	**0**	**2**	**3**	**1**	**1**
MDA101.5	**3**	**3**	**3**	**3**	**0**	**3**	**2**	**2**	**2**
MDA101.6	**3**	**3**	**3**	**3**	**0**	**2**	**2**	**1**	**2**

School: SSES	**Batch: 2025-27**			
Program: M.Sc.	**Academic Year: 2025-26**			
Branch: Data Science & Analytics	**Semester: I**			
Course Code	MDA102			
Course Title	Mathematics for Machine Learning			
Credits	4			
Contact Hours(L-T-P)	4-0-0			
Course Status	Compulsory			
Course Objective	To enable the students to understand the concept of mathematics inmachine learning.			
Course Outcomes	CO1: Solve a system of Linear equations by applying the Gauss Eliminationmethod. (K2, K3) CO2: Explain the basics of Vectors, Spaces, and Affine Spaces. (K2, K3) CO3: Apply different methods to evaluate the Inverse and Rank of aMatrix. (K1, K2, K3) CO4: Evaluate Eigen values and Eigen vectors using Linear transformation and power methods. (K3, K4) CO5: Evaluate Derivatives and Partial Derivatives using rules ofdifferentiation. (K4, K5) CO6: Apply optimization using gradient function. (K5, K6)			
Course Description	The course focuses on iterative techniques for solving large sparse linear systems of equations which typically stem from the Discretization of partial differential equations. In addition, the computation of eigenvalues, least square problems and error analysis will be discussed.			
Outline syllabus				CO Mapping
Unit 1	**Matrices and Determinants**			
A	Matrices – Determinant, Identity matrix, Inverse of amatrix.			CO1
B	The rank of a matrix, Nullity, trace of a matrix.			CO1
C	Eigen values, Eigen vectors, Matrix decompositions.			CO1
Unit 2	**Basic Concept of Linear Algebra**			
A	Linear Algebra-System of Linear equations, SolvingSystem of Linear equations.			CO2
B	Linear Independence, Vectors, Scalars, Addition, Scalarmultiplication.			CO2
C	Dot product, vector projection, cosine similarity			CO2
Unit 3	**Vector**			
A	Orthogonal vectors, normal and Orthonormal vectors.			CO3
B	Vector norm, vector space, linear combination.			CO3
C	Basis of vectors, Affine spaces.			CO3
Unit 4	**Derivatives**			
A	Differentiation, rules of differentiation, Derivatives, Scalar derivatives.			CO4
B	Partial derivatives, Principle Component analysis – Concepts and properties.			CO4
C	Dimensionality reduction with PCA			CO4
Unit 5	**Derivatives of Function**			
A	Differentiation of univariate functions, Partial differentiation and gradients.			CO5
B	Gradient of a vector-valued function. Gradient of matrices.			CO5
C	Optimization using gradient functions, Constrained optimization, and Lagrange multipliers. Convex optimization.			CO6
Mode of examination	**Theory**			
Weightage	CA	MTE	ETE	

Distribution	25 %	25 %	50 %	
Text book/s*	1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning**", Cambridge University Press, 2020.**			
Other References	1. Erwin Kreyszig, Advanced EngineeringMathematics, 10th Edition., John Wiley & Sons, (2014). 2. B. S.Grewal, Higher Engineering Mathematics, 38th Edition. Khanna Publications, (2005).			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA102.1	**3**	**0**	**2**	**3**	**0**	**3**	**3**	**2**	**1**
MDA102.2	**3**	**0**	**2**	**3**	**0**	**3**	**2**	**1**	**1**
MDA102.3	**3**	**0**	**2**	**3**	**0**	**2**	**2**	**1**	**1**
MDA102.4	**3**	**0**	**2**	**3**	**0**	**2**	**3**	**1**	**1**
MDA102.5	**3**	**0**	**2**	**3**	**0**	**3**	**2**	**2**	**2**
MDA102.6	**3**	**0**	**2**	**3**	**0**	**2**	**2**	**1**	**2**

School: SSBSR	**Batch: 2025-27**
Program: M.Sc.	**Academic Year: 2025-26**
Branch: Data Science & Analytics	**Semester: I**
Course Code	**STT4701**
Course Title	**Distribution Theory**
Credits	4
Contact Hours (L-T-P)	4-0-0
Course Status	Compulsory
Course Objective	This course explores probability distributions, their properties, and applications in statistical modeling. It covers univariate, bivariate, sampling, non-central, and mixture distributions, along with truncation and order statistics, equipping students with essential skills for statistical inference and data analysis.
Course Outcomes	After completion of this course, students will be able to CO1: Understand and analyze various univariate discrete probability distributions, derive their properties, and apply them to real-world problems. (K2, K3, K4) CO2: Explore univariate continuous probability distributions, derive their properties, and utilize them in practical applications. (K4, K5) CO3: Examine bivariate distributions and key sampling distributions (Chi-square, t, F), their interrelationships, and their role in statistical inference. (K4, K5) CO4: Investigate non-central and compound probability distributions, along with truncation techniques, and assess their applications in statistical modeling. (K3, K4) CO5: Analyze order statistics, their distributions, recurrence relations, and related systematic statistics for deriving statistical properties. (K4, K5) CO6: Understand and apply concepts related to interrelationships in sampling distributions, truncation effects, and mixture distributions, including finite mixtures and zero-modified distributions. (K5,K6)
Course Description	This course covers probability distributions, their properties, and applications in statistical modeling. Topics include univariate, bivariate, sampling, non-central, and mixture distributions, along with truncation and order statistics, preparing students for statistical inference and data analysis.

		CO Mapping
Unit 1	**Univariate Discrete Distributions (Derivation, properties and applications)**	
A	Discrete Uniform distribution, Binomial, Multinomial, Poisson distribution	CO1
B	Negative binomial, geometric distribution	CO1
C	Hyper geometric distribution, power series Distribution	CO1
Unit 2	**Univariate Continuous Distributions (Derivation, properties and applications)**	
A	Exponential, Gamma distribution and Lindley distribution	CO2
B	Beta (1st kind and 2nd kind), Weibull, Cauchy distribution	CO2
C	Normal and Log-normal distribution, Pareto and Rayleigh distribution	CO2
Unit 3	**Bivariate Distributions and Sampling Distributions**	
A	Derivation, properties and applications of bivariate normal distribution	CO3
B	Derivation, properties and applications of Chi-square, t and F-distributions and	CO3
C	Interrelationship between sampling distribution.	CO3, CO6
Unit 4	**Non-central Distributions, Compound Distributions and Truncation**	

A	Non-central chi-square, t and F distributions			CO4
B	Compound distribution- Neyman's Type A distribution, Polya-Eggenberger distribution, Inverse Polya-Eggenberger distribution			CO4
C	Truncation of basic discrete and continuous distributions with their properties.			CO4, CO6
Unit 5	**Order Statistics and Mixture Distribution**			
A	Distributions of r-th order statistics, joint density of two order statistics, some special joint distributions resulting from order statistics			CO5
B	Distribution of range and other systematic statistics, moments of order statistics, recurrence relations and identities for moments of order statistics from an arbitrary distribution			CO5
C	Mixture distribution- finite mixture, zero-modified distributions, mixture of binomial distribution.			CO5, CO6
Mode of examination	**Theory**			
Weightage Distribution	CA	MTE	ETE	
	25 %	25 %	50 %	
Text book/s*	1. Sheldon Ross; A First Course in Probability,Pearson, 2014. 2. Parimal Mukhopadhyay; An Introduction to theTheory of Probability, World scientific, 2012. 3. Irwin Miller, Marylee's Miller, John E. Freund's;Mathematical Statistics, Pearson, 2017			
Other References	1. FetsjeBijma, Marianne Jonker and Aad van der Vaart; Introduction to Mathematical Statistics, Amsterdam University Press, 2018. 2. Krishnamoorthy, K., Handbook of Statistical Distributions with Applications, Chapman & Hall/CRC, 2006. 3. Rohatgi, V.K. and Ebsanes Saleh, A.K. Md., An introduction to Probability and Statistics, 2nd Ed.,John Wiley & Sons, 2002. 4. Shanmugam, R., Chattamvelli, R. Statistics forscientists and engineers, John Wiley, 2015.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STT4701.1	**3**	**2**	**2**	**3**	**-**	**3**	**3**	**2**	**1**
STT4701.2	**3**	**2**	**2**	**3**	**-**	**3**	**2**	**1**	**1**
STT4701.3	**3**	**2**	**2**	**3**	**-**	**2**	**2**	**1**	**1**
STT4701.4	**3**	**2**	**2**	**3**	**-**	**2**	**3**	**1**	**1**
STT4701.5	**3**	**2**	**2**	**3**	**-**	**3**	**2**	**2**	**1**
STT4701.6	**3**	**2**	**2**	**3**	**-**	**2**	**2**	**1**	**1**

School: SSES		**Batch: 2025-27**
Programme: Data Science & Analytics		**Academic Year: 2025-26**
Branch: Statistics		**Semester: I**
1	Course Code.	STT4704
2	Course Title	Probability & Statistical Methods
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course status	Compulsory
5	Course Objectives	This course aims to develop a strong foundation in descriptive statistics, probability theory, and statistical inference. Students will learn key concepts such as probability spaces, random variables, probability functions, generating functions, and hypothesis testing. The course also covers laws of large numbers, probability inequalities, and central limit theorems, equipping students with essential tools for data analysis and statistical modeling.
6	Course Outcomes	CO1: Understand and analyze descriptive statistics, measures of central tendency, dispersion, and fundamental set theory concepts. (K1, K2, K6) CO2: Grasp fundamental probability concepts, including probability spaces, independence, conditional probability, and Bayes' theorem. (K1,K2,K4) CO3:Explore random variables, probability functions, mathematical expectations, and probability inequalities. (K2,K3,K4) CO4: Analyze bivariate distributions, marginal and conditional distributions, and their statistical implications. (K2,K4) CO5: Understand generating functions, hypothesis testing, and statistical inference concepts, including Type I & II errors. (K1,K2, K5) CO6: Apply laws of large numbers, central limit theorems, and statistical inequalities in probability and inference.. (K2,K3,K4)
7	Course Description	This course covers descriptive statistics, probability theory, random variables, probability distributions, generating functions, and hypothesis testing. It also explores laws of large numbers, probability inequalities, and central limit theorems for statistical analysis and decision-making.
8	Outline syllabus:	

UNIT1	Descriptive Statistics and Probability	CO Mapping
A	Representation of data (measures of central tendency).	CO1
B	Dispersion & other characteristics of data (mean deviation, variance, quartiles, Skewness and Kurtosis, Moments).	CO1
C	Classes of Sets, Fields, sigma-fields, minimal sigma-field, Borel field	CO1
UNIT 2	Probability: Basic Concepts and Conditional Probability	
A	Probability space, Basic terminologies and theorems on probability, theorem of total probability, theorems on compound probability	CO2
B	Independence of events, conditional probability	CO2
C	Bayes' Theorem and its applications	CO2

UNIT 3	Random Variables and Probability Functions			
A	Random Variable and its properties, mathematical expectation and inequalities involving random variables viz. Markov's, Holder's, Minkowski's and Jenson's Inequalities			CO3
B	PDF, PMF, Distribution function			CO3
C	Bivariate random variables, Marginal and conditional distributions			CO3, CO4
UNIT 4	Generating Functions and Hypothesis			
A	Generating functions, probability generating function, moment generating function characteristic functions,			CO3, CO5
B	factorial moment generating functions, Uniqueness theorem.			CO5, CO6
C	Hypothesis testing, Type I and II error, Level of Significance, power of test, large and small sample test.			CO5, CO6
UNIT 5	The Laws of Large Numbers, Inequalities and Central limit Theorem			
A	Law of large numbers, Chebyshev's and Khinchin's weak law of large numbers, Kolmogorov's theorem, Strong law of large numbers.			CO5, CO6
B	Central limit theorem, De-Moivre's Laplace central limit theorem.			CO5, CO6
C	Statement of Lindeberg- Feller's central limit theorem.			CO5, CO6
	Mode of Examination	Theory		
	Weightage distribution	CA	MTE	ETE
		25%	25%	50%
	Text books	1. Gupta,S.C and Kapoor,V.K, "Fundamental of Mathematical Statistics". Sultan Chand & sons.		
	Other references	1.Ash, Robert B. (2000). Probability and Measure Theory, Second Edition, Academic Press, New York. 2. Feller, W. (1985). Introduction to Probability Theory and its Applications, Wiley Eastern, New Delhi 3. Bhatt, B.R. (1999). Modern Probability Theory, 3rd Edition, New Age International Publishers. 4. A. K. Md. Ehsanes Saleh and Vijay K. Rohatgi (2010) An Introduction to Probability and STATistics, Wiley India Pvt. Ltd.		

COURSE OUTCOMES – PROGRAMMEME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STT4704.1	3	3	3	3	3	3	3	2	1
STT4704.2	3	2	3	3	2	3	2	1	2
STT4704.3	2	2	2	2	2	2	2	2	1
STT4704.4	2	2	1	2	2	2	3	1	1
STT4704.5	3	2	2	3	2	3	2	2	2
STT4704.6	3	2	1	3	2	2	2	1	2

School: SSES		**Batch: 2025-27**			
Programme: M.Sc.		**Academic Year: 2025-26**			
Branch: Data Science & Analytics		**Semester: I**			
1	Course Code	DAP4754			
2	Course Title	Data Science Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objective	To provide hands-on experience in data science using Python, covering data handling, exploratory data analysis (EDA), preprocessing, and basic machine learning techniques.			
6	Course Outcomes	CO1: Understand basic Python concepts for data science.(K1, K2) CO2: Perform data visualization and EDA. (K2, K3) CO3: Apply data preprocessing techniques like cleaning and transformation. (K3, K4) CO4: Work with different data sources and manage datasets.(K4, K5) CO5: Implement basic machine learning algorithms.(K5, K6) CO6: Build simple web applications using Python.(K4, K6)			
7	Course Description	This practical course focuses on implementing foundational data science techniques using Python. Students will work with real-world datasets to perform exploratory analysis, data preprocessing, statistical modeling, and machine learning.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Python and Data Science**			
		Python basics, installation, and libraries (NumPy, Pandas). Handling datasets and understanding the data science workflow.			CO1
	Unit 2	**Exploratory Data Analysis (EDA) in Python**			
		Summary statistics, histograms, boxplots, scatter plots. Understanding data patterns and relationships.			CO2
	Unit 3	**Data Preprocessing and Feature Selection in Python**			
		Handling missing values and outliers. Feature selection techniques (Decision Trees, Wrappers, Filters).			CO3
	Unit 4	**Working with Data Sources**			
		Importing and manipulating data from CSV, Excel, and databases. Using Python for data retrieval.			CO4
	Unit 5	**Data Mining and Machine Learning**			
		Basic supervised and unsupervised learning (Association, Regression, Clustering).			CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ESE	
		30 %	30%	40 %	
	Text book				
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAP4754.1	1	3	1	1	1	3	3	2	2
DAP4754.2	1	3	1	1	1	3	2	1	2
DAP4754.3	1	3	1	1	1	2	2	1	2
DAP4754.4	1	3	1	1	1	2	3	1	2
DAP4754.5	1	3	1	1	1	3	2	2	2
DAP4754.6	1	3	1	1	1	2	2	1	2

School: SSES		**Batch: 2025-27**			
Programme: M.Sc.		**Academic Year: 2025-26**			
Branch: Data Science		**Semester: I**			
1	Course Code	**DAP4755**			
2	Course Title	Mathematics for Machine Learning Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objectiv				
6	Course Outcome	CO1: Implement matrix operations, determinants, and eigenvalues using Python (K1,K2) CO2: Apply vector operations and solve systems of linear equations. (K2,K3) CO3: Understand vector spaces and perform vector transformations. (K2,K3,K4) CO4: Compute derivatives, gradients, and implement PCA. (K3,K4) CO5: Apply differentiation techniques and compute function derivatives. (K4,K5) CO6: Implement optimization techniques using gradient functions. (K4,K5)			
7	Course Descript	Introduce basic concepts of Python environment and provide students with a general understanding of R/ Python for solving the data analytics based problem. Equip students With the skills to apply Python concepts and analytical tools to analyze data analytics problem and handle real-world issues.			
8	Outline syllabus				CO Mapping
	Unit 1	**Matrices and Determinants**			
		Implementing matrix operations: Addition, multiplication, inverse, and rank. Computing determinants, eigenvalues, and eigenvectors using NumPy.			CO1
	Unit 2	**Linear Algebra Concepts**			
		Solving systems of linear equations using Gaussian elimination and NumPy functions. Implementing vector operations: Dot product, scalar multiplication, and cosine similar			CO2
	Unit 3	**Vector Operations and Spaces**			
		Working with orthogonal, normal, and orthonormal vectors. Computing vector norms, basis vectors, and affine spaces.			CO3, CO6
	Unit 4	**Differentiation and PCA**			
		Implementing differentiation and partial derivatives using SymPy. Performing Principal Component Analysis (PCA) for dimensionality reduction.			CO4, CO6
	Unit 5	**Optimization and Gradient Functions**			
		Computing gradients of scalar and vector functions using Autograd. Implementing constrained optimization using Lagrange multipliers. Applying convex optimization techniques in machine learning problems.			CO5, CO6
	Mode of examin	Practical			
	Weightage Distr	CA	CE	ESE	
		30 %	30%	40 %	
	Text book				
	Other Reference				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAP4755.1	**1**	**3**	**1**	**1**	**1**	**3**	**3**	**1**	**2**
DAP4755.2	**1**	**3**	**1**	**1**	**1**	**3**	**2**	**1**	**2**
DAP4755.3	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**1**	**2**
DAP4755.4	**1**	**3**	**1**	**1**	**1**	**2**	**3**	**1**	**2**
DAP4755.5	**1**	**3**	**1**	**1**	**1**	**3**	**2**	**1**	**2**
DAP4755.6	**1**	**3**	**1**	**1**	**1**	**2**	**2**	**1**	**2**

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2025-26**
Branch: Data Science & Analytics		**Semester: I**
1	Course Code	**STP4752**

2	Course Title	**Statistical Method Lab**			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objective	To provide hands-on experience in solving statistical and probability-related problems using computational tools and real-life data applications.			
6	Course Outcomes	After the completion of this course, students will be able to: CO1: Demonstrate descriptive statistical measures and probability concepts using computational tools. (K2, K3, K4) CO2: Analyze correlation, regression, and curve fitting techniques. (K4, K5) CO3: Implement regression models and evaluate their effectiveness. (K4, K5) CO4: Perform hypothesis testing using various parametric and non-parametric tests. (K3, K4) CO5: Apply design of experiments in statistical data analysis. (K4, K5) CO6: Utilize measure theory concepts in probability and statistical applications. (K5, K6)			
7	Course Description	This practical course reinforces the theoretical foundations of descriptive statistics, probability, correlation, regression, hypothesis testing, design of experiments, and measure theory through computational simulations and data analysis. Students will use programming tools such as R or Python to implement statistical models and conduct real-world data-driven analysis.			
8	Outline syllabus				CO Mapping
	Unit 1	**Descriptive Statistics**			CO1
		Problem Based on Descriptive Statistics using R or Python			
	Unit 2	**Probability**			CO2, CO3
		Problem Based on probability using R or Python			
	Unit 3	**Random Variable and Distribution Function**			CO4
		Problem based on random variable and distribution functions using R or Python			
	Unit 4	**Testing of Hypothesis**			CO5
		Problem based on testing of Hypothesis using R or Python			
	Unit 5	**Inequalities and Central limit Theorem**			CO6
		Problem based on inequalities and central limit theorem using R or Python			
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ESE	
		30 %	30%	40 %	
	Text book/s*	• Introduction to Probability and Statistics by S.C. Gupta & V.K. Kapoor • Probability and Statistical Inference by Robert V. Hogg & Elliot A. Tanis			
	Other References	• Introduction to Probability Models by Sheldon M. Ross • Computational Probability and Statistics using R/Python (Online Resources)			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**

STP4752.1	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**
STP4752.2	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**
STP4752.3	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**
STP4752.4	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**
STP4752.5	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**
STP4752.6	**1**	**3**	**1**	**1**	**2**	**1**	**2**	**1**	**2**

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2025-26**
Branch: Data Science & Analytics		**Semester: I**
	Course Code	**STP4753**
	Course Title	**Distributions Theory Lab**
	Credits	1
	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
	Course Objective	To provide hands-on experience in solving probability-related problems and statistical distributions using computational tools and real-life data applications.
	Course Outcomes	CO1: Demonstrate probability concepts using computational tools. (K2, K3, K4) CO2: Analyze and visualize probability distributions and density functions. (K4, K5) CO3: Compute and interpret expectations and moment-generating functions. (K4, K5) CO4: Implement various types of generating functions in statistical analysis. (K3, K4) CO5: Apply sampling distributions for hypothesis testing. (K4, K5) CO6: Utilize statistical methods to solve real-world problems. (K5, K6)

	Course Description	This practical course reinforces the theoretical foundations of probability theory and distributions through computational simulations and data analysis. Students will use programming tools such as R or Python to implement probability models, derive distributions, and perform hypothesis testing.		
	Outline syllabus			CO Mapping
	Unit 1	**Basic Probability Concepts and Random Variables**		
		Problem based on conditional probability and Bayes' theorem using real-world data. Also Visualization of probability distributions (discrete and continuous)		CO1 CO2
	Unit 2	**Expectations and Inequalities**		
		Problem based on expectation, variance, and covariance of random variables, Conditional expectation and variance calculations. Verification of probability inequalities (Markov, Chebyshev, etc.) using data		CO2, CO3
	Unit 3	**Generating Functions and Discrete Distributions**		
		Problem based on moment generating functions and probability generating functions. Simulating and analyzing discrete distributions (Bernoulli, Binomial, Poisson, etc.)		CO3, CO4
	Unit 4	**Continuous Distributions**		
		Problem based on Simulation and visualization of continuous distributions (Normal, Exponential, Gamma, Beta, etc.)		CO4,CO5
	Unit 5	**Sampling Distributions and Hypothesis Testing**		
		Problem based on Sampling distribution of sample mean and proportion Performing hypothesis tests using t, F, and chi-square distributions. Real-life case studies involving hypothesis testing		CO5, CO6
	Mode of examination	Practical		
	Weightage Distribution	CA	CE	ESE
		30 %	30%	40 %
	Text book/s*			
	Other References			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP4753.1	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**
STP4753.2	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**
STP4753.3	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**
STP4753.4	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**
STP4753.5	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**
STP4753.6	**1**	**1**	**3**	**3**		**1**	**2**	**1**	**2**

<table>
<tr><td colspan="2">SCHOOL:
SSES</td><td>TEACHING DEPARTMENT:
Community Connect</td><td>Academic Year:
2025-26</td><td>FOR STUDENTS of M.Sc.
Batch: 2025-27</td></tr>
<tr><td>1</td><td>Course Number</td><td colspan="3">Course Code: CCP4001</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="3">Community Connect</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="3">0</td></tr>
<tr><td>3.01</td><td>(L-T-P)</td><td colspan="3">(0-0-4)</td></tr>
<tr><td>4</td><td>Learning Hours</td><td colspan="3"><table>
<tr><td>Contact Hours</td><td>30</td></tr>
<tr><td>Project/Field Work</td><td>20</td></tr>
<tr><td>Assessment</td><td>00</td></tr>
<tr><td>Guided Study</td><td>10</td></tr>
<tr><td>Total hours</td><td>60</td></tr>
</table></td></tr>
<tr><td>5</td><td>Course Objectives</td><td colspan="3">1. To expose our students to different social issues faced by the people in different sections of society.
2. To connect their class-room learning with problem solving skills in real life scenario.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="3">After completion of this course students will be able to:
CO1. Recognise social problems prevailing in different sections of society and finding the solution in sustainable manner.
CO2. Get practical exposure of all round development which complements their class room learning
CO3. These activities will add value to students, faculty members, school and university.
CO4. Apply their knowledge via research, and training for community benefit.
CO5. Analyze work on socio-economic projects with teamwork and timely delivery.
CO6. Survey will help to identify the gaps and create a plan to further improve the situation related to social problems prevailing in different sections of society and finding the solution in sustainable</td></tr>
</table>

		manner.
7	**Theme**	**Major themes for research:** 1. ***Survey and self-learning***: In this mode, students will make survey, analyse data and will extract results out of it to correlate with their theoretical knowledge. E.g. Crops and animals, land holding, labour problems, medical problems of animals and humans, savage and sanitation situation, waste management etc. 2. ***Survey and solution providing***: In this mode, students will identify the common problems and will provide solution/ educate rural population. E.g. air and water pollution, need of after treatment, use of renewable
		(mainly solar) energy, electricity saving devices, inefficiencies in cropping system, animal husbandry, poultry, pest control, irrigation, machining in agriculture etc. 3. Survey and reporting: In this mode students will educate villagers and survey the ground level status of various government schemes meant for rural development. The analysed results will be reported to concerned agencies which will help them for taking necessary/corrective measures. E.g. Pradhan Mantri Jan Dhan Yojana, Pradhan Mantri MUDRA Yojana, Pradhan Mantri Jeevan Jyoti Bima Yojana, Atal pension Yojana, Pradhan Mantri Awas Yojana, Pradhan Mantri FasalBima Yojana, Swachh Bharat Abhiyan, Soil Health Card Scheme, Digital India, Skill India Programme, Beti Bachao, Beti Padhao Yojana, DeenDayal Upadhyaya Gram Jyoti Yojana, Shyama Prasad Mukherjee Rurban Mission, UJWAL Discom Assurance Yojana, PAHAL,Pradhan Mantri Awas Yojana-Gramin, Pradhan Mantri Yuva Yojana, Pradhan Mantri Jan Aushadhi Yojana, Pradhan Mantri KhanijKshetra Kalyan Yojana, Pradhan Mantri Suraksha Bima Yojana, UDAN scheme, DeenDayal Upadhyaya Grameen Kaushalya Yojana, Pradhan Mantri Sukanya Samriddhi Yojana, Sansad Adarsh Gram Yojana, Pradhan Mantri SurakshitMatritva Abhiyan, Pradhan Mantri RojgarProtsahan Yojana, Midday Meal Scheme, Pradhan Mantri Vaya Vandana Yojana, Pradhan Mantri Matritva Vandana Yojana, and Ayushman Bharat Yojana.
8.1	**Guidelines for Faculty Members**	It will be a group assignment. There should be not more than 10 students in each group. The faculty guide will guide the students and approve the project title and help the student in preparing the questionnaire and final report. The questionnaire should be well design and it should carry at least 20 questions (Including demographic questions). The faculty will guide the student to prepare the PPT. The topic of the research should be related to social, economical or environmental issues concerning the common man. The report should contain 2,500 to 3,000 words and relevant charts, tables and photographs. The student should submit the report to CCC-Coordinator signed by the faculty guide by 15 April 2019. The students have to send the hard copy of the report and PPT, and then only they will be allowed for ETE.
8.2	**Role of CCC-Coordinator**	The CCC Coordinator will supervise the whole process and assign students to faculty members. 1. PG-M.Sc.-Semester II – the students will be allocated to faculty member (mentors/faculty member) in even term. 2. UG- B.Sc.-Semester III - the students will be allocated to faculty member (mentors/faculty member) in odd term.
8.3	**Layout of the Report**	Abstract(250 words) a. Introduction b. Literature review(optional) c. Objective of the research d. Research Methodology

		e. Finding and discussion f. Conclusion and recommendation g. References Note: Research report should base on primary data.
8.4	**Guideline for Report Writing**	Title Page: The following elements must be included: • Title of the article; • Name(s) and initial(s) of author(s), preferably with first names spelled out; • Affiliation(s) of author(s); • Name of the faculty guide and Co-guide Abstract: Each article is to be preceded by a succinct abstract, of up to 250 words, that highlights the objectives, methods, results, and conclusions of the paper. Text:Manuscripts should be submitted in Word. • Use a normal, plain font (e.g., 12-point Times Roman) for text. • Use italics for emphasis. • Use the automatic page numbering function to number the pages. • Save your file in docx format (Word 2007 or higher) or doc format (older Word versions) Reference list: The list of references should only include works that are cited in the text and that have been published or accepted for publication. The entries in the list should be in alphabetical order. Journal article Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. Ann. Mat. Pura Appl. 169, 321–354 (1995) Article by DOI Sajti, C.L., Georgio, S., Khodorkovsky, V., Marine, W.: New nanohybrid materials for biophotonics. Appl. Phys. A (2007). doi:10.1007/s00339-007-4137-z Book Geddes, K.O., Czapor, S.R., Labahn, G.: Algorithms for Computer Algebra. Kluwer, Boston (1992) Book chapter Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Denert, E. (eds.) Software Pioneers, pp. 10–13. Springer, Heidelberg (2002) Online document Cartwright, J.: Big stars have weather too. IOP Publishing PhysicsWeb. http://physicsweb.org/articles/news/11/6/16/1 (2007). Accessed 26 June 2007
		Always use the standard abbreviation of a journal's name according to the ISSN List of Title Word Abbreviations, see www.issn.org/2-22661-LTWA-online.php For authors using EndNote, Springer provides an output style that supports the formatting of in-text citations and reference list. EndNote style (zip, 2 kB) Tables:All tables are to be numbered using Arabic numerals. Figure Numbering:All figures are to be numbered using Arabic numerals. The soft copy of final report should be submitted by email to Dr. PialiHaldar(piali.haldar@sharda.ac.in)within 16**th April2019 along with hard copy signed by faculty guide**.
8.5	**Format:**	The report should be Spiral/ hardbound The Design of the Cover page to report will be given by the Coordinator- CCC Coverpage Acknowledgement Content Project report Appendices

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CCP4001.1	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**1**
CCP4001.2	**2**	**2**	**3**	**3**	**2**	**3**	**2**	**1**	**2**
CCP4001.3	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**1**
CCP4001.4	**2**	**2**	**1**	**2**	**2**	**2**	**3**	**1**	**2**
CCP4001.5	**2**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**2**
CCP4001.6	**2**	**2**	**1**	**3**	**2**	**2**	**2**	**1**	**2**

School: SSES		**Batch: 2025-27**	
Program: M.Sc.		**Academic Year: 2025-26**	
Branch: Statistics		**Semester: II**	
1	**Course Code**	**MDA105**	
2	**Course Title**	**Regression Analysis and Predictive Models**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	DSE	
5	Course Objective	The main objective of this course is to demonstrate and intended to verse students in the techniques necessary to understand and carry out regression and predictive analysis.	
6	Course Outcomes	At the end of the course, the student should be able to CO1: Explain the concept of regression with two and multiple variables. CO2: Testing of the single and subset of the regression coefficient. CO3: Explain the concept of multicollinearity. CO4: Describe how to overcome the problem of heteroscedasticity and autocorrelation. CO5: Explain the concept of dummy variables. CO6: How to apply logistic regression on a dataset.	
7	Course Description	A PG-level course in regression analysis, intended to verse students in the techniques necessary to understand and carry out methods of research in serial analysis. Lectures study the large-sample properties of estimators based on one-sample, k- sample, and partial likelihood inference, with proofs based on the counting process and Martingale theory. The theory of competing risks is studied from several angles. Many extensions of the Cox model to more complex data structures are considered.	
8	Outline syllabus		CO Mapping
	Unit 1	Correlation and Simple linear regression	
	A	Correlation, Types of Correlation, Rank Correlation, Simple linear regression model. Least- squares estimation of parameters. Hypothesis testing on the slope and intercept.	CO1
	B	Interval estimation in simple linear regression. Coefficient of determination. Estimation by maximum likelihood.	CO1
	C	Properties of BLUEs and the residual sum of squares under normality, Gauss-Markov Model.	CO1
	Unit 2	Multiple linear regression	

	A	Multiple linear regression: Multiple linear regression models. Estimation of the model parameters. Hypothesis testing in multiple linear regression. Confidence intervals in multiple regression. Coefficient of determination and Adjusted R2.	CO2
	B	Properties of least square estimator, confidence intervals for mean, regression coefficients and prediction in multiple regression, collinearity	CO2
	C	Inverse regression, two-phase linear regression, inclusion of qualitative variable as regressors, multiple and partial correlations.	CO2
	Unit 3	Logistic regression and Model Adequacy	
	A	Logistic Regression: Introduction, Linear predictor and link functions, logit, probit, odds ratio, the test of hypothesis. Discriminant Analysis.	CO3
	B	Model Adequacy: Checking of linearity between study and explanatory variable, Residual Analysis, Detection and treatment of outliers, Residual plots.	CO3
	C	The PRESS statistic. Outlier test based on Studentized Residual (R- student). Test for lack of fit of the regression model.	CO3
	Unit 4	Generalized Linear models and Logistic Regression	
	A	Basic concept of generalized linear models.	CO4
	B	Logit transformation, maximum likelihood estimation	CO4
	C	Tests of hypothesis: Wald test, likelihood ratio (LR) test, score test, test for overall regression	CO4
	Unit 5	**Machine Learning & Regression**	
	A	Model Evaluation and Deployment Introduction, Model Validation, Rule Induction Using CHAID.	CO5
	B	Bayesian Networks (Naïve Bayes) , Linear Regression, Cox Regression, and Association rules, Clustering(K-means and Hierarchical clustering)	CO5
	C	Decision trees, Logistic regression, Discriminant analysis, Support vector machine.	CO5, CO6
	Mode of examination	Theory	
	Weightage Distribution	CA: 25% / MTE: 25% / ESE: 50%	
	Text book/s*	Johnston, J. (1984). Econometric Methods, McGraw Hill Kogakusha Ltd.	
	Other References	Draper, N. R., and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third edition.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA105.1	3	2	3	3	-	2	2	1	1
MDA105.2	3	2	3	3	-	2	2	1	1
MDA105.3	3	2	2	2	-	2	2	1	1
MDA105.4	3	2	2	2	-	2	2	1	1
MDA105.5	3	2	2	2	-	2	2	1	1
MDA105.6	3	2	2	2	-	2	2	1	1

School: SSES		**Batch: 2025-27**	
Program: M.Sc.		**Academic Year: 2025-26**	
Branch: Data Science & Analytics		**Semester: II**	
1	Course Code	**MDA107**	
2	Course Title	**Advanced Big Data and Text Analytics**	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	This course aims to provide insight into the concepts of Natural Language Processing and its applications. This course helps the students to implement NLP applications using deep learning algorithms. This course helps to understand various word/text representation algorithms.	
6	Course Outcomes	At the end of the course, the student should be able to CO1: Learn about Big data techniques and their applications. CO2: Analyse various neural network problems. CO3: Use different word/text representation methods to see how words are related to each other. CO4: Model different NLP applications using Machine Learning/Deep learning algorithms CO5: Implement different deep learning models to solve real-time NLP problems CO6: Provide a body of concepts and techniques for designing intelligent systems.	
7	Course Description	A PG-level course in Soft Computing Techniques to Improve Big Data Analysis solutions is to strengthen the dialogue between the statistics and soft computing research communities.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A	Introduction to Big Data: Introduction to Big Data, Big Data characteristics	CO1
	B	Types of Big Data, Structured Data, Unstructured Data, and semi Structured Data.	CO1
	C	Traditional vs. Big Data business approach, Case Study of Big Data Solutions.	CO1
	Unit 2		
	A	Mining Data Streams: The Stream Data Model: A Data Stream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing.	CO2
	B	Sampling Data in a Stream: Obtaining a Representative Sample, The General Sampling Problem, Varying the Sample Size. Filtering Streams: The Bloom Filter Analysis.	CO2
	C	Counting Distinct Elements in a Stream: The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements Counting Ones in a Window: The Cost of Exact Counts.	CO2
	Unit 3		
	A	The Big Data Analytics and Big Data Analytics Techniques: Big	CO3

		Data and its Importance, Drivers for Big data, Optimization techniques, Dimensionality Reduction techniques.			
	B	Time series Forecasting, Social Media Mining, and Social Network Analysis, and its Application.			CO3
	C	Big Data analysis using Hadoop, Pig, Hive, MongoDB, Spark, and Mahout, Data analysis techniques like Discriminant Analysis and Cluster Analysis.			CO3
	Unit 4				
	A	Introduction to Natural Language Processing Words Regular Expressions N-grams Language modeling Part of Speech.			CO4
	B	Tagging Named Entity Recognition Syntactic and Semantic Parsing-Morphological Analysis			CO4
	C	Text Representation and Transformation-Vector space models Bag of Words Term Frequency Inverse Document Frequency Word Vector representations: Word2vec, GloVe, FastText, BERT-Topic Modelling			CO4
	Unit 5				
	A	Neural language models - Recurrent Neural Network - Long Short-Term Memory Networks			CO5
	B	Encoder decoder architecture - Attention Mechanism - Transformer networks			CO6
	C	Text classification-Sentiment Analysis-Neural Machine Translation - Question answering - Text summarization			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. S.N. Sivanandam& S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011. 2.S, Rajasekaran& G.A. VijayalakshmiPai, Neural Networks, 3. Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.			
	Other References	1.N. K. Bose, Ping Liang, Neural Network fundamental with Graph, Algorithms & Applications, TMH, 1st Edition, 1998. 2. Rich E, Knight K, Artificial Intelligence, TMH, 3rd Edition, 2012. 3. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA107.1	**3**	**2**	**3**	**3**	**1**	**1**	**2**	**1**	**2**
MDA107.2	**3**	**2**	**3**	**3**	**1**	**1**	**2**	**1**	**2**
MDA107.3	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**2**
MDA107.4	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**2**
MDA107.5	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**2**
MDA107.6	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**2**

School: SSES	**Batch: 2025-27**

Program: M.Sc.		**Academic Year: 2025-26**	
Branch: Data Science & Analytics		**Semester: II**	
1	Course Code	STT4803	
2	Course Title	Time Series Analysis and Vital Statistics	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	DSE(OE)	
5	Course Objective	The paper provides the students exposure to different models used in the field of time series analysis. On studying this paper students shall acquire knowledge of both theoretical and computational aspects of time series data as well as data coming from the field of medical science. Understand role, function and activities of various statistical organizations for collecting official statistics.	
6	Course Outcomes	At the end of the course, the student should be able to CO1: Basic Concept of Time Series CO2: Analyse Stationary process and Time series model CO3: Define the forecasting, non-stationary time series and financial time series model. CO4: Understand concept of demography and measures of fertility. CO5: Life table and its applications CO6: Provide a body of concepts and techniques for official statistics	
7	Course Description	A PG-level course in Time Series and Vital Statistics to Improve applied statistics and let them know how the probabilistic and computational models can be applied to some real-life domains	
8	Outline syllabus		CO Mapping
	Unit 1	**Overview of Time Series**	
	A	Time Series: introduction and overview, characteristics of time series	CO1
	B	auto covariance and autocorrelation functions and their properties.	CO1
	C	Exploratory time series analysis, tests for trend and seasonality. Exponential and moving average smoothing, Holt and winters smoothing.	CO1
	Unit 2	**Stationary Processes**	
	A	Detailed study of the stationary processes: (i) moving average (MA) (ii) auto regressive (AR)	CO2
	B	(iii) ARMA and (iv) AR integrated MA (ARIMA) models.	CO2
	C	Box-Jenkin's models, SARIMA	CO2
	Unit 3	**Forecasting and Modelling time series and Non-Stationary Process**	
	A	Introduction to forecasting, selecting forecasting models, modelling seasonality and forecasting	CO3

	B	Forecasting seasonal series, characterizing and modelling cycles			CO3
	C	Non-stationary time series. Time series with non-stationary variance. Non-stationary mean. ARCH and GARCH model			CO3
	Unit 4	Basic Demography			
	A	Measures of mortality and fertility, Migration and Urbanization.			CO4
	B	Life table: complete and abridged, King's method, Greville's method, Reed and Merrell method, uses of life table			CO4,CO5
	C	GRR, NRR			CO4, CO5
	Unit 5	Indian Official Statistics			
	A	Official statistics- Indian and International Statistical systems: Role, function and activities of Central and State Statistical organizations.			CO6
	B	Organization of large-scale sample surveys.			CO6
	C	Role of National Sample Survey Organization, Sample Registration System (SRS), National Family Health Surveys, General and special data dissemination systems			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Montgomery, D. C. and Johnson, L. A. (1977). Forecasting and Time Series Analysis, McGraw Hill. 2. Chatfield, C. and Xing, H. (2019). The Analysis of Time Series: An Introduction with R, Chapman and Hall/CRC.			
		Publication, 1st Edition, 2009.			
	Other References	Keyfitz, N. (1977). Applied Mathematical Demography, Springer Verlag. Benjamin, B. (1969). Demographic Analysis, George, Allen and Unwin UNESCO. Principles for Vital statistics Systems. Series M -12. Gun AM., Gupta MK. and Dasgupta B. (2001) Fundamentals of Statistics, Vol. 2, World Press. Box, G. E. P. and Jenkins, G. M. (1976). Time Series Analysis - Forecasting and Control, Holden-day, San Francisco.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO									

STT4803.1	3	2	3	3	-	2	2	1	1
STT4803.2	3	2	3	3	-	2	2	1	1
STT4803.3	3	2	2	2	-	2	2	1	1
STT4803.4	3	2	2	2	-	2	2	1	1
STT4803.5	3	2	2	2	-	2	2	1	1
STT4803.6	3	2	2	2	-	2	2	1	1

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2025-26**
Branch: Data Science & Analytics		**Semester: II**
1	Course Code	MDA108
2	Course Title	Data Mining & Artificial Intelligence
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Compulsory
5	Course Objective	To introduce students to the applications, concepts, and techniques of data mining. To provide a strong foundation of fundamental concepts in Artificial Intelligence.
6	Course Outcomes	CO1: Learn about the data mining pattern and functionalities CO2: Understand the basic concepts and classification of Data mining CO3: Explain the mining of frequency pattern CO4: Explain the correlation and cluster analysis with applications. CO5: Learn about the basic concept of AI CO6:Explain computable functions, predicates, forward and backward reasoning
7	Course	The data mining process includes data selection and cleaning, machine learning

	Description	techniques to ``learn" knowledge that is ``hidden" in data, and the reporting and visualization of the resulting knowledge. AI helps the students to understand various searching techniques, constraint satisfaction problems, and example problems- game playing techniques.			
8	Outline syllabus				CO Mapping
	Unit 1	Data Mining			
	A	Introduction, Data, Types of Data, Data Mining Functionalities,			CO1,
	B	Interestingness of Patterns, Classification of Data Mining Systems, Data Mining Task Primitives,			CO1,
	C	Integration of a Data Mining System with Data Warehouse Issues, Data Preprocessing			CO1,
	Unit 2	Mining Frequent Pattern			
	A	Mining Frequent Patterns, Associations, and Correlations, Mining Methods, Mining various Kinds of Association Rules,			CO2
	B	Correlation Analysis, Constraint-Based Association Mining Classification, and Prediction, Basic Concepts, Decision Tree Induction, Bayesian Classification, Rule Based Classification,			CO2
	C	Classification by Back propagation, Support Vector Machines, Associative Classification, Lazy Learners, Other Classification Methods, and Prediction.			CO3
	Unit 3	Cluster Analysis			
	A	Cluster Analysis, Types of Data, Categorization of Major Clustering Methods, K-means, Partitioning Methods, Hierarchical Methods,			CO4
	B	Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Clustering High Dimensional Data, Constraint, Based Cluster Analysis, and Outlier Analysis.			CO4
	C	Data Mining Applications. Apply data mining techniques and methods to large data sets, Use data mining tools, and Compare and contrast the various classifiers.			CO4
	Unit 4	Basic of AI			
	A	Defining Artificial Intelligence, Defining AI techniques,			CO5
	B	Defining problems such as State Space search, Production systems, and characteristics,			CO5
	C	Hill Climbing, Breadth first and depth first search, Best first search.			CO5
	Unit 5	Mapping in AI			
	A	Representations and Mappings, Approaches to knowledge representation, Representing simple facts in logic,			CO6
	B	Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming,			CO6
	C	Forward vs backward reasoning, Non-monotonic Reasoning, Logic for non-monotonic reasoning.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008. 2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012. 3. Artificial Intelligence: A Modern Approach, Stuart Russel, Peter Norvig			
	Other References	1. Artificial Intelligence, 2nd Edition, Rich and Knight. 2. . K.P. Soman, ShyamDiwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA108.1	3	2	3	1		1	2	1	2
MDA108.2	3	2	3	1		1	2	1	2
MDA108.3	3	2	2	1		1	2	1	2
MDA108.4	3	2	2	1		1	2	1	2
MDA108.5	3	2	2	1		1	2	1	2
MDA108.6	3	2	2	1		1	2	1	2

School: SSES		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2025-26**			
Branch: Data Science & Analytics		**Semester: II**			
1	Course Code	**STP4854**			
2	Course Title	Time Series Analysis Lab			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	DSE(OE)			
5	Course Objective	To provide hands-on experience to develop skills in time series analysis, forecasting, stationarity testing, ARIMA modeling.			
6	Course Outcomes	After the completion of this course, students will be able to: CO1: Understanding the fundamental concepts of time series, autocovariance, and autocorrelation functions. (K2, K3, K4) CO2: Analyze test for stationarity using ADF and KPSS tests.. (K4, K5) CO3: Analyzing and model stationary processes (MA, AR, ARMA, ARIMA. (K4, K5) CO4: Perform forecasting techniques. (K3, K4) CO5: Apply design of experiments in statistical data analysis. (K4, K5) CO6: Utilize non-stationary time series and Volatility modeling. (K5, K6)			
7	Course Description	This practical course explores time series analysis, covering stationarity, ARIMA modeling, forecasting, volatility modeling (ARCH/GARCH), and demographic statistics, with applications in economic, financial, and official statistical data analysis.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Time Series Data**			
		Importing and visualizing time series data using R or Python Understanding time series components (trend, seasonality, randomness) Computing autocovariance and autocorrelation functions			CO1
	Unit 2	**Stationary Processes & Model Identification**			
		Checking for stationarity: Augmented Dickey-Fuller (ADF) test and KPSS test Implementing Moving Average (MA) and Auto-Regressive (AR) models			CO2, CO3
	Unit 3	**ARMA, ARIMA & SARIMA Models**			
		Model fitting using Box-Jenkins methodology, ARIMA, SARIMA			CO4
	Unit 4	**Forecasting Techniques**			
		Forecast evaluation: Mean Squared Error (MSE), Mean Absolute Error (MAE) Forecasting seasonal data (e.g., retail sales, temperature)			CO5
	Unit 5	**Non-Stationary Time Series & Volatility Modeling**			
		Problem based on ARCH and GARCH model			CO6
	Mode of examination	Practical/CE			
	Weightage Distribution	CA	CE	ESE	
		30%	30%	40%	
	Text book/s*	• Aileen Nielsen – *Practical Time Series Analysis: Prediction with Statistics and Machine Learning* (O'Reilly) • Williams, B. – *Hands-On Time Series Analysis with Python* (Packt)			
	Other References	• **Montgomery, D. C., Jennings, C. L., & Kulahci, M.** – *Introduction to Time Series Analysis and Forecasting* (Wiley)			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / **CO**	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP4854.1	1	3	1	1	2	1	2	1	2
STP4854.2	1	3	1	1	2	1	2	1	2
STP4854.3	1	3	1	1	2	1	2	1	2
STP4854.4	1	3	1	1	2	1	2	1	2
STP4854.5	1	3	1	1	2	1	2	1	2
STP4854.6	1	3	1	1	2	1	2	1	2

School: SSES	**Batch: 2025-27**			
Program: M.Sc.	**Academic Year: 2025-26**			
Branch: Data Science & Analytics	**Semester: II**			
Course Code	**DAR4856**			
Course Title	**Project**			
Credits	4			
Contact Hours (L-T-P)	0-0-8			
Course Status	Compulsory			
Course Objective	This course introduces students to problem identification, literature review, and data collection for a Data Science project.			
Course Outcomes	CO1: Identify a research problem and define objectives. (K2, K3) CO2: Conduct literature review and feasibility study. (K3) CO3: Collect, organize, and preprocess relevant data. (K3, K4) CO4: Analyze data to explore patterns and relationships. (K4) CO5: Develop a structured project proposal. (K5) CO6: Present initial findings in a report and presentation. (K5, K6)			
Course Description	This course introduces students to problem identification, literature review, and data collection for a Data Science project. It helps students develop a structured approach to research, establish objectives, and prepare a comprehensive project proposal.			
Outline syllabus				CO Mapping
Unit 1	**Project Planning and Problem Identification**			
A	Selection of a topic and defining project scope			CO1
B	Literature review and feasibility analysis			CO1
C	Setting research objectives and expected outcomes			CO1
Unit 2	**Data Collection and Organization**			
A	Identifying sources of data			CO2
B	Collection, structuring, and documentation of data			CO2
C	Handling and managing missing or inconsistent data			CO2
Unit 3	**Initial Data Analysis**			
A	Exploring data characteristics			CO3
B	Identifying trends, patterns, and correlations			CO3
C	Generating preliminary insights			CO3
Unit 4	**Project Proposal Development**			
A	Outlining project methodology and approach			CO4
B	Identifying evaluation criteria			CO4
C	Addressing potential challenges and limitations			CO4
Unit 5	**Presentation and Review**			
A	Structuring and formatting the proposal			CO5
B	Preparing visual and written reports			CO6
C	Presenting and refining based on feedback			CO6
Mode of examination				
Weightage Distribution	CA	CE	ESE	
	30%	30%	40%	

Text book/s*	• The Data Science Handbook – Carl Shan, Henry Wang, William Chen, and Max Song • Practical Research: Planning and Design – Paul D. Leedy and Jeanne Ellis Ormrod	
Other References	• Exploratory Data Analysis with Python – John W. Tukey • The Craft of Research – Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams	

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAR4856.1	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
DAR4856.2	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**
DAR4856.3	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**
DAR4856.4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
DAR4856.5	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
DAR4856.6	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

School: SSES		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2026-27**			
Branch: Data Science & Analytics		**Semester: III**			
1	Course Code	**MDA201**			
2	Course Title	**Inferential Statistics**			
3	Credits	4			
4	Contact Hours (L-T-P)	4-0-0			
	Course Status	Compulsory			
5	Course Objective	The course aims to understand the different properties of an estimator. After studying this course students will be able to understand the power of the test.			
6	Course Outcomes	CO1: Learn about the properties of the estimator. CO2: Understand the concept of the best estimator with examples CO3: Learn about the Rao, Lehman, and Bhattacharya bounds CO4: Understand the properties of MLE CO5: Learn the concept of the critical region and the power of the test CO6: Understand the unbiased test and Neyman structure			
7	Course Description	Inferential statistics are concerned with making inferences based on relations found in the sample, to relations in the population.			
8	Outline syllabus				CO Mapping
	Unit 1	**Properties of Estimator**			
	A	Point estimator, Interval estimator, Unbiasedness, Consistency, Efficiency, Sufficiency, Neyman Fisher lemma, Sufficient Statistics, and completeness,			CO1, CO2
	B	UMVUE, Cramer Rao Inequality along with the underlying conditions,			CO1, CO2
	C	Modification and extension of CR inequality.			CO1, CO2
	Unit 2	**Blackwellization**			
	A	Rao Blackwell theorem			CO3
	B	Lehman Scheffe theorem,			CO3
	C	Introduction to Bhattacharya bounds, consistency of an estimator.			CO3
	Unit 3	**MLE**			
	A	Maximum Likelihood estimation			CO4
	B	Properties of MLE			CO4
	C	BAN, Pitman estimator, and its efficiency.			CO4
	Unit 4	**Critical Region**			
	A	Best critical region, Generalized Neyman Pearson lemma,			CO5
	B	UMP tests for distribution with MLR			CO5
	C	LR test and their properties.			CO5
	Unit 5	**Neyman Structure**			
	A	Unbiased tests,			CO6
	B	Locally most powerful tests,			CO6
	C	Similar regions and tests of Neyman structure.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Mood, Graybill and Boes, An introduction to the theory of Statistics 3rd edition	
	Other References	1. Kendal & Stuart, The Advanced Theory of Statistics Vol II, Charles Griffin. 2. E. L. Lehman, Testing of Statistical Hypothesis, John Wiley & Wiley Eastern	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA201.1	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA201.2	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA201.3	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA201.4	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA201.5	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA201.6	**1**		**3**	**3**		**1**	**2**	**1**	**2**

School: SSES		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2025-26**			
Branch: Data Science & Analytics		**Semester: III**			
1	Course Code	MDA202			
2	Course Title	Multivariate Data Analysis			
3	Credits	4			
4	Contact Hours (L-T-P)	4-0-0			
	Course Status	Compulsory			
5	Course Objective	The course aims to analyze multivariate data and understand the characteristics of multivariate quantitative research, including strengths and weaknesses. It also discusses the principles and characteristics of multivariate data analysis techniques.			
6	Course Outcomes	CO1: Learn about the multivariate data; Evolution and understanding of the data. CO2: Understand the basic concepts of multivariate normal distribution. CO3: Utilize the Wishart distribution in multivariate analysis. CO4: Mahalanobis D^2 and Hotelling T^2 CO5:Apply the classification rule in decision theory CO6: Utilization of PCA and factor analysis.			
7	Course Description	A large amount of data is collected on many different variables across disciplines to understand the underlying process(es). The multivariate analysis of data deals with examining the interrelationship between three or more equally important variables or explaining variation in usually one (or more than one) dependent variable(s) based on two or more independent (explaining) variables.			
8	Outline syllabus				CO Mapping
	Unit 1	**Multivariate Normal Distribution**			
	A	Multivariate Normal Distribution			CO1, CO2
	B	Probability density function and other properties			CO1, CO2
	C	Marginal and condition distribution.			CO1, CO2
	Unit 2	**Wishart**			
	A	Wishart distribution			CO3
	B	Probability density and distribution function,			CO3
	C	Characteristic function and its properties.			CO3
	Unit 3	**Data Pre-processing and Feature Selection**			
	A	Hotelling T^2, Mahalanobis D^2,			CO4
	B	Properties and functional forms of T^2 and D^2			CO4
	C	Represent their relationship and application.			CO4
	Unit 4	**Basic of R**			
	A	Classification analysis,			CO5
	B	discrimination analysis,			CO5
	C	Bayesian classification and decision design.			CO5
	Unit 5	**Basic Data Mining**			
	A	Principal Component Analysis,			CO6
	B	Canonical Correlation and variables,			CO6
	C	Factor Analysis,			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. T.W. Anderson, Multivariate Analysis, John Wiley & Wiley Eastern.	
	Other References	2. Johnson & Wichem, Applied Multivariate Analysis, Wiley & Wiley Eastern.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA202.1	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA202.2	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA202.3	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA202.4	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA202.5	**1**		**3**	**3**		**1**	**2**	**1**	**2**
MDA202.6	**1**		**3**	**3**		**1**	**2**	**1**	**2**

School: SSES	**Batch: 2025-27**			
Program: M.Sc.	**Academic Year: 2026-27**			
Branch: Data Science & Analytics	**Semester: III**			
Course Code	**DAT5303**			
Course Title	**Introduction to Deep Learning**			
Credits	3			
Contact Hours (L-T-P)	3-0-0			
Course Status	Compulsory			
Course Objective	To introduce fundamental concepts of deep learning, including artificial neural networks, optimization techniques, and applications in various domains. The course provides theoretical insights and practical exposure to deep learning models.			
Course Outcomes	At the end of the course, the student should be able to CO1: Understand the basic principles and differences between machine learning and deep learning. (K2, K3) CO2: Explain the architecture and working of artificial neural networks (ANNs). (K3, K4) CO3: Apply optimization techniques for training deep learning models. (K3, K4) CO4: Implement deep learning models for image and text data using standard libraries. (K4, K5) CO5: Analyze and evaluate the performance of deep learning models. (K4, K5) CO6: Explore ethical considerations and emerging trends in deep learning. (K5, K6)			
Course Description	This course introduces students to deep learning fundamentals, including artificial neural networks, optimization techniques, and commonly used deep learning architectures. It covers the application of deep learning in areas such as computer vision and natural language processing (NLP) using Python-based libraries like TensorFlow and PyTorch.			
Outline syllabus				CO Mapping
Unit 1	**Introduction to Deep Learning**			
A	Basics of Machine Learning vs. Deep Learning, Introduction to Neural Networks and Perceptron			CO1
B	Activation Functions (ReLU, Sigmoid, Tanh)			CO1
C	Introduction to Deep Learning Frameworks (TensorFlow, PyTorch)			CO1
Unit 2	**Artificial Neural Networks (ANNs)**			
A	Architecture of Feedforward Neural Networks			CO2
B	Loss Functions and Optimization Techniques (Gradient Descent, Backpropagation)			CO2,CO3
C	Overfitting and Regularization (Dropout, L1/L2), Hyperparameter Tuning			CO3
Unit 3	**Convolutional Neural Networks (CNNs) for Image Processing**			
A	Introduction to Image Data and Feature Extraction			CO4
B	Convolutional Layers, Pooling, and Fully Connected Layers			CO4, CO5
C	Pretrained Models (VGG, ResNet, MobileNet), Applications in Image Classification and Object Detection			CO5
Unit 4	**Recurrent Neural Networks (RNNs) for Sequence Data**			
A	Basics of Sequence Modeling			CO4
B	Recurrent Neural Networks (RNN), Long Short-Term Memory (LSTM)			CO5
C	Applications in Text Processing (Sentiment Analysis, Text Generation)			CO5
Unit 5	**Recent Trends and Ethical Considerations**			
A	Introduction to Transfer Learning and Fine-Tuning			CO5
B	Basics of Generative AI (Chatbots, GANs)			CO6
C	Ethical Considerations in AI (Bias, Fairness, Explainability)			CO6
Mode of examination	Theory			
Weightage Distribution	CA	MTE	ETE	
	25%	25%	50%	
Text book/s*	• Ian Goodfellow, Yoshua Bengio, Aaron Courville – Deep Learning • François Chollet – Deep Learning with Python			
Other References	• Aurélien Géron – *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* • Christopher M. Bishop – *Pattern Recognition and Machine Learning*			

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAT5303.1	2	1	3	3	0	2	1	2	2
DAT5303.2	2	2	3	3	0	2	1	2	2
DAT5303.3	2	2	3	3	0	2	1	2	2
DAT5303.4	2	3	3	3	0	2	1	2	2
DAT5303.5	2	3	3	3	0	2	1	2	2
DAT5303.6	2	2	3	3	0	2	1	2	2

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Statistics/ Data Science & Analytics		**Semester: III**
1	Course Code	**STT5305**

2	Course Title	Research Methodology & IPR	
3	Credits	1	
4	Contact Hours (L-T-P)	1-0-0	
	Course Status	Compulsory	
5	Course Objective	This course introduces postgraduate students to research processes and intellectual property rights, with emphasis on Statistics and Data Science. It covers research objectives, methodologies, literature review techniques, and research problem formulation. Students will learn data collection, statistical analysis, and interpretation methods. The course also highlights the significance of patents, copyrights, and trademarks in safeguarding innovations like algorithms, models, software tools, and data-driven applications.	
6	Course Outcomes	At the end of the course, the student should be able to CO1: Identify and define clear, concise research problems, establishing appropriate objectives and hypotheses. (K2, K4) CO2: Perform thorough literature searches, critically analyze existing research, and identify gaps to position new research effectively. (K3) CO3: Develop suitable research designs, select appropriate methodologies, and apply relevant data collection and analysis techniques. (K2, K4, K5) CO4: Recognize and adhere to ethical standards in research, addressing issues such as plagiarism, data fabrication, and authorship ethics. (K1, K2) CO5: Comprehend various forms of intellectual property, including patents, copyrights, and trademarks, and their significance in protecting innovations. (K1, K2) CO6: Understand the processes for filing intellectual property rights and the legal and economic implications of IPR in the global business environment. (K2, K6)	
7	Course Description	This course introduces the fundamentals of research design, data collection, and analysis, with emphasis on ethical research practices in Statistics and Data Science. Students will learn to formulate research problems, conduct literature reviews, and apply suitable statistical and computational methodologies. The course also covers various forms of intellectual property, including patents, copyrights, and trademarks, highlighting their role in protecting algorithms, models, software, and data-driven innovations.	
8	Outline syllabus		CO Mapping
	Unit 1	**Research Problem Identification**	
	A	Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem in Statistics/Data Science.	CO1
	B	Approaches of investigation of solutions for research problem, data collection, analysis interpretation.	CO1
	C	Essential software and computational tools.	CO1
	Unit 2	**Literature Review & Research Ethics**	
	A	Effective literature studies approaches	CO2
	B	Analysis Plagiarism, Research ethics	CO2
	C	Understanding plagiarism and ethical data handling.	CO2
	Unit 3	**Research Design and Data Analysis**	
	A	Effective technical writing, how to write report, Paper Developing a Research Proposal	CO3
	B	Format of research proposal	CO3
	C	Proposal presentation and review process.	CO3
	Unit 4	**Intellectual Property Basics**	

	A	Patents, Designs, Trade and Copyright. Process of Patenting and Development:			CO4
	B	Technological research, innovation, patenting, development.			CO4
	C	International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.			CO4
	Unit 5	**Patent Rights & Licensing**			
	A	Scope of Patent Rights. Licensing and transfer of technology.			CO6,CO5
	B	Patent information and databases. Geographical Indications,			CO6,CO5
	C	Patent system administration.			CO6,CO5
	Mode of examination	**Practical**			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text books	1. Santosh M. Nejakar: Research Methodology and Intellectual Property Rights, Sunstar, 2024			
	Other references	1. A. Gnana Soundari, S. Muthubalaji, and S. Gopalakrishnan: Research Methodology & IPR, Scholars' Press, 2024. 2. Kailas Pathade: Research Methodology and Intellectual Property Rights, Notion Press, 2024.			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STT5305.1	3	3	3	3	2	3	3	2	1
STT5305.2	3	2	3	3	3	3	2	1	2
STT5305.3	2	2	2	3	2	2	2	1	1
STT5305.4	2	2	1	2	2	2	3	1	1
STT5305.5	3	2	2	3	2	3	2	2	2
STT5305.6	3	2	1	3	2	2	2	1	2

School: SSBSR		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2026-27**			
Branch: Data Science & Analytics		**Semester: III**			
1	Course Code	**STP5351**			
2	Course Title	**Inference Lab**			
3	Credits	1			
4	Contact Hours (L-T-P)	0-0-2			
	Course Status	Compulsory			
5	Course Objective	After studying this course students will be able to understand how to calculate the power of the test, analyze the multivariate data and understand the characteristics of multivariate quantitative research, including strengths and weaknesses. It also discusses the principles and characteristics of multivariate data analysis techniques.			
6	Course Outcomes	At the end of the course, the student should be able to CO1: Estimate the parameter by MOM CO2: Learn about how to calculate the power of test, unbiased test and inference on regression. CO3: Estimation of parameter by MLE. CO4: Understand the basic concepts of Unbiasedness and consistency. Goodness of fit. CO5: Understanding BLUE. CO6: Apply the UMP, LRT, Lahman and CR Bound.			
7	Course Description	In this course, students are concerned with making inferences based on relations found in the sample, to relations in the population. Also multivariate analysis of data deals with examining the interrelationship between three or more equally important variables or explaining variation in, usually one (or more than one) dependent variable(s) based on two or more independent (explaining) variables.			
8	Outline syllabus				CO Mapping
	Unit 1				
		Problem-based on the estimation by MOM both discrete and continuous case. Regression and Model Inference.			CO1, CO2
	Unit 2				
		Problem-based on critical region, power of the test, unbiased test, and Neyman structure using R/Python. Hypothesis testing.			CO2, CO3
	Unit 3				
		Problem-based On MLE both discrete and continuous case. Goodness-of-fit tests (Chi-square test, Kolmogorov-Smirnov test)			CO3, CO4
	Unit 4				
		Problem Base on Consistency and Unbiasedness. Problem based on BLUE.			CO4, CO5
	Unit 5				
		Problem based on UMP and LRT. Application of Lahman and CR Bound.			CO5, CO6
	Mode of examination	Practical			
	Weightage	CA	CE	ESE	

	Distribution	30 %	30%	40 %	
	Text book/s*				
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / **CO**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
STP5351.1	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
STP5351.2	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
STP5351.3	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
STP5351.4	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
STP5351.5	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**
STP5351.6	**1**	**3**	**1**	**1**	**1**	**1**	**1**	**1**	**2**

School: SSBSR		**Batch: 2025-27**	
Program: M.Sc.		**Academic Year: 2026-27**	
Branch: Statistics		**Semester: III**	
1	Course Code	**STP5352**	
2	Course Title	Multivariate Analysis Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of this course is to analyze solutions to strengthen the dialogue between the statistics and soft computing research communities to cross-pollinate both fields and generate mutual improvement activities. It covers essential exploratory techniques for understanding multivariate data by summarizing it through statistical methods and graphical methods.	
6	Course Outcomes	At the end of the course, the student should be able to CO1: Learn about soft computing techniques and their applications, and analyze various neural network architectures. CO2: Understand perceptrons and counter propagation networks, Define the fuzzy systems. CO3: Analyze the genetic algorithms and their applications. CO4: Handle missing data in real-world data sets by choosing appropriate methods. CO5: Summarize the data using basic statistics. Visualize the data using basic graphs and plots. Identify the outliers if any in the data set. CO6: Choose appropriate feature selection and dimensionality reduction. Techniques for handling multi-dimensional data.	
7	Course Description	Using R/ Python try to solve the problem related to Soft Computing Techniques. Exploratory Data Analysis, Visualization, summarizes the insurer's use of predictive analytics, identifies the outliers, dimensionality reduction, and Data Visualization for multi-dimensional data.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Multivariate Data	
		Problem Based on multivariate data analysis. Summary statistics: Mean vector, covariance, and correlation matrix. Standardization and transformation of multivariate data.	CO1,CO2

	Unit 2	Multivariate Normal Distributions			
		Problem based on Multivariate normal distribution. Estimation of mean vector and covariance matrix Problem based on Mahalanobis D2 using R/Python.			CO1, CO2
	Unit 3	Inference of Multivariate Distributions			
		Problem-based on Wishart distribution, Problem based on HottelingT2 using R/Python.			CO2, CO3
	Unit 4	MLR and MANOVA			
		Problem-based Multivariate Linear Regression (MLR) and MANOVA (Multivariate Analysis of Variance) using R/Python.			CO4,CO5
	Unit 5	Dimension Reduction Techniques			
		Problem-based on PCA, Canonical Correlation Analysis, Factor Analysis using R/python.			CO5, CO6
	Mode of examination	Practical			
	Weightage Distribution	CA	CE	ESE	
		30 %	30%	40 %	
	Text book/s*				
	Other References				

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP5352.1	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
STP5352.2	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
STP5352.3	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
STP5352.4	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
STP5352.5	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**
STP5352.6	**1**	**3**	**1**	**1**	**-**	**1**	**1**	**1**	**2**

School: SSES		**Batch: 2024-26**			
Program: M.Sc.		**Academic Year: 2025-26**			
Branch: Data Science & Analytics		**Semester: IV**			
1	Course Code	**DAR5356**			
2	Course Title	**Capstone Project I**			
3	Credits	6			
4	Contact Hours (L-T-P)	0-0-12			
	Course Status	Compulsory			
5	Course Objective	This course focuses on model development, evaluation, and optimization to ensure robust and effective machine learning solutions.			
6	Course Outcomes	CO1: Develop an approach to solve the identified problem. (K3) CO2: Test and refine the proposed approach. (K4) CO3: Compare different techniques and assess their effectiveness. (K4, K5) CO4: Analyze results and draw meaningful conclusions. (K5) CO5: Document the findings systematically. (K6) CO6: Present progress and seek constructive feedback. (K6)			
7	Course Description	This course guiding students in developing and evaluating the proposed solution. Students focus on refining their approach, testing multiple strategies, and assessing their effectiveness based on defined evaluation criteria.			
8	Outline syllabus				CO Mapping
	Unit 1	**Approach Development**			
	A	Structuring the problem-solving methodology			CO1
	B	Setting evaluation criteria			CO1
	C	Addressing assumptions and constraints			CO1
	Unit 2	**Implementation and Testing**			
	A	Applying and testing different strategies			CO2
	B	Refining the approach based on initial results			CO2
	C	Ensuring consistency and reliability of the process			CO2
	Unit 3	**Comparative Analysis**			
	A	Evaluating the effectiveness of different techniques			CO3
	B	Identifying strengths and weaknesses in the approach			CO3
	C	Selecting the most suitable solution			CO3
	Unit 4	**Interpretation and Documentation**			
	A	Analyzing outcomes and their significance			CO4
	B	Structuring the project report			CO4
	C	Ensuring clarity and coherence in the documentation			CO4
	Unit 5	**Progress Review and Refinement**			
	A	Presenting interim results			CO5
	B	Incorporating feedback for improvement			CO6
	C	Refining the approach for final implementation			CO6
	Mode of examination				
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	• The Elements of Statistical Learning" – Trevor Hastie, Robert Tibshirani, and Jerome Friedman • Applied Research Design: A Practical Guide" – Terry E. Hedrick, Leonard Bickman, Debra J. Rog			

	Other References	• Research Design: Qualitative, Quantitative, and Mixed Methods Approaches – John W. Creswell • Designing Data-Intensive Applications"– Martin Kleppmann	

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAR5356.1	3	3	3	3	1	3	3	3	3
DAR5356.2	3	3	3	3	1	3	3	3	3
DAR5356.3	3	3	3	3	1	3	3	3	3
DAR5356.4	3	3	3	3	1	3	3	3	3
DAR5356.5	3	3	3	3	2	3	2	3	3
DAR5356.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2026-27**			
Branch: Data Science & Analytics		**Semester: IV**			
1	Course Code	MDA215			
2	Course Title	Advances in Design and Experiment			
3	Credits	4			
4	Contact Hours (L-T-P)	4-0-0			
	Course Status	Elective			
5	Course Objective	To introduce the basic principles and methods of statistical design of experiments. The significances of effects of various factors on a given response are determined under uncertainty using statistical principles.			
6	Course Outcomes	After the completion of this course, the student will be able to CO1: Build knowledge of basic principles of design of the experiment. CO2: Make use of the concept of various simple types of experimental designs. CO3: Make use of the concept of complex types of experimental designs. CO4: Evaluate the factorial experiment, confounding, and split/strip plot design. CO5: Apply the concept of missing-plot techniques, CO6: Apply cross-over design and transformation of data and response equation.			
7	Course Description	To introduce the basic principles and methods of statistical design of experiments. The significances of effects of various factors on a given response are determined under uncertainty using statistical principles.			
8	Outline syllabus				CO Mapping
	Unit 1				
	A	Analysis of variance., Analysis of Covariance			CO1
	B	Basic principles of design of experiments			CO1
	C	Uniformity trials.			CO1
	Unit 2				
	A	Completely randomized design (CRD),			CO2
	B	Randomized complete block design (RCBD),			CO2
	C	Latin square design (LSD),			CO2
	Unit 3				
	A	Balanced incomplete block (BIB) design,			CO3
	B	Resolvable block designs and their applications:			CO3
	C	Randomization procedure, analysis, and interpretation of results.			CO3
	Unit 4				
	A	Factorial experiments (symmetrical as well as asymmetrical).			CO4
	B	Confounding in factorial experiments-application in 2n and 3n factorial experiments. Factorial experiments with extra treatment(s).			CO4
	C	Split plot and Strip plot designs.			CO4
	Unit 5				
	A	Groups of experiments.			CO5
	B	Missing plot technique and its application to RCBD,			CO6
	C	LSD, Cross-over design, Sampling in field experiments.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	1. Cochran, W.G. and Coxx, G.M.1957. Experimental Designs. John Wiley and Sons. 2. Das, M.N. and Giri, N.C.1986. Design and Analysis of Experiments. New Age International.	
	Other References	1. Gomez, K.A. and Gomez, A.A.1984.Statistical Procedures for Agricultural Research. John Wiley & Sons. 2. Panse, V.G. and Sukhatme, P.V.1967.Statistical Methods for Agricultural Workers. ICAR Publication. 3. Steel, R.G.D.and Torrie, J.H.1960. Principles and Procedures of Statistics. McGraw Hill.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
MDA215.1	**3**		**3**	**3**		**1**	**1**	**1**	**2**
MDA215.2	**3**		**3**	**3**		**1**	**1**	**1**	**2**
MDA215.3	**3**		**3**	**3**		**1**	**1**	**1**	**2**
MDA215.4	**3**		**3**	**3**		**1**	**1**	**1**	**2**
MDA215.5	**3**		**3**	**3**		**1**	**1**	**1**	**2**
MDA215.6	**3**		**3**	**3**		**1**	**1**	**1**	**2**

School: SSES		**Batch: 2025-27**	
Program: M.Sc.		**Academic Year: 2026-27**	
Branch: Data Science & Analytics		**Semester: IV**	
1	Course Code	**STP5454**	
2	Course Title	**Reliability and Survival Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Core Course	
5	Course Objective	This course aims to develop expertise in Reliability and Survival Analysis, focusing on failure modeling, survival estimation, parametric and non-parametric methods, system reliability, and real-world applications in healthcare, engineering, and manufacturing.	
6	Course Outcomes	CO1: Explain the fundamental concepts of reliability, failure rates, survival functions, and hazard functions. (K2, K3) CO2: Identify and analyze different types of censoring (right, left, interval) in time-to-event data. (K3, K4) CO3: Apply non-parametric estimation techniques such as Kaplan-Meier and Nelson-Aalen estimators for survival analysis. (K4, K5) CO4: Fit and evaluate parametric survival models (Exponential, Weibull, Log-Normal) for failure time analysis. (K4, K5, K6) CO5: Implement Cox Proportional Hazards (Cox-PH) and Accelerated Failure Time (AFT) models to assess survival relationships. (K4, K5) CO6: Develop Reliability Block Diagrams (RBD) and evaluate system reliability using analytical and simulation techniques. (K5, K6)	
7	Course Description	This course covers Reliability and Survival Analysis, focusing on failure rates, survival functions, and hazard functions. Students learn time-to-event analysis, censoring types, Kaplan-Meier, parametric models (Weibull, Exponential), Cox-PH. Applications include healthcare, engineering, and manufacturing for system reliability and predictive analysis.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Reliability and Survival Analysis**	
	A	Introduction to time-to-event data and different types of censoring (right, left, interval)	CO1
	B	Estimating the Survival Function using Kaplan-Meier Estimator.	CO1
	Unit 2	**Failure Time Distributions and Hazard Functions**	
	A	Estimating the Hazard Function using Nelson-Aalen Estimator	CO2
	B	Modeling Failure Time with Parametric Distributions (Fit and compare Exponential, Weibull, Log-Normal distributions)	CO2
	Unit 3	**Parametric and Non-Parametric Survival Models**	
	A	Build a Cox regression model for survival prediction	CO3
	B	Accelerated Failure Time (AFT) Model for Survival Prediction(Fit an AFT model and compare it with Cox-PH)	CO3
	Unit 4	**Application on Machine Learning for Reliability and Survival**	
	A	Model system reliability using series and parallel system.	CO4
	B	Machine Learning for Failure Prediction (Predict survival outcomes using Random Forest & Gradient Boosting)	CO4
	Unit 5	**Application on real world phenomenon**	
	A	Implement Deep Neural Networks for survival prediction.	CO5
	B	Survival analysis on real-world data.	CO6
	Mode of examination	Theory	

	Weightage Distribution	CA	CE	ESE	
		30%	30%	40%	
	Text book/s*	1. Moore, D. F. (2016). *Applied survival analysis using R* (Vol. 473, pp. 1-10). Cham: Springer. 2. Pohar, M., & Stare, J. (2006). Relative survival analysis in R. *Computer methods and programs in biomedicine*, *81*(3), 272-278.			
	Other References	1. Davidson-Pilon, C. (2019). lifelines: survival analysis in Python. *Journal of Open Source Software*, *4*(40), 1317. 2. Klein, J. P., Van Houwelingen, H. C., Ibrahim, J. G., & Scheike, T. H. (Eds.). (2014). *Handbook of survival analysis*. Boca Raton, FL:: CRC Press. 3. Lord, L., Sell, J., Bagirov, F., & Newman, M. (2018, August). Survival analysis within stack overflow: Python and r. In *2018 4th international conference on big data innovations and applications (innovate-data)* (pp. 51-59). IEEE Computer Society.			

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP5454.1	3	3	3	3	1	3	3	3	3
STP5454.2	3	3	3	3	1	3	3	3	3
STP5454.3	3	3	3	3	1	3	3	3	3
STP5454.4	3	3	3	3	1	3	3	3	3
STP5454.5	3	3	3	3	2	3	2	3	3
STP5454.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2025-27**			
Program: M.Sc.		**Academic Year: 2026-27**			
Branch: Data Science & Analytics		**Semester: III**			
1	Course Code	DAP5358			
2	Course Title	**Exploratory Data Analysis with Tableau & Power BI**			
3	Credits	2			
4	Contact Hours (L-T-P)	0-0-4			
	Course Status	SEC			
5	Course Objective	To enable students to acquire hands-on skills in data visualization and exploratory data analysis using industry-standard BI tools such as Tableau and Power BI. The course emphasizes understanding data patterns, interactive dashboards, and storytelling with visual data.			
6	Course Outcomes	After completion of this course, students will be able to: CO1: Understand the purpose and process of exploratory data analysis using visualization tools. (K2, K3) CO2: Import, clean, and organize datasets for visual analysis. (K3, K4) CO3: Create meaningful charts, graphs, and dashboards to summarize key insights. (K4, K5) CO4: Perform comparative and trend analysis through interactive visualizations. (K4, K5) CO5: Integrate multiple data sources and derive insights using filters and calculations. (K4, K5) CO6: Present data-driven stories using dashboards and publish reports for stakeholders. (K5, K6)			
7	Course Description	This lab-based course introduces students to exploratory data analysis using Tableau and Power BI. Students learn to clean and visualize data, identify key patterns, and build interactive dashboards. The focus is on acquiring practical skills that aid in decision-making and effective data storytelling without emphasizing programming.			
8					
	Unit 1	**Introduction to BI Tools**			
		Overview of Tableau and Power BI environments, navigation, and interface, Understanding data connections, file formats, and live vs. extract data			CO1
	Unit 2	**Data Preparation**			
		Loading and shaping data using GUI features, Handling null values, data types, and categorical encoding			CO2
	Unit 3	**Visual Design**			
		Creating bar charts, line charts, maps, and tables, Using filters, highlights, tooltips, and slicers			CO3
	Unit 4	**Advanced Dashboarding**			
		Building interactive dashboards with drill-down features, Applying calculated fields, parameters, and relationships			CO4, CO5
	Unit 5	**Storytelling and Publishing**			
		Designing data stories, layout best practices, Publishing reports and dashboards for sharing			CO6
	Mode of examination	**Practical**			
	Weightage Distribution	CA	CE	ESE	
		30 %	30%	40 %	

	Text book/s*	• Cole Nussbaumer Knaflic, *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015. • Daniel G. Murray, *Tableau Your Data!*, Wiley, 2016.	
	Other References	• Alberto Ferrari & Marco Russo, Introducing Microsoft Power BI, Microsoft Press, 2016. • Pavan Lalwani, Tableau & Power BI Videos & Guides (YouTube, Blogs). • Microsoft & Tableau Official Documentation (Online Help Centers)	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAP5358.1	3	2	2	2	0	2	2	2	1
DAP5358.2	3	3	3	3	0	3	2	2	2
DAP5358.3	3	3	3	3	0	3	3	2	2
DAP5358.4	3	3	3	3	0	3	3	2	2
DAP5358.5	3	3	3	3	0	3	3	3	2
DAP5358.6	3	3	3	3	0	3	3	3	3

School: SSES		**Batch: 2025-27**			
Programme: M.Sc.		**Academic Year: 2026-27**			
Branch: Data Science & Analytics		**Semester: III**			
1	Course Code	STR5356			
2	Course Title	Dissertation-I			
3	Credits	2			
4	Contact Hours (L-T-P)	0-0-4			
	Course Status	Compulsory/Elective			
5	Course Objective	To introduce students to basic research methodology, enable application of fundamental statistical tools, and develop skills in data collection, analysis, report writing, and presentation under faculty guidance.			
6	Course Outcomes	CO1: Identify and formulate a simple, relevant research problem in the field of Statistics. CO2: Conduct a brief literature review and frame clear research objectives. CO3: Apply appropriate basic statistical techniques to analyze real or simulated data. CO4: Prepare a structured dissertation report with interpretation of results. CO5: Present and defend their project work effectively through oral presentation and viva voce.			
7	Course Description	This course introduces basic research skills, including topic selection, literature review, data collection, and analysis using standard statistical tools. Students will prepare a short dissertation and present their findings through a written report and viva voce.			
8	Outline syllabus				CO Achievement
	Unit 1	**Introduction to Research Problem**			
		Topic selection with supervisor guidance Problem statement and objective formulation			**CO1**
	Unit 2	**Abstract & Key-words**			
		Abstract writing and Specific Key words choosing			**CO2**
	Unit 3	**Introduction/ Literature review**			
		Overview of related past studies Identifying research gaps			**CO3**
	Unit 4	**Identifying Objectives**			
		Choose two or three objectives based on research			**CO4**
	Unit 5	**Data Collection**			
		Collection of Data, Make questionnaire Make an initial draft upto data collection and future possible work.			CO5
	Mode of examination	Jury/Practical/Viva			
	Mode of examination	Jury/Practical/Viva			
	Weightage Distribution	CA	CE	ETE	
		30%	30%	40%	
	Text book/s*	Panneerselvam, R. (2014). *Research methodology*. PHI Learning Pvt. Ltd. Kothari, C. R., & Garg, G. (2019). Research Methodology: Methods and Techniques (4th Ed.). New Age International Publishers.			
	Other References	Gupta, S. C., & Kapoor, V. K. (2020). Fundamentals of Applied Statistics. Sultan Chand & Sons– Useful for basic statistical techniques applied in small-scale research projects.			

COURSE OUTCOMES – PROGRAMMEME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STR5356.1	3	3	2	2	2	3	2	3	3
STR5356.2	2	3	3	2	3	2	3	3	2
STR5356.3	2	3	2	2	3	3	3	3	3
STR5356.4	2	3	2	2	2	3	2	3	2
STR5356.5	2	2	2	3	3	3	3	3	3
STR5356.6	2	2	2	3	3	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: III**
1	Course Code	DAR5360
2	Course Title	Dissertation-I
3	Credits	16
4	Contact Hours(L-T-P)	0-0-32
	Course Status	Project
5	Course Objective	To guide students in transitioning from project proposal to implementation by refining research questions, performing in-depth literature review, finalizing datasets, and beginning exploratory and model-based analysis.

6	Course Outcomes	CO1: Refine project objectives and scope based on feedback and further review. (K3, K4) CO2: Perform a comprehensive literature survey and contextual analysis. (K4) CO3: Finalize datasets and preprocess data for deeper analysis. (K3, K4) CO4: Apply exploratory and statistical methods to extract actionable insights. (K4, K5) CO5: Develop models or solution strategies based on problem type. (K5) CO6: Compile an interim report and defend progress through presentation. (K5, K6)	
7	Course Description	In this phase, students continue their project work with a deeper focus on analysis and early modeling. This includes reviewing advanced literature, refining methodology, validating datasets, and setting the groundwork for the final dissertation.	
8			
	Unit 1	**Research Refinement**	
		Review of earlier proposal and feedback integration, Refining research problem and objectives, Alignment with real-world applications	CO1
	Unit 2	**Advanced Literature Review**	
		Reviewing related methodologies, Critical appraisal of existing solutions, Identifying advanced techniques for implementation	CO2
	Unit 3	**Data Finalization and Preprocessing**	
		Validating dataset relevance, Data wrangling and transformation, Feature engineering	CO3
	Unit 4	**Exploratory and Model-based Analysis**	
		EDA techniques and visualization, Identifying candidate models or techniques, Performance metrics and baseline analysis	CO4, CO5
	Unit 5	**Progress Presentation**	
		Drafting interim report, Designing presentation slides, Review and feedback from committee	CO6
	Mode of examination	**Practical**	
	Weightage Distribution	CA: 30 % / CE: 30% / ESE: 40 %	
	Text book/s*	• Practical Research: Planning and Design – Paul D. Leedy and Jeanne Ellis Ormrod • Python for Data Analysis – Wes McKinney	
	Other References	• The Craft of Research – Booth et al. • Data Science from Scratch – Joel Grus • Research articles and project reports	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAR5360 .1	3	2	2	2	0	2	2	2	1
DAR5360 .2	3	3	3	3	0	3	2	2	2
DAR5360 .3	3	3	3	3	0	3	3	2	2

DAR5360 .4	3	3	3	3	0	3	3	2	2
DAR5360 .5	3	3	3	3	0	3	3	3	2
DAR5360 .6	3	3	3	3	0	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Statistics		**Semester: IV**
1	Course Code	**STT5403**
2	Course Title	**Reliability and Survival Analysis**
3	Credits	5
4	Contact Hours (L-T-P)	5-0-0
	Course Status	Core Course
5	Course Objective	The objective of this course is to evaluate and compare different survival models for reliability engineering applications in different real fields.
6	Course Outcomes	CO1: Explain fundamental concepts of reliability, failure rates, and survival analysis. (K2, K3) CO2: Apply probability distributions and hazard functions to model failure times. (K3, K4) CO3: Implement parametric and non-parametric survival models. (K4, K5)

		CO4: Utilize machine learning methods for reliability predictions. (K4, K5, K6) CO5: Analyze censoring, competing risks, and repairable system reliability. (K4, K5) CO6: Interpret real-world applications in healthcare, engineering, and predictive maintenance. (K5, K6)			
7	Course Description	This course covers the statistical foundations and modern data-driven methods for reliability engineering and survival analysis. Topics include time-to-failure modeling, hazard functions, censoring techniques, life distributions, parametric and non-parametric survival models, and predictive analytics for system reliability and failure prediction.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Reliability and Survival Analysis**			
	A	Concepts of reliability, failure rate, survival function, and hazard function.			CO1
	B	Time-to-event data and types of censoring (right, left, interval).			CO1
	C	Reliability block diagrams and system reliability analysis.			CO1
	Unit 2	**Failure Time Distributions and Hazard Functions**			
	A	Common probability distributions: Exponential, Weibull, Gamma, Log-Normal, and their applications in reliability.			CO2
	B	Hazard function: increasing, decreasing, and bathtub-shaped failure rates			CO2
	C	Estimation of survival and hazard functions from data			CO2
	Unit 3	**Parametric and Non-Parametric Survival Models**			
	A	Kaplan-Meier estimator and Nelson-Aalen estimator			CO3
	B	Cox Proportional Hazards Model: Assumptions, estimation, and interpretation			CO3
	C	Accelerated Failure Time (AFT) Models and their applications			CO3
	Unit 4	**Machine Learning for Reliability and Survival Analysis**			
	A	Supervised learning for failure prediction (Random Forests, Neural Networks)			CO4
	B	Deep Survival Analysis using Neural Networks			CO4
	C	Applications in predictive maintenance and warranty analysis			CO4
	Unit 5	**Advanced Topics in Reliability Engineering**			
	A	Competing risks, multiple failure modes, and dependent censoring			CO5
	B	Repairable systems and reliability growth models			CO6
	C	Case studies: Reliability analysis in healthcare, engineering, and manufacturing			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	3. Meeker, W. Q., Escobar, L. A., & Pascual, F. G. (2021). Statistical Methods for Reliability Data (2nd Ed.). Wiley. 4. Klein, J. P., & Moeschberger, M. L. (2013). Survival Analysis: Techniques for Censored and Truncated Data (2nd Ed.). Springer.			
	Other References	1. Nelson, W. (2004). Applied Life Data Analysis. Wiley. 2. Lawless, J. F. (2011). Statistical Models and Methods for Lifetime Data (2nd Ed.). Wiley. 3. Gordon, A. D. (2020). Data Science for Business and Decision Making. Academic Press. 4. Genschel, U., & Meeker, W. Q. (2020). Reliability Data Analysis with R. Chapman & Hall/CRC Press.			

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STT5403.1	3	3	3	3	1	3	3	3	3
STT5403.2	3	3	3	3	1	3	3	3	3
STT5403.3	3	3	3	3	1	3	3	3	3
STT5403.4	3	3	3	3	1	3	3	3	3
STT5403.5	3	3	3	3	2	3	2	3	3
STT5403.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	**STP5454**
2	Course Title	**Reliability and Survival Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core Course
5	Course Objective	This course aims to develop expertise in Reliability and Survival Analysis, focusing on failure modeling, survival estimation, parametric and non-parametric methods, system reliability, and real-world applications in healthcare, engineering, and manufacturing.
6	Course Outcomes	CO1: Explain the fundamental concepts of reliability, failure rates, survival functions, and hazard functions. (K2, K3) CO2: Identify and analyze different types of censoring (right, left, interval) in time-

		to-event data. (K3, K4) CO3: Apply non-parametric estimation techniques such as Kaplan-Meier and Nelson-Aalen estimators for survival analysis. (K4, K5) CO4: Fit and evaluate parametric survival models (Exponential, Weibull, Log-Normal) for failure time analysis. (K4, K5, K6) CO5: Implement Cox Proportional Hazards (Cox-PH) and Accelerated Failure Time (AFT) models to assess survival relationships. (K4, K5) CO6: Develop Reliability Block Diagrams (RBD) and evaluate system reliability using analytical and simulation techniques. (K5, K6)			
7	Course Description	This course covers Reliability and Survival Analysis, focusing on failure rates, survival functions, and hazard functions. Students learn time-to-event analysis, censoring types, Kaplan-Meier, parametric models (Weibull, Exponential), Cox-PH. Applications include healthcare, engineering, and manufacturing for system reliability and predictive analysis.			
8	Outline syllabus				CO Mapping
	Unit 1	**Introduction to Reliability and Survival Analysis**			
	A	Introduction to time-to-event data and different types of censoring (right, left, interval)			CO1
	B	Estimating the Survival Function using Kaplan-Meier Estimator.			CO1
	Unit 2	**Failure Time Distributions and Hazard Functions**			
	A	Estimating the Hazard Function using Nelson-Aalen Estimator			CO2
	B	Modeling Failure Time with Parametric Distributions (Fit and compare Exponential, Weibull, Log-Normal distributions)			CO2
	Unit 3	**Parametric and Non-Parametric Survival Models**			
	A	Build a Cox regression model for survival prediction			CO3
	B	Accelerated Failure Time (AFT) Model for Survival Prediction(Fit an AFT model and compare it with Cox-PH)			CO3
	Unit 4	**Application on Machine Learning for Reliability and Survival**			
	A	Model system reliability using series and parallel system.			CO4
	B	Machine Learning for Failure Prediction (Predict survival outcomes using Random Forest & Gradient Boosting)			CO4
	Unit 5	**Application on real world phenomenon**			
	A	Implement Deep Neural Networks for survival prediction.			CO5
	B	Survival analysis on real-world data.			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	CE	ESE	
		30%	30%	40%	
	Text book/s*	5. Moore, D. F. (2016). *Applied survival analysis using R* (Vol. 473, pp. 1-10). Cham: Springer. 6. Pohar, M., & Stare, J. (2006). Relative survival analysis in R. *Computer methods and programs in biomedicine*, *81*(3), 272-278.			
	Other References	1. Davidson-Pilon, C. (2019). lifelines: survival analysis in Python. *Journal of Open Source Software*, *4*(40), 1317. 2. Klein, J. P., Van Houwelingen, H. C., Ibrahim, J. G., & Scheike, T. H. (Eds.). (2014). *Handbook of survival analysis*. Boca Raton, FL:: CRC Press. 3. Lord, L., Sell, J., Bagirov, F., & Newman, M. (2018, August). Survival analysis within stack overflow: Python and r. In *2018 4th international conference on big data innovations and applications (innovate-data)* (pp. 51-59). IEEE Computer			

		Society.	

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP5454.1	3	3	3	3	1	3	3	3	3
STP5454.2	3	3	3	3	1	3	3	3	3
STP5454.3	3	3	3	3	1	3	3	3	3
STP5454.4	3	3	3	3	1	3	3	3	3
STP5454.5	3	3	3	3	2	3	2	3	3
STP5454.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2024-26**
Program: M.Sc.		**Academic Year: 2025-26**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	**DAR5457**
2	Course Title	**Capstone Project II**
3	Credits	14
4	Contact Hours (L-T-P)	0-0-28
	Course Status	Compulsory
5	Course Objective	The objective of the course is to focuses on deploying the model, integrating additional optimizations, and assessing real-world impact.
6	Course Outcomes	CO1: Finalize the project based on refined methodology. (K4, K5) CO2: Ensure the solution is applicable in real-world scenarios. (K5) CO3: Conduct impact assessment on industry, academia, and society. (K5) CO4: Address ethical and sustainability concerns. (K5)

		CO5: Prepare a comprehensive technical report. (K6) CO6: Present the final project and demonstrate its effectiveness. (K6)			
7	Course Description	This course focuses on completing the project, optimizing its real-world application, and assessing its impact. Students finalize their implementation, analyze broader implications, and present their work in a professional format.			
8	Outline syllabus				CO Mapping
	Unit 1	**Final Implementation**			
	A	Completing the methodology			CO1
	B	Addressing limitations and refining the final solution			CO1
	C	Ensuring robustness and efficiency			CO1
	Unit 2	**Application and Usability**			
	A	Testing the final implementation in different scenarios			CO2
	B	Evaluating adaptability and scalability			CO2
	C	Optimizing performance			CO2
	Unit 3	**Impact Assessment**			
	A	Analyzing the project's relevance to industry and academia			CO3
	B	Examining ethical and sustainability aspects			CO3
	C	Identifying future scope and potential improvements			CO3
	Unit 4	**Report Preparation**			
	A	Structuring the final report			CO4
	B	Ensuring clarity and completeness			CO4
	C	Citing relevant literature and methodologies			CO4
	Unit 5	**Final Presentation & Review**			
	A	Preparing for project defense			CO5
	B	Showcasing results and impact			CO6
	C	Incorporating final feedback and submitting the project			CO6
	Mode of examination				
	Weightage Distribution	CA	CE	ESE	
		30 %	30%	40 %	
	Text book/s*	• Research Methods in Applied Settings: An Integrated Approach to Design and Analysis– Jeffrey A. Gliner, George A. Morgan, Nancy L. Leech • Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking – Foster Provost, Tom Fawcett. • The Craft of Research – Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams			
	Other References	• Interpretable Machine Learning– Christoph Molnar • Practical Statistics for Data Scientists– Peter Bruce, Andrew Bruce, Peter Gedeck • Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data– EMC Education Services			

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAR5457.1	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**
DAR5457.2	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**

DAR5457.3	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**
DAR5457.4	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**
DAR5457.5	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**
DAR5457.6	**3**	**3**	**3**	**3**	**1**	**2**	**2**	**3**	**3**

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Statistics		**Semester: IV**
1	Course Code	**STT5401**
2	Course Title	**Statistical Quality Control**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	Core Course
5	Course Objective	To develop skills in demographic analysis, life table construction, quality control charts, sampling inspection plans, OC curves, and process capability assessment..
6	Course Outcomes	CO1: Understand and Apply Life Table Methods in Demography (K2, K3) CO2: Analyze Population Growth and Projection Models. (K3, K4) CO3: Implement and Evaluate Statistical Quality Control (SQC) Techniques. (K4, K5) CO4: Develop and Interpret OC Curves and Sampling Inspection Plans. (K4, K5,

		K6) CO5: Design and Optimize Sampling Inspection Plans. (K4, K5) CO6: Implement Cumulative Sum (Cu-Sum) Charts and Process Capability Analysis (K5, K6)			
7	Course Description	This course covers demography and statistical quality control, including life tables, population models, control charts, sampling inspection plans, OC curves, Cu-Sum charts, and process capability analysis for industrial applications.			
8	Outline syllabus				CO Mapping
	Unit 1	**Demography**			
	A	Measures of mortality, description of life table, construction of complete and abridged life tables			CO1
	B	maximum likelihood, MVU and CAN estimators of life table parameters.			CO1
	C	Measures of fertility, models for population growth, intrinsic growth rate, stable population analysis, population projection by component method and using Leslie matrix.			CO1
	Unit 2	**Quality Control**			
	A	Meaning and scope of SQC, Stewarts control chart, Statistical basis of a control chart, control chart for variables (X, R, & S) charts.			CO2
	B	Control charts for attributes (np, p & C) charts. Moving average charts.			CO2
	C	Operating Characteristic function (OC) and Average Run length (ARL) of Xbar chart.			CO2
	Unit 3	**OC curve**			
	A	Consumer and producer's risk, Operating Characteristic curve/function (OC). Corrective Sampling Plan (CSP)			CO3
	B	Average Sample Number (ASN), Average out-going Quality (AOQ),			CO3
	C	Graphical method of drawing AOQ, Average out-going Quality Limit (AOQL)			CO3
	Unit 4	**Sampling Inspection plan**			
	A	Single Sampling Plan, Methods of finding n and c, Double Sampling Inspection Plan and sequential sampling plan.			CO4
	B	methods for estimating (n, c) using large sample and Bayesian techniques, curtailed and semi-curtailed sampling plans			CO4
	C	Dodge's continuous sampling inspection plans for inspection by variables for one-sided and two-sided specifications.			CO4
	Unit 5	**Cu-sum chart**			
	A	Cu-sum charts using V-masks and decision			CO5
	B	Capability indices: Cp, Cpk and Cpm.			CO6
	C	Confidence intervals relating to capability indices for normally distributed characteristics			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Montgomery, D.C. (1985) Introduction to Statistical Quality Control; WileyKlein, J. P., & Moeschberger, M. L. (2013). Survival Analysis: Techniques for Censored and Truncated Data (2nd Ed.). Springer.			
	Other References	2. Biswas, S.(1996). Statistical Quality Control, Sampling Inspection and Reliability; New Age International			

		3. Bain, L. J and Engelhardt, M. (1991). Statistical Analysis of Reliability and Life Testing Models, Marcel Dekker. 4. Spiegelman, M. (1969). Introduction to Demographic Analysis, Harvard University Press.	

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / **CO**	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STT5401.1	3	3	3	3	1	3	3	3	3
STT5401.2	3	3	3	3	1	3	3	3	3
STT5401.3	3	3	3	3	1	3	3	3	3
STT5401.4	3	3	3	3	1	3	3	3	3
STT5401.5	3	3	3	3	2	3	2	3	3
STT5401.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: III**
1	Course Code	**DAT5404**
2	Course Title	**Deep Learning and Neural Network**
3	Credits	4
4	Contact Hours (L-T-P)	4-0-0
	Course Status	DSE
5	Course Objective	To provide foundational understanding of deep learning and neural network architectures, enabling students to conceptualize, analyze, and apply them to solve real-world problems in a general data-driven context.

6	Course Outcomes	After completion of this course, students will be able to: CO1: Describe the structure and functioning of artificial neural networks and key components. (K2, K3) CO2: Identify the learning mechanisms used in training multi-layer neural networks. (K3, K4) CO3: Explain the architecture and characteristics of deep neural networks. (K3, K4) CO4: Analyze various types of advanced neural network architectures and their general applicability. (K4, K5) CO5: Evaluate the challenges and potential of deep learning applications. (K5) CO6: Integrate and apply learned concepts to formulate a project proposal using neural network methodologies. (K5, K6)			
7	Course Description	This course introduces the fundamentals of deep learning and neural networks. It aims to provide an understanding of neural architectures, training mechanisms, and application areas. Students will explore the theoretical concepts and learn how to design and evaluate models for real-world problems. The course emphasizes conceptual understanding without diving deeply into specific programming implementations.			
8					CO Mapping
	Unit 1	**Fundamentals of Neural Networks**			
	A	Biological and artificial neuron models, network architecture, activation concepts			CO1
	B	Understanding the general learning process in neural networks			CO1
	C	Role of parameters and layered structures			CO1
	Unit 2	**Learning Mechanisms**			
	A	Basic concepts of supervised and unsupervised learning			CO2
	B	General framework for loss estimation and optimization			CO2
	C	Impact of learning rate and general constraints			CO2
	Unit 3	**Deep Learning Architectures**			
	A	General structure of deep feedforward and convolutional models			CO3
	B	Concepts of abstraction in deeper layers			CO3
	C	Common challenges in deep models (e.g., vanishing gradients)			CO3, CO6
	Unit 4	**Advanced Architectures**			
	A	High-level overview of various architectures (e.g., recurrent, hybrid models)			CO4
	B	Applications in temporal, sequential, or multi-modal data			CO4
	C	Concepts of generative learning and representational learning			CO4, CO6
	Unit 5	**Evaluation & Project Ideation**			
	A	Conceptual performance metrics and model validation			CO5
	B	Application domains of deep learning (general overview)			CO5
	C	Group ideation for project formulation			CO5, CO6
	Mode of examination	**Theory**			
	Weightage Distribution	CA	MTE	ETE	
		25 %	25 %	50 %	
	Text book/s*	• Ian Goodfellow, Yoshua Bengio, and Aaron Courville,			

		Deep Learning, MIT Press, 2016. • Charu Aggarwal, *Neural Networks and Deep Learning: A Textbook*, Springer, 2018.	
	Other References	• Michael Nielsen, *Neural Networks and Deep Learning*, Determination Press, 2015. • Simon Haykin, *Neural Networks and Learning Machines*, Pearson, 3rd Edition, 2009. • Francois Chollet, *Deep Learning with Python*, Manning Publications, 2nd Edition, 2021.	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAT5404.1	**3**	**2**	**3**	**2**	**0**	**2**	**2**	**1**	**1**
DAT5404.2	**3**	**3**	**3**	**3**	**0**	**2**	**2**	**2**	**2**
DAT5404.3	**3**	**3**	**2**	**3**	**0**	**2**	**2**	**1**	**2**
DAT5404.4	**3**	**3**	**3**	**3**	**0**	**3**	**2**	**2**	**2**
DAT5404.5	**3**	**3**	**3**	**3**	**0**	**3**	**3**	**2**	**2**
DAT5404.6	**3**	**3**	**3**	**3**	**0**	**3**	**3**	**3**	**3**

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	**STP5455**
2	Course Title	**Quality Control Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Core Course
5	Course Objective	To develop skills in demographic analysis, life table construction, quality control charts, sampling inspection plans, OC curves, and process capability assessment..
6	Course	CO1: Understand and Apply Life Table Methods in Demography (K2, K3)

	Outcomes	CO2: Analyze Population Growth and Projection Models. (K3, K4) CO3: Implement and Evaluate Statistical Quality Control (SQC) Techniques. (K4, K5) CO4: Develop and Interpret OC Curves and Sampling Inspection Plans. (K4, K5, K6) CO5: Design and Optimize Sampling Inspection Plans. (K4, K5) CO6: Implement Cumulative Sum (Cu-Sum) Charts and Process Capability Analysis (K5, K6)			
7	Course Description	This course covers demography and statistical quality control, including life tables, population models, control charts, sampling inspection plans, OC curves, Cu-Sum charts, and process capability analysis for industrial applications.			
8	Outline syllabus				CO Mapping
	Unit 1	**Life Table Construction & Mortality Analysis**			
	A	Import mortality data using R or Python.			CO1
	B	Compute Age-Specific Death Rates (ASDR) and Cumulative Death Rates**.**			CO1
		Construct a life table (lx, qx, ex calculations).			CO1
	Unit 2	**Control Charts**			
	A	Develop $\bar{X}$, R, S, np, p, c, Moving Average control charts.			CO2
	B	Control charts for attributes (np, p & C) charts. Moving average charts.			CO2
		implement np, p, c charts for attribute data.			CO2
		Detect out-of-control processes in simulated datasets.			
	Unit 3	**OC curve**			
	A	Develop OC curves, compute ASN, AOQ, AOQL for given sampling plans.			CO3
	B	Graphical method of drawing AOQ, Average out-going Quality Limit (AOQL)			CO3
					CO3
	Unit 4	**Sampling Inspection Plans & Bayesian Estimation**			
	A	Single Sampling Plan, Methods of finding n and c, Double Sampling Inspection Plan and sequential sampling plan.			CO4
	B				CO4
		Implement Single & Double Sampling Plans using (n, c) estimation.			CO4
		methods for estimating (n, c) using large sample and Bayesian			
	Unit 5	**Cu-sum chart**			
	A	Implement Cu-Sum control charts using V-Masks.			CO5
	B	Capability indices: Cp, Cpk and Cam.			CO6
		Confidence intervals relating to capability indices for normally distributed characteristics			CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	CE	ESE	
		30%	30%	40%	
	Text book/s*	1. Montgomery, D.C. (1985) Introduction to Statistical Quality Control; WileyKlein, J. P., & Moeschberger, M. L. (2013). Survival Analysis: Techniques for Censored and Truncated Data (2nd Ed.). Springer.			
	Other References	2. Biswas, S.(1996). Statistical Quality Control, Sampling Inspection and Reliability; New Age International 3. Bain, L. J and Engelhardt, M. (1991). Statistical Analysis of			

		Reliability and Life Testing Models, Marcel Dekker. 4. Spiegelman, M. (1969). Introduction to Demographic Analysis, Harvard University Press.	

COURSE OUTCOMES– PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STP5455.1	3	3	3	3	1	3	3	3	3
STP5455.2	3	3	3	3	1	3	3	3	3
STP5455.3	3	3	3	3	1	3	3	3	3
STP5455.4	3	3	3	3	1	3	3	3	3
STP5455.5	3	3	3	3	2	3	2	3	3
STP5455.6	3	3	3	3	2	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	DAP5459
2	Course Title	**Deep Learning Lab**
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	DSE
5	Course Objective	To provide practical exposure to deep learning concepts through implementation of basic neural network architectures. This lab emphasizes

<table>
<tr><td></td><td></td><td colspan="4">experiential learning through hands-on experiments, helping students to design, train, and evaluate neural models on sample datasets.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="4">After completion of this course, students will be able to:
CO1: Understand the steps to construct and compile neural network models. (K2, K3)
CO2: Implement basic neural networks using software tools and sample datasets. (K3, K4)
CO3: Visualize training performance and interpret learning curves. (K4)
CO4: Apply deep learning architectures on sample classification or regression problems. (K4, K5)
CO5: Evaluate model results with basic performance metrics. (K5)
CO6: Document experiments with clear observations and learning. (K5, K6)</td></tr>
<tr><td>7</td><td>Course Description</td><td colspan="4">This lab course is designed to reinforce theoretical understanding by providing opportunities for hands-on implementation. Students will learn to develop simple deep learning models, visualize outcomes, and interpret results. Emphasis is placed on general understanding, logical workflow, and proper documentation of experiments without tool-specific focus.</td></tr>
<tr><td>8</td><td colspan="4"></td><td>CO Mapping</td></tr>
<tr><td></td><td>Unit 1</td><td colspan="3">Getting Started</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Setting up deep learning environment, introduction to computational workflows, Building and compiling a basic model structure</td><td>CO1</td></tr>
<tr><td></td><td>Unit 2</td><td colspan="3">Model Design</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Designing a neural network for simple classification tasks, Adjusting architecture parameters for training</td><td>CO2</td></tr>
<tr><td></td><td>Unit 3</td><td colspan="3">Training and Monitoring</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Model training with iterative logging and visualization, Observing loss, accuracy and overfitting behavior</td><td>CO3</td></tr>
<tr><td></td><td>Unit 4</td><td colspan="3">Performance Analysis</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Evaluating model results with standard metrics, Comparing multiple trained models on similar tasks</td><td>CO4</td></tr>
<tr><td></td><td>Unit 5</td><td colspan="3">Reporting and Review</td><td></td></tr>
<tr><td></td><td></td><td colspan="3">Project-style implementation with report writing, Oral presentation and explanation of lab experiments</td><td>CO5</td></tr>
<tr><td></td><td>Mode of examination</td><td colspan="3">Practical</td><td></td></tr>
<tr><td></td><td>Weightage Distribution</td><td>CA</td><td>CE</td><td>ESE</td><td></td></tr>
<tr><td></td><td></td><td>30 %</td><td>30%</td><td>40 %</td><td></td></tr>
<tr><td></td><td>Text book/s*</td><td colspan="3">• Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press, 2016.

• Charu Aggarwal, Neural Networks and Deep Learning: A Textbook, Springer, 2018.</td><td></td></tr>
<tr><td></td><td>Other References</td><td colspan="3">• Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
• Simon Haykin, Neural Networks and Learning Machines, Pearson, 3rd Edition, 2009.
• Francois Chollet, Deep Learning with Python, Manning Publications, 2nd Edition, 2021.</td><td></td></tr>
</table>

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAP5459.1	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**1**	**1**
DAP5459.2	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**2**
DAP5459.3	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**2**
DAP5459.4	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**2**	**2**
DAP5459.5	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**2**
DAP5459.6	**3**	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**3**

School: SSES		**Batch: 2025-27**
Programme: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	STR5457
2	Course Title	Dissertation-II
3	Credits	3
4	Contact Hours (L-T-P)	0-0-6
	Course Status	Compulsory/Elective
5	Course Objective	To engage students in advanced independent research, involving in-depth literature review, data-driven analysis using complex statistical methods, and comprehensive scientific reporting with presentation and defense of findings before an academic committee.
6	Course Outcomes	CO1: Define a complex research problem and articulate specific objectives and

		hypotheses. CO2: Critically evaluate literature to identify gaps and justify research design. CO3: Apply advanced statistical techniques/models using software tools for data analysis. CO4: Develop a comprehensive dissertation report with scientific rigor and proper referencing. CO5: Communicate and defend research findings through academic presentation and viva voce.	
7	Course Description	This course emphasizes advanced research skills involving critical literature review, statistical modeling, and real or simulated data analysis. Students will produce a detailed dissertation report and defend their findings through presentation and viva before an expert committee.	
8	Outline syllabus		CO Achievement
	Unit 1	**Research Problem**	
		Writing a clear problem statement and research objectives Preparing the Abstract and identifying Key Words	**CO1**
	Unit 2	**Literature Review**	
		Study of related and recent research articles Identifying research gaps Establishing context and rationale of study Re-defining objectives based on review insights	**CO2**
	Unit 3	**Research Objectives and Methodology**	
		Choosing appropriate statistical methods Study design and analytical plan formulation	**CO3**
	Unit 4	**Data Collection and Drafting**	
		Initial draft preparation covering introduction, review, objectives, methodology, and data tools Identification of future scope/work	**CO4**
	Unit 5	**Report Writing and Presentation**	
		Writing the final dissertation/report (30–40 for 3 credits) Incorporating statistical results, charts, and interpretation Final presentation and viva voce before an evaluation committee	**CO5**
	Mode of examination	Jury/Practical/Viva	
	Mode of examination	Jury/Practical/Viva	
	Weightage Distribution	CA: 30% / CE: 30% / ESE: 40%	
	Text book/s*	Rajasekar, D., & Verma, R. (2013). *Research methodology*. Archers & Elevators Publishing House. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th Ed.). Pearson Education.	
	Other References	Montgomery, D. C., & Runger, G. C. (2018). *Applied Statistics and Probability for Engineers* (7th Ed.). Wiley.	

COURSE OUTCOMES – PROGRAMMEME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
STR5457.1	3	3	2	2	2	3	2	3	3
STR5457.2	2	3	3	2	3	2	3	3	2
STR5457.3	2	3	2	2	3	3	3	3	3

STR5457.4	2	3	2	2	2	3	2	3	2
STR5457.5	2	2	2	3	3	3	3	3	3
STR5457.6	2	2	2	3	3	3	3	3	3

School: SSES		**Batch: 2025-27**
Program: M.Sc.		**Academic Year: 2026-27**
Branch: Data Science & Analytics		**Semester: IV**
1	Course Code	DAR5461
2	Course Title	**Dissertation-II**
3	Credits	16
4	Contact Hours(L-T-P)	0-0-32
	Course Status	Project
5	Course Objective	To complete the research/dissertation project through implementation of advanced models, evaluation of results, deriving conclusions, and compiling

		a formal dissertation.	
6	Course Outcomes	CO1: Implement and refine the proposed methodology or model. (K4, K5) CO2: Evaluate model performance using appropriate metrics. (K5) CO3: Interpret results in line with research objectives. (K5) CO4: Draw conclusions and discuss limitations and implications. (K5, K6) CO5: Prepare and submit a well-structured dissertation report. (K6) CO6: Defend the work in a viva and public presentation. (K6)	
7	Course Description	This final component of the research-based learning pathway involves hands-on implementation, detailed result analysis, documentation, and oral defense of the dissertation project. Students are expected to demonstrate originality, technical depth, and academic integrity.	
8			
	Unit 1	**Model Implementation**	
		Fine-tuning methodology, Code implementation of algorithms, Debugging and optimization	CO1
	Unit 2	**Performance Evaluation**	
		Testing and validation techniques, Quantitative evaluation and metric analysis, Comparative studies if applicable	CO2
	Unit 3	**Results and Interpretation**	
		Visualization and interpretation, Contextual discussion of findings, Addressing research questions	CO3
	Unit 4	**Conclusion and Limitations**	
		Implications for industry or research, Stating limitations and future scope, Generalizing or contrasting with existing works	CO4, CO5
	Unit 5	**Report Writing and Viva**	
		Report structure and formatting, Plagiarism check and submission, Oral defense of findings	CO6
	Mode of examination	**Practical**	
	Weightage Distribution	CA: 30 % / CE: 30% / ESE: 40 %	
	Text book/s*	• The Data Science Handbook – Carl Shan et al. • Writing Your Thesis – Paul Oliver	
	Other References	• The Craft of Research – Booth et al. • Data Science from Scratch – Joel Grus • Research articles and project reports	

COURSE OUTCOMES – PROGRAMME OUTCOMES MAPPING TABLE

PO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
DAR5461 .1	3	2	2	2	0	2	2	2	1
DAR5461 .2	3	3	3	3	0	3	2	2	2
DAR5461 .3	3	3	3	3	0	3	3	2	2

DAR5461 .4	3	3	3	3	0	3	3	2	2
DAR5461 .5	3	3	3	3	0	3	3	3	2
DAR5461 .6	3	3	3	3	0	3	3	3	3