KANNUR UNIVERSITY

(Abstract)

First and second semester Scheme and Syllabus of B.Sc. Statistics Programme in tune with KU-FYUGP Regulations 2024 with effect from 2024 Admission onwards- Approved- Implemented- Orders Issued

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FYUGP Spl.cell

ACAD/FYSC-III/21093/2024 Dated: 24.10.2024

Read:-1. U.O. No. FYUGPSC/FYSC-I/5074/2024, dated: 18/04/2024

2. E-mail of the Chairperson, Board of Studies in Statistics (UG), dated 30.05.2024
3. The Minutes of the Meeting of the Scrutiny Committee held on 12.06.2024
4. E-mail of the Chairperson, Board of Studies in Statistics(UG), dated 21.06.2024
5. Orders of the Vice Chancellor on 24.06.2024.
6. The Minutes of the Meeting of the Academic Council, held on 25.06.2024

ORDER

1.The Regulations of the Kannur University Four Year UG Programmes (KU-FYUGP Regulations 2024) for affiliated Colleges was implemented with effect from 2024 admission onwards, vide paper read as(1) above.

2.Subsequently, the Chairperson, Board of Studies in Statistics(UG) vide paper read as (2) above, submitted the Syllabus of the B.Sc. Statistics programme for first and second semesters in tune with KUFYUGP Regulations 2024 with effect from 2024 admission onwards.

3.Thereafter, the scrutiny committee, which included the Dean, Faculty of Science vide paper read as (3) above, scrutinized the above syllabus and recommended certain suggestions.

4.Subsequently, vide paper read as (4) above, the Chairperson, Board of Studies in Statistics (UG) forwarded the modified syllabus of the B.Sc. Statistics programme for first and second semesters.

5. Thereafter, the Vice Chancellor ordered to place the same before the Academic Council for consideration, as per the paper read (5) above.

5. Accordingly, the syllabus of the B.Sc. Statistics programme for first and second Semesters in tune with KU-FYUGP Regulations 2024 was approved by the meeting of the Academic Council held on 25-06-2024 and granted permission to publish the same, as and when it is ready, after making the necessary modifications, as per paper read as (6) above.

7.The Vice Chancellor approved the Minutes of the aforesaid meeting of the Academic Council and the Syllabus of the B.Sc. Statistics programme for first and second semesters, prepared in tune with KU-FYUGP Regulations, 2024.

8.The approved Syllabus of the first and second semesters of the B.Sc. Statistics programme is appended with this U.O. and uploaded in the University website.

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: The Principals of Arts and Science Colleges affiliated to Kannur University

Copy To: 1. The Examination Branch (through PA to CE)
2. The Chairperson, Board of Studies in Statistics(UG)
3. PS to VC/PA to R
4. DR/AR (Academic)
5. The IT Cell (For uploading in the website)
6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY

Four Year Under Graduate Programme (KU-FYUGP)

Syllabus

Major Discipline STATISTICS

May 2024

ABOUT THE DISCIPLINE

In the modern era, statistics has transformed into an indispensable discipline that underpins the data-driven world. It encompasses the science of collecting, analysing, interpreting, and presenting data, empowering us to derive meaningful insights from vast amounts of information. This discipline is far from being just a collection of numbers; it is a dynamic and systematic framework that allows us to understand complex phenomena and make informed decisions.

The digital revolution has exponentially increased the volume of data generated daily, making the role of statistics even more crucial. This "age of big data" requires advanced statistical models and computational tools to manage and analyse complex datasets effectively. Fields such as machine learning and artificial intelligence heavily rely on statistical algorithms to extract valuable knowledge from these large data pools, driving innovation, efficiency, and advancements across various industries.

Statistics permeates nearly every aspect of modern life. In business, it guides marketing strategies, product development, and financial forecasting. Governments depend on it to assess economic trends, allocate resources efficiently, and formulate public policies based on demographic and healthcare data. In sports, statistics are used to analyse player performance, optimize training programs, and predict game outcomes.

Modern statistics education equips students with essential skills to navigate this data-rich environment. Courses delve into probability theory, covering concepts such as random events, probability distributions, and statistical inference. These fundamentals help students understand data patterns and make accurate predictions. Students also learn a diverse array of statistical methods, including hypothesis testing, regression analysis, time series analysis, and non-parametric statistics, enabling them to analyse real-world data and test hypotheses effectively.

Critical thinking and problem-solving are core components of statistical education. Students learn to identify relevant data, choose appropriate methods, and interpret results meaningfully. Effective communication of findings is also emphasized, with a focus on data visualization skills. Students are taught to present complex information clearly and compellingly using charts, graphs, and other visual tools, ensuring that data insights are accessible and actionable.

The demand for skilled statisticians is soaring across various sectors. Statistics courses prepare students for rewarding careers in data analysis, research, and decision-making in fields like finance, healthcare, marketing, government, and scientific research. Modern statistical education also includes training in specialized software such as R, Python, and spreadsheet tools, equipping students with the technical expertise to handle and analyse large datasets efficiently.

Statistics transcends disciplinary boundaries, encouraging collaboration with researchers and professionals from diverse fields. This interdisciplinary approach fosters a comprehensive understanding of how data can be effectively utilized in different contexts, making statisticians invaluable in the contemporary job market.

COURSE STRUCTURE FOR FOUR YEAR UNDER GRADUATE PROGRAMME (FYUGP) IN STATISTICS (2024 ADMISSION ONWARDS)

SEMESTER I

No	Title	Credit
1	AEC 1 (English)	3
2	AEC 2 (Additional Language)	3
3	MDC 1	3
4	DSC A1 (Major)	4
5	DSC B1 (Minor 1)	4
6	DSC C1 (Minor 2)	4
	Total Credits	**21**

SEMESTER II

No	Title	Credit
1	AEC 3 (English)	3
2	AEC 4 (Additional Language)	3
3	MDC 2	3
4	DSC A2 (Major)	4
5	DSC B2 (Minor 1)	4
6	DSC C2 (Minor 2)	4
	Total Credits	**21**

SEMESTER III

No	Title	Credit
1	MDC 3	3
2	VAC 1	3
3	DSC A3 (Major)	4
4	DSC A4 (Major)	4
5	DSC B3 (Minor 1)	4
6	DSC C3 (Minor 2)	4
	Total Credits	**22**

SEMESTER IV

No	Title	Credit
1	SEC 1	3
2	VAC 2	3
3	VAC 3	3
4	DSC A5 (Major)	4
5	DSC A6 (Major)	4
6	DSC A7 (Major)	4
	Total Credits	**21**

SEMESTER V

No	Title	Credit
1	SEC 2	3
2	DSC A8 (Major)	4
3	DSC A9 (Major)	4
4	DSC A10 (Major)	4
5	DSE 1 (A11)	4
6	DSE 2 (A12)	4
	Total Credits	**23**

SEMESTER VI

No	Title	Credit
1	SEC 3	3
2	DSC A13 (Major)	4
3	DSC A14 (Major)	4
4	DSC A15 (Major)	4
5	DSE 3 (A16)	4
6	DSE 4 (A17)	4
7	INTERNSHIP	2
	Total Credits	**25**

EXIT WITH UG DEGREE/PROCEED TO FOURTH YEAR WITH 133 CREDITS

17 Major courses 17 x 4 = 68

6 Minor courses 6 x 4 = 24

13 Foundation courses (AEC, SEC, VAC, MDC) 13 x 3 = 39

1 Internship 2 x1 = 2

Total = 133

SEMESTER VII

No	Title	Credit
1	DSC A18 (Major)	4
2	DSC A19 (Major)	4
3	DSC A20 (Major)	4
4	DSC A21 (Major)	4
5	DSC A22 (Major)	4
	Total Credits	**20**

SEMESTER VIII

No	Title	Credit
1	DSC A23 (Major)	4
2	DSC A24 (Major)	4
3	DSC A25 (Major)	4
4	PROJECT	12
	OR	
	DSC A26 (Major)	4
	DSC A27 (Major)	4
	DSC A28 (Major)	4
	Total Credits	**24**

FOUR-YEAR UNDERGRADUATE PROGRAMME IN STATISTICS

DETAILS OF COURSES OFFERED

LIST OF DISCIPLINE-SPECIFIC COURSES (DSC)

SEMESTER	COURSE CODE	COURSE NAME	MARKS				CREDIT	HOURS/WEEK
			CA	ESE	PRACTICAL	TOTAL		
	DISCIPLINE SPECIFIC MAJOR COURSES							
I	KU1DSCSTA101	Basic Statistics	30	70	-	100	4	4
II	KU2DSCSTA102	Descriptive Statistics	30	70	-	100	4	4
III	KU3DSCSTA201	Probability Theory	25	50	25	100	4	5
	KU3DSCSTA202	Basic Linear Algebra	25	50	25	100	4	5
IV	KU4DSCSTA203	Bivariate Random Variables	25	50	25	100	4	5
	KU4DSCSTA204	Standard Probability Distributions	25	50	25	100	4	5
	KU4DSCSTA205	Introduction to R Programming	25	50	25	100	4	5
V	KU5DSCSTA301	Mathematical Analysis	25	50	25	100	4	5
	KU5DSCSTA302	Sampling Techniques	25	50	25	100	4	5
	KU5DSCSTA303	Estimation Theory	25	50	25	100	4	5
	KU5DSCSTA304	Introduction to Stochastic Processes	25	50	25	100	4	5
VI	KU6DSCSTA305	Testing of Hypotheses	25	50	25	100	4	5
	KU6DSCSTA306	Design of Experiments	25	50	25	100	4	5
	KU6DSCSTA307	Regression Analysis	25	50	25	100	4	5
	KU6DSCSTA308	Statistical Quality Control	25	50	25	100	4	5
	KU6INTSTA311	Internship	15	35	-	50	2	2
VII	KU7DSCSTA401	Advanced Analytical Tools in Statistics	25	50	25	100	4	5
	KU7DSCSTA402	Measure and Probability	25	50	25	100	4	5
	KU7DSCSTA403	Advanced Distribution Theory	25	50	25	100	4	5
	KU7DSCSTA404	Advanced Sampling Techniques & Design of Experiments	25	50	25	100	4	5
	KU7DSCSTA405	Time Series Analysis	25	50	25	100	4	5

VIII	KU8DSCSTA406	Advanced Statistical Inference	30	70	-	100	4	4
	KU8DSCSTA407	Multivariate Analysis	30	70	-	100	4	4
	KU8DSCSTA408	Advanced Regression Techniques	30	70	-	100	4	4
	KU8RPHSTA411	Project(Honours with Research Programme)	90	210	-	300	12	12
	DISCIPLINESPECIFICMINORCOURSES							
I	KU1DSCSTA121	Introductory Statistics	30	70	-	100	4	4
	KU1DSCSTA122	Statistical Methods	30	70	-	100	4	4
	KU1DSCSTA123	Introduction to Operations Research	30	70	-	100	4	4
	KU1DSCSTA124	Basic Statistics and Numerical Skills	30	70	-	100	4	4
II	KU2DSCSTA131	Probability and Random Variables	30	70	-	100	4	4
	KU2DSCSTA132	Probability Theory and Bivariate Data Analysis	30	70	-	100	4	4
	KU2DSCSTA133	Time Series and Index Numbers	30	70	-	100	4	4
	KU2DSCSTA134	Quantitative Techniques in Data Analysis – I	30	70	-	100	4	4
III	KU3DSCSTA221	Probability Distributions	25	50	25	100	4	5
	KU3DSCSTA222	Statistical Inference	25	50	25	100	4	5
	KU3DSCSTA223	Inferential Statistics	25	50	25	100	4	5
	KU3DSCSTA224	Quantitative Techniquesin Data Analysis – II	25	50	25	100	4	5

LISTOFDISCIPLINE-SPECIFICELECTIVECOURSES(DSE)

SEMESTER	COURSECODE	COURSENAME	MARKS				CREDIT	HOURS/WEEK
			CA	ESE	PRACTICAL	TOTAL		
V	KU5DSESTA309	Index Numbers and Time Series	25	50	25	100	4	5
	KU5DSESTA310	Statistical Data Analysis Using R	25	50	25	100	4	5
	KU5DSESTA311	Operations Research	25	50	25	100	4	5
	KU5DSESTA312	Actuarial Statistics	25	50	25	100	4	5
	KU5DSESTA313	Research Methodology	25	50	25	100	4	5

VI	KU6DSESTA314	Introduction to Biostatistics	25	50	25	100	4	5
	KU6DSESTA315	Official Statistics	25	50	25	100	4	5
	KU6DSESTA316	Population Statistics	25	50	25	100	4	5
	KU6DSESTA317	Financial Statistics	25	50	25	100	4	5
	KU6DSESTA318	Econometrics	25	50	25	100	4	5
	KU6DSESTA319	Statistical Decision Theory	25	50	25	100	4	5
VIII	KU8DSESTA421	Optimization Techniques	30	70	-	100	4	4
	KU8DSESTA422	Reliability Theory	30	70	-	100	4	4
	KU8DSESTA423	Survival Analysis	30	70	-	100	4	4
	KU8DSESTA424	Advanced Research Methodology	30	70	-	100	4	4
	KU8DSESTA425	Statistical Analysis and Business Intelligence	25	50	25	100	4	5

LIST OF MULTI-DISCIPLINARY COURSES (MDC)

SEMESTER	COURSE CODE	COURSE NAME	MARKS			CREDIT	HOURS/WEEK
			CA	ESE	TOTAL		
I	KU1MDCSTA141	Basics of Statistics	25	50	75	3	3
II	KU2MDCSTA151	Introduction to Data Analysis	25	50	75	3	3
III	KU3MDCSTA241	Introduction to Statistical Inference	25	50	75	3	3

LIST OF SKILL ENHANCEMENT COURSES (SEC)

SEMESTER	COURSE CODE	COURSE NAME	MARKS				CREDIT	HOURS/WEEK
			CA	ESE	PRACTICAL	TOTAL		
IV	KU4SECSTA251	Statistical Computing and Data Visualization by MS Excel	25	50	25	100	3	4
V	KU5SECSTA341	Introduction to Data Analysis using R	25	50	25	100	3	4
VI	KU6SECSTA351	Statistical Techniques in Research Methodology	25	50	25	100	3	4

LIST OF VALUE-ADDED COURSES (VAC)

SEMESTER	COURSE CODE	COURSE NAME	MARKS			CREDIT	HOURS/WEEK
			CA	ESE	TOTAL		
III	KU3VACSTA261	Data Visualization and Interpretation	25	50	75	3	3
IV	KU4VACSTA361	Big Data Analysis	25	50	75	3	3
IV	KU4VACSTA362	Study Design in Research	25	50	75	3	3

INDEX

KANNURUNIVERSITY

FOUR YEAR UNDERGRADUATE PROGRAMME

SYLLABUS FOR SINGLE MAJOR IN STATISTICS

PROGRAMME OUTCOMES (PO):

At the end of the graduate programme at Kannur University, a student would:

PO1	**Critical Thinking and Problem-Solving**	**Apply critical thinking skills to analyse information and develop effective problem-solving strategies for tackling complex challenges.**
PO2	**Effective Communication and Social Interaction**	**Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.**
PO3	**Holistic Understanding**	**Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex issues.**
PO4	**Citizenship and Leadership**	**Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.**
PO5	**Global Perspective**	**Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.**
PO6	**Ethics, Integrity and Environmental Sustainability**	**Uphold high ethical standards in academic and professional endeavours, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.**
PO7	**Lifelong Learning and Adaptability**	**Cultivate a commitment to continuous self-directed learning, adapting to evolving challenges, and acquiring knowledge throughout life.**

PROGRAMME SPECIFIC OUTCOMES (PSO):

At the end of the BSc Statistics program at Kannur University, a student would:

PSO 1	**Gain a thorough grasp of the concepts, principles, and theories in Statistics.**
PSO 2	**Utilize basic concepts in descriptive and inferential statistics for exploratory data analysis.**
PSO 3	**Develop expertise in utilizing statistical software to address the demands of employability, research, and development.**
PSO 4	**Recognize the potential applications of statistical theories in various fields.**
PSO 5	**Create statistical models to tackle real-world problems and derive solutions.**
PSO 6	**Blend analytical techniques with a critical mindset to address statistical challenges effectively.**
PSO 7	**Gain proficiency in classical statistical inference and decision-making fundamentals.**

DISCIPLINE SPECIFIC MAJOR COURSES

SEMESTER I

A1 – DISCIPLINE SPECIFIC MAJOR COURSE

KU1DSCSTA101: BASIC STATISTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MAJOR	100 – 199	KU1DSCSTA101	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course covers the fundamentals of statistics including the nature and scope of statistics, types of data, scales of measurement, methods of data collection and presentation, graphical representation, measures of central tendency, and measures of dispersion.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to explain the definition, nature, and scope of statistics in various fields.	R
2	Students will demonstrate an understanding of different types of data, including quantitative, qualitative, geographical, and chronological, and their respective scales of measurement.	U
3	Students will be able to collect and classify data using primary and secondary sources, and present it effectively through classification, tabulation, and graphical representation techniques.	A
4	Students will analyse and interpret data using various measures of central tendency, including arithmetic mean, median, mode, geometric mean, and harmonic mean, as well as partition values such as quartiles, deciles, and percentiles.	An

5	Students will calculate and interpret measures of dispersion, including range, quartile deviation, mean deviation, and standard deviation, and understand relative measures of dispersion such as coefficient of range, quartile deviation, variation, and mean deviation.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓					✓	
CO 2				✓		✓	
CO 3			✓		✓		✓
CO 4	✓		✓	✓		✓	✓
CO 5	✓	✓				✓	✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Introduction, collection and Presentation of Data**	12
	1	Statistics: Definition, nature and scope of statistics in various streams	
	2	Different types of data: quantitative, qualitative, geographical and chronological	
	3	Scales of measurement of data: nominal, ordinal, interval and ratio scale	
	4	Time series, cross sectional and longitudinal data	

2	**Statistical Methods**		**12**
	1	Collection of data: Primary and Secondary and their sources	
	2	Presentation of data: classification and tabulation of data	
	3	Line diagram, bar diagrams and pie diagrams	
	4	Histogram, frequency polygon, frequency curve and ogives	
3	**Measures of Central Tendency**		**12**
	1	Definition and properties of various measures of central tendency – Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean	
	2	Short-cut method for the evaluation of mean of raw and grouped data	
	3	Partition values - Quartiles, Deciles, Percentiles	
4	**Measures of Dispersion**		**12**
	1	Measures of Dispersion: Range, Quartile deviation, Mean Deviation and Standard deviation	
	2	Properties and relative measures of dispersion (Coefficient of range, Coefficient of quartile deviation, Coefficient of variation, Coefficient of mean deviation)	
5	**Open End**		**12**
	Practical using MS Excel		
	History of Statistics, Data entry using MS Excel, Understanding the usage of various statistical and mathematical functions in Excel, Preparation of diagrams and analysis of data using methods explained in Module 2 to 4 by Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). ***Statistical Methods***, Sultan Chand & Sons, New-Delhi.

Suggested Readings:

1. Spiegel, M. R. and Stephens, L. J. (2017). ***Schaum's Outline of Statistics***, 6th Edn., McGraw-Hill Education.
2. Gun, A. M., Gupta, M.K. and Dasgupta, B. (2008). ***Fundamentals of Statistics.*** India: World Press.
3. Armitage, P., Berry, G., and Matthews, J. N. S. (2008). ***Statistical Methods in Medical Research***. John Wiley & Sons.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER II

A2 – DISCIPLINE SPECIFIC MAJOR COURSE

KU2DSCSTA102: DESCRIPTIVE STATISTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MAJOR	100 – 199	KU2DSCSTA102	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course covers fundamental statistical concepts and techniques including moments, curve fitting, correlation analysis, and simple linear regression, providing students with the tools to analyse data and understand relationships between variables.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will understand the relationship between raw moments and central moments, and be able to calculate and interpret measures of skewness and kurtosis.	U
2	Students will grasp the principle of least squares and apply it to fit linear, quadratic, and exponential curves to data sets.	A
3	Students will differentiate between types of correlation, utilize scatter diagrams and Karl Pearson correlation coefficient to analyse correlation, and solve problems related to rank correlation coefficient.	An
4	Students will comprehend the process of fitting regression lines and interpret regression coefficients, understanding their definitions and properties.	E
5	Students will demonstrate the ability to calculate and interpret partial and multiple correlation coefficients in a tri-variate context.	C

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓			✓		✓	✓
CO 2	✓		✓	✓		✓	
CO 3			✓		✓		✓
CO 4		✓		✓			
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Moments**		12
	1	Definition and relationship between raw moments and central moments	
	2	Skewness: Definition and various measures of skewness	
	3	Kurtosis - Definition and various measures of kurtosis	
2	**Curve fitting**		12
	1	Principle of least squares	
	2	Fitting of linear and quadratic curves	
	3	Fitting of exponential curves (ab^X , $a\,X^b$, $a\,e^{bX}$)	

3	**Correlation Analysis**		**12**
	1	Definition and types of correlation	
	2	Methods of studying correlation: Scatter diagram, Karl Pearson correlation coefficient	
	3	Rank correlation coefficient-formula and problems only	
	4	Definitions of partial and multiple correlation coefficients (tri-variate case only)	
4	**Simple linear regression**		**12**
	1	Fitting of regression lines	
	2	Regression coefficients: Definition, properties and examples	
5	**Open End**		**12**
	Practical using MS Excel		
	Understanding the usage of various statistical and mathematical functions in Excel, Analysis of data using methods explained in Module 1 to 4 by Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta, S. C. and Kapoor, V. K. (2002): ***Fundamentals of Mathematical Statistics***, Sultan Chand & Co.
2. Gupta, S. C (1984): ***Fundamentals of Statistics***, Himalayan Publishing House.
3. Agrawal, B. L. (2013): ***Basic Statistics***, New Age International Publishers.

Suggested Readings:

1. Mood A. M., Graybill F. A., Bose, D C (2007): ***Introduction to the theory of statistics***, Tata Magrow Hill.
2. Gun, A. M., Gupta, M.K. and Dasgupta, B. (2008). ***Fundamentals of Statistics.*** India: World Press.
3. Croxton, F. E. and Cowden, D. J. (1973): ***Applied General Statistics***, Printice Hall of India.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

DISCIPLINE SPECIFIC MINOR COURSES

SEMESTER I

B1 – DISCIPLINE SPECIFIC MINOR COURSE
KU1DSCSTA121: INTRODUCTORY STATISTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MINOR	100 – 199	KU1DSCSTA121	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course covers statistical methods including data classification, sources of data, sampling techniques, measures of central tendency and dispersion, moments, skewness, and kurtosis, providing a comprehensive understanding of data analysis and interpretation.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to identify and classify data based on nominal, ordinal, interval, and ratio scales of measurement.	R
2	Students will understand the concepts of primary and secondary data and their respective sources.	U
3	Students will be able to compare census and sample survey methods, and understand the principal steps involved in a sample survey.	An
4	Students will understand and be able to apply simple random sampling, stratified random sampling, and systematic random sampling for data collection.	A
5	Students will be able to compute measures of central tendency (mean, median, mode, etc.), dispersion (range, quartiles, standard	E

	deviation, etc.), moments, skewness, and kurtosis, and interpret their properties and significance in data analysis.	

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		✓	✓		✓		✓
CO 2	✓		✓	✓		✓	
CO 3	✓	✓			✓		✓
CO 4			✓	✓		✓	✓
CO 5	✓	✓		✓	✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Statistical Methods**	12
	1	Different types of data: Scales of measurement - Nominal, ordinal, interval and ratio, Classification of data	
	2	Source of data: Primary and Secondary data, their sources	
	3	Census and Sampling method: Definitions, Comparison of census method and sample survey method, Principal steps in a sample survey	
	4	Probability sampling – simple random sampling, stratified and systematic random sampling, non-probability sampling (concepts only)	
2		**Measures of Central Tendency**	12
	1	Definition and properties of various measures of central tendency – Arithmetic Mean, Median, Mode	

	2	Geometric Mean, Harmonic Mean and weighted averages	
	3	Partition values - Quartiles, Deciles, Percentiles	
3	**Measures of Dispersion**		**12**
	1	Definition and properties of various measures of dispersion - Range, Quartile Deviation, Mean Deviation, Standard Deviation	
	2	Properties and relative measures of dispersion (Coefficient of range, Coefficient of quartile deviation, Coefficient of variation, Coefficient of mean deviation)	
4	**Moments**		**12**
	1	Definitions of raw and central moments, calculation of moments	
	2	Relationship between raw and central moments	
	3	Skewness: Definition and various measures of skewness	
	4	Kurtosis - Definition and various measures of kurtosis	
5	**Open End**		**12**
	Practical using MS Excel		
	History of Statistics, Data entry using MS Excel, Understanding the usage of various statistical and mathematical functions in Excel, Preparation of diagrams and analysis of data using methods explained in Module 2 to 4 by Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). ***Statistical Methods***, Sultan Chand & Sons, New-Delhi.

Suggested Readings:

1. Mukhopadhyay, P. (1996). ***Mathematical Statistics***, New Central Book Agency (P) Ltd., Kolkata.
2. Agarwal, B. L. (2006). ***Basic Statistics***, 4th Edition, New Age International (P) Ltd., New Delhi.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER I

B2 – DISCIPLINE SPECIFIC MINOR COURSE
KU1DSCSTA122: STATISTICAL METHODS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MINOR	100 – 199	KU1DSCSTA122	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course provides an introductory understanding of statistics, covering topics such as the definition and nature of statistics, variables, data tabulation, graphical representation, measures of central tendency and dispersion, skewness, and kurtosis.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to define statistics, understand its nature, uses, and its relation to other disciplines, as well as recognize the potential for misuse of statistics.	R
2	Students will understand the concepts of variables, attributes, primary data, secondary data, population, and sample, as well as the difference between census and sample survey methods.	U
3	Students will be able to create frequency distributions (ungrouped and grouped) and cumulative frequency distributions and understand the principles of data tabulation.	E
4	Students will understand and be able to create various charts and diagrams (e.g., bar diagrams, pie charts, histograms, frequency polygons, frequency curves, ogives) and recognize the advantages of graphical representation in data analysis.	An
5	Students will be able to calculate measures of central tendency (mean, median, mode, geometric mean, harmonic mean) and measures of dispersion (range, quartile deviation, mean deviation, standard deviation, variance) from raw data and understand their advantages, disadvantages, as well as measures of skewness and kurtosis.	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓		✓		✓
CO 2		✓		✓		✓	
CO 3	✓		✓		✓		✓
CO 4		✓		✓		✓	
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Introduction to Statistics**	12
	1	Introduction- definition of Statistics, Nature of Statistics, uses of Statistics, Statistics in relation to other disciplines, abuse of Statistics	
	2	Variables, Attributes. Primary data and secondary data. Population and sample. Census and sample survey	
	3	Tabulation of data- basic principles	
	4	Frequency distribution-ungrouped and grouped, cumulative frequency distribution	
2		**Diagrammatic and Graphical Representation of Data**	12
	1	Charts and diagrams- bar diagram, pie chart	
	2	Histogram, frequency polygon, frequency curve	
	3	Ogives	

	4	Advantages of diagram and graphical representation of data	
3	**Measures of Central tendency**		**12**
	1	Definition and properties of Various measures of central tendency- AM, median, mode, GM, HM	
	2	Calculation of various measure of Central tendency (from raw data only)	
	3	Advantages and disadvantages of various measures of central tendency	
4	**Measures of Dispersion**		**12**
	1	Definitions – Range, QD, MD, SD, Variance	
	2	Calculation of various measures of dispersion (from raw data only)	
	3	Skewness: Definition and various measures of skewness	
	4	Kurtosis - Definition and various measures of kurtosis	
5	**Open End**		**12**
	Practical using MS Excel		
	History of Statistics, Data entry using MS Excel, Understanding the usage of various statistical and mathematical functions in Excel, Preparation of diagrams and analysis of data using methods explained in Module 2 to 4 by Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). ***Statistical Methods***, Sultan Chand & Sons, New-Delhi.

Suggested Readings:

1. Mukhopadhyay, P. (1996). ***Mathematical Statistics***, New Central Book Agency (P) Ltd., Kolkata.
2. Agarwal, B. L. (2006). ***Basic Statistics***, 4th Edition, New Age International (P) Ltd., New Delhi.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER I

B3 – DISCIPLINE SPECIFIC MINOR COURSE

KU1DSCSTA123: INTRODUCTION TO OPERATIONS RESEARCH

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MINOR	100 – 199	KU1DSCSTA123	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course offers a comprehensive study of linear programming, transportation, and assignment problems, covering topics such as mathematical formulation, solution methods including graphical, simplex, and Hungarian methods, as well as duality and special cases.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to understand the basics of linear programming and its applications in various real-world problems.	U
2	Students will be able to formulate mathematical models for linear programming problems (LPP) and solve them using graphical methods, simplex method, and understand canonical and standard forms of LPP.	An
3	Students will understand the transportation problem and its mathematical formulation, and will be able to solve it using various methods such as the North-West corner rule, matrix minima method, Vogel's approximation method, and modified distribution method.	A
4	Students will understand the assignment problem and its mathematical formulation, and will be able to solve it using the Hungarian method. They will also be able to handle special cases such as maximization case and prohibited assignments.	E
5	Students will grasp the concept of duality in linear programming, including its basic concepts and applications. They will understand how primal and dual problems are related and the significance of duality in optimization problems.	R

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓			✓	✓		✓
CO 2		✓		✓			✓
CO 3	✓			✓	✓		
CO 4		✓		✓		✓	✓
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Linear Programming Problem**	**12**
	1	Introduction	
	2	Mathematical formulation of a linear programming problem	
2		**Solution of a Linear Programming Problem**	**12**
	1	Solution of a linear programming problem by graphical method	
	2	General Linear programming problem, canonical and standard forms of LPP	
	3	Solution of a linear programming problem by simplex method (Simplex algorithm and simple problems only)	
	4	Duality in LPP (Basic concepts only)	

3	**Transportation Problem**		**12**
	1	Mathematical formulation	
	2	Solution of a Transportation Problem by North-West corner rule and Matrix minima method	
	3	Vogel's Approximation method	
	4	Modified distribution method	
4	**Assignment Problem**		**12**
	1	Mathematical formulation	
	2	Solution of an Assignment problem by Hungarian method	
	3	Special cases in assignment problem: Maximization case, prohibited assignments	
5	**Open End (Practical)**		**12**
	Numerical computation using methods explained in Module 1 to 4.		

Essential Readings:

1. Kantiswarup, Gupta P. K. and Manmohan. (2022): ***Operations Research***, Sultan Chand and Sons.
2. Hira, D. S. (1992): ***Operations Research***, S. Chand Publishing.

Suggested Readings:

1. Taha, H. A. (2019): ***Operations Research – An Introduction***, Pearson Education.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER I

B4 – DISCIPLINE SPECIFIC MINOR COURSE

KU1DSCSTA124: BASIC STATISTICS AND NUMERICAL SKILLS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MINOR	100 – 199	KU1DSCSTA124	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course provides a comprehensive understanding of statistical methods, covering different types of data, sources of data, sampling methods, measures of central tendency, measures of dispersion, and basic concepts of matrix algebra, including mathematical operations, determinants, and solutions of simultaneous equations using Crammer's rule.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to classify different types of data according to their scales of measurement and understand the properties of nominal, ordinal, interval, and ratio data.	R
2	Students will acquire the knowledge to distinguish between primary and secondary data sources and understand the importance of each in statistical analysis.	An
3	Upon completion of the course, students will demonstrate proficiency in designing and executing sampling methods, including census and various types of probability sampling techniques.	E
4	Students will be able to calculate and interpret various measures of central tendency, such as arithmetic mean, median, and mode, along with partition values like quartiles, deciles, and percentiles.	A
5	By the end of the course, students will have a solid understanding of measures of dispersion, including range, quartile deviation, mean deviation, and standard deviation, and be able to apply relative measures of dispersion effectively.	U

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		✓		✓	✓		✓
CO 2	✓			✓	✓		✓
CO 3	✓			✓		✓	
CO 4		✓		✓		✓	✓
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Statistical Methods**	12
	1	Different types of data: Scales of measurement - Nominal, ordinal, interval and ratio, Classification of data	
	2	Source of data: Primary and Secondary data, their sources	
	3	Census and Sampling method: Definitions, Comparison of census method and sample survey method, Principal steps in a sample survey	
	4	Probability sampling – simple random sampling, stratified and systematic random sampling, non-probability sampling (concepts only)	
2		**Measures of Central Tendency**	12
	1	Definition and properties of various measures of central tendency – Arithmetic mean, median, mode	
	2	Geometric mean, harmonic mean and weighted averages	
	3	Partition values - Quartiles, Deciles, Percentiles	

3	**Measures of Dispersion**		**12**
	1	Definition and properties of various measures of dispersion - Range, quartile deviation, mean deviation, standard deviation	
	2	Properties and relative measures of dispersion (Coefficient of range, Coefficient of quartile deviation, Coefficient of variation, Coefficient of mean deviation)	
4	**Matrix Algebra**		**12**
	1	Definition and types of matrices, transpose of a matrix	
	2	Mathematical operations on matrices – Addition, scalar multiplication and product of two matrices	
	3	Determinant of a matrix (of order 2 and 3), rank of a matrix	
	4	Solution of simultaneous equations using Crammer's rule (3 variables)	
5	**Open End (Practical)**		**12**
	Set theory, Types of sets, set operations, Representation of sets using Venn diagram, Numerical computation of concepts explained in Module 2 and 3 using MS Excel.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). ***Statistical Methods***, Sultan Chand & Sons, New-Delhi.
4. Shanthi Narayan, & Mittal P.K. (2010). ***A Text book of matrices***. S. Chand and company Pvt. Ltd.
5. Mittal P. K. (2007). ***Matrices***, Vrinda Publications Pvt. Ltd.

Suggested Readings:

1. Mukhopadhyay, P. (1996). ***Mathematical Statistics***, New Central Book Agency (P) Ltd., Kolkata.
2. K.B. Datta. (2007). ***Matrix and Linear Algebra***. Prentice Hall of India Pvt. Ltd.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER II

B5 – DISCIPLINE SPECIFIC MINOR COURSE

KU2DSCSTA131: PROBABILITY AND RANDOM VARIABLES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MINOR	100 – 199	KU2DSCSTA131	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course delves into probability theory, random variables, bivariate random variables, and correlation and regression analysis, covering topics such as definitions of probability, conditional probability, probability distributions, random variable transformations, joint and marginal probability distributions, correlation analysis, and regression analysis techniques.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will grasp the concepts of random experiments and probability, including frequency, classical, and axiomatic definitions.	U
2	Students will comprehend the definitions of discrete and continuous random variables and their probability mass and density functions.	R
3	Students will understand the concept of bivariate random variables and they will be able to compute conditional distributions and determine the independence of random variables.	A
4	Students will understand the concepts of correlation and its different types, and able to perform simple linear regression, including fitting regression lines and understanding regression coefficients.	An
5	Students will be able to apply correlation and regression analysis, probability theory, random variables, and bivariate random variables to analyse and solve real-world problems in various fields such as business, economics, and social sciences.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1		✓		✓		✓	✓
CO 2			✓			✓	
CO 3	✓	✓		✓			✓
CO 4	✓			✓	✓		✓
CO 5		✓		✓		✓	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Probability Theory**		12
	1	Random experiment, definitions of probability (frequency, classical and axiomatic) addition theorem (2 and 3 events), numerical examples	
	2	Conditional probability, multiplication theorem	
	3	Independence of events: pair wise and mutual independence	
	4	Baye's theorem and its applications	
2	**Random Variables**		12
	1	Definition - discrete and continuous random variables	
	2	Probability mass function and probability density function	
	3	Distribution function - definition and properties	
	4	Transformation of random variables - discrete and continuous	
3	**Bivariate Random Variables**		12
	1	Definition of bivariate random variable	
	2	Joint and marginal probability distributions	
	3	Conditional distributions. Independence of random variables	
4	**Correlation and Regression Analysis**		12
	1	Method of least squares - Fitting of linear and quadratic equations	
	2	Correlation analysis – Definition and different types of correlation	
	3	Methods of studying correlation: Scatter diagram, Karl Pearson	

		correlation coefficient and its properties	
	4	Simple linear regression: Fitting of regression lines, regression coefficients and their properties	
5	**Open End (Practical)**		**12**
	Numerical computation of concepts explained in Module 4 using MS Excel.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Gupta, S. P. (2004). ***Statistical Methods***, Sultan Chand & Sons, New-Delhi.

Suggested Readings:

1. Mukhopadhyay, P. (1996). ***Mathematical Statistics***, New Central Book Agency (P) Ltd., Kolkata.
2. Agarwal, B. L. (2006). ***Basic Statistics***, 4th Edition, New Age International (P) Ltd., New Delhi.

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER II

B6 – DISCIPLINE SPECIFIC MINOR COURSE

KU2DSCSTA132: PROBABILITY THEORY AND BIVARIATE DATA ANALYSIS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MINOR	100 – 199	KU2DSCSTA132	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course provides a comprehensive study of probability theory, random variables, standard probability distributions, and bivariate data analysis, covering topics such as classical definition of probability, addition and multiplication laws, conditional probability, standard probability distributions including binomial, Poisson, and normal distributions, and simple correlation and regression analysis.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will gain a solid understanding of random experiments, events, and sample space, including the classical definition of probability.	U
2	Students will understand the definitions of discrete and continuous random variables and be able to compute probability mass and density functions.	R
3	Students will comprehend the properties of the binomial, Poisson, and normal distributions and they will apply these distributions to model and solve real-world problems in various fields.	An
4	Students will be able to calculate and interpret the simple correlation coefficient regression coefficients for bivariate data.	E
5	Students will apply probability theory, random variables, standard probability distributions, and bivariate data analysis techniques to analyse and solve real-world problems in various domains, such as business, economics, and social sciences.	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓	✓		✓		✓	✓
CO 2			✓		✓		✓
CO 3		✓	✓			✓	
CO 4	✓			✓		✓	✓
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Probability Theory**	12
	1	Random experiment, Events, sample space- classical definition of probability	
	2	Addition and multiplication laws of probability (for two events)	
	3	Conditional probability and statistical independence	
	4	Baye's theorem and its applications	
2		**Random Variables**	12
	1	Definition - discrete and continuous random variables	
	2	Probability mass function and probability density function	
	3	Expectation and variance (definition and simple problems only)	

3	**Standard Probability Distributions**		**12**
	1	Binomial distribution-definition, properties (statement and problems only)	
	2	Poisson distribution- definition, properties (statement and problems only)	
	3	Normal and standard normal distribution-definition, properties (statement and problems only)	
4	**Bivariate Data Analysis**		**12**
	1	Simple Correlation coefficient and properties	
	2	Spearman rank correlation coefficient (in the case of no tie)	
	3	Simple linear regression lines-equations and application	
	4	Regression coefficients and their properties	
5	**Open End (Practical)**		**12**
	Numerical computation of concepts explained in Module 4 using MS Excel.		

Essential Readings:

1. Gupta, S. C. & Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.
2. Elhance, D.N., Veena E. and Aggarwal, B. M. (2010). ***Fundamentals of Statistics***, Kitab mahal, Allahabad.
3. Lipschutz, S. and Schiller, J. J. (1998). ***Schaum's Outline of Theory and Problems of Introduction to Probability and Statistics***, The McGraw-Hill Companies, Inc.

Suggested Readings:

1. Biswas, D. (2012). ***Probability and Statistics***, Vol. 1, New Central Book Agency Pvt. Ltd., Kolkata.
2. Pitman, J. (1993). ***Probability***, Narosa Publishing House, New Delhi.
3. Rohatgi, V. K. (1993). ***An Introduction to Probability Theory and Mathematical Statistics***, Wiley Eastern, New Delhi.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER II

B7 – DISCIPLINE SPECIFIC MINOR COURSE

KU2DSCSTA133: TIME SERIES AND INDEX NUMBERS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MINOR	100 – 199	KU2DSCSTA133	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course explores time series analysis, measurement of trend, index numbers, and methods of constructing index numbers, covering topics such as time series data, trend analysis techniques, index number construction, and tests of index number adequacy.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will be able to identify and explain the different components of a time series, such as trend, seasonality, cyclical variations, and irregular fluctuations.	An
2	Students will learn various methods to measure trend in time series data, including graphic methods, semi-average method, moving average method, and method of least squares in both linear and quadratic forms.	U
3	Students will understand the definition and uses of index numbers in economic and statistical analysis.	R
4	Students will learn the methods of constructing unweighted and weighted index numbers, including Laspeyres, Paasche, Dorbish and Bowley, and Fisher's methods.	A
5	Students will be able to evaluate the adequacy of index number formulas using various tests, such as unit test, time reversal test, and factor reversal test.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1			✓	✓		✓	
CO 2	✓		✓		✓		✓
CO 3	✓			✓	✓		✓
CO 4		✓	✓			✓	✓
CO 5	✓		✓		✓	✓	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Time Series Analysis**	12
	1	Time series data	
	2	Utility of time series analysis	
	3	Different components of time series	
2		**Measurement of Trend**	12
	1	Graphic method	
	2	Semi-average method	
	3	Moving average method	
	4	Method of least squares (Linear and quadratic form)	
3		**Index Numbers**	12
	1	Definition and uses of index numbers	
	2	Problems in the construction of index numbers	
	3	Limitations of index numbers	
4		**Methods of Constructing Index Numbers**	12
	1	Unweighted index numbers	
	2	Weighted index numbers: Laspeyres, Paasche, Dorbish, Bowley and Fisher's method	
	3	Test of adequacy of index numbers formulae: Unit test, time reversal test and factor reversal test	

	4	Base shifting	
5	**Open End (Practical)**		**12**
	Numerical computation of the above concepts using MS Excel.		

Essential Readings:

1. Gupta, S. P. (2021). ***Statistical Methods***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Elhance, D.N., Veena E. and Aggarwal, B. M. (2010). ***Fundamentals of Statistics***, Kitab mahal, Allahabad.

Suggested Readings:

1. John E. Freund (1980). ***Mathematical Statistics***, Prentice Hall of India, New Delhi.
2. Gupta, S. C. &Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

SEMESTER II

B8 – DISCIPLINE SPECIFIC MINOR COURSE

KU2DSCSTA134: QUANTITATIVE TECHNIQUES IN DATA ANALYSIS – I

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MINOR	100 – 199	KU2DSCSTA134	4	60

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	-	-	30	70	100	2

Course Description: This course offers a comprehensive study of correlation, regression analysis, time series analysis, and index numbers, covering topics such as different types of correlation, methods for studying correlation, regression types, trend measurement methods, index number construction, and tests of index number adequacy.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Students will understand the concept and various types of correlation and be able to apply methods such as scatter diagrams, Karl Pearson's correlation coefficient, and Spearman's rank correlation coefficient to analyse relationships between variables.	An
2	Upon completion of the course, students will be able to define regression analysis, distinguish between different types of regressions, and demonstrate proficiency in constructing regression lines and equations.	U
3	Students will acquire the skills to identify and analyze time series data, including understanding the components of time series and applying methods such as graphical, semi-average, moving average, and method of least squares for trend measurement.	R
4	By the end of the course, students will be familiar with index numbers, including their definitions, uses, construction methods,	A

	and tests of adequacy such as unit test, time reversal test, and factor reversal test.	
5	Students will develop the ability to interpret and analyse statistical data using correlation, regression analysis, time series analysis, and index numbers to make informed decisions in various fields.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓		✓		✓
CO 2		✓			✓	✓	
CO 3			✓	✓		✓	✓
CO 4			✓		✓		✓
CO 5	✓	✓		✓			✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Correlation**		12
	1	Meaning and various types of correlation	
	2	Methods for studying correlation – Scatter diagram, Karl Pearson's correlation coefficient	
	3	Spearman's rank correlation coefficient.	

2	**Regression Analysis**		**12**
	1	Meaning and definition	
	2	Types of regressions	
	3	Regression lines and regression equations	
	4	Properties of regression coefficients	
3	**Time Series Analysis**		**12**
	1	Definitions and components of time series	
	2	Methods for measuring trend – Graphical method and semi-average method	
	3	Moving average method and method of least squares	
4	**Index Numbers**		**12**
	1	Definition and uses of index numbers	
	2	Unweighted index numbers	
	3	Weighted index numbers: Laspeyres, Paasche, Dorbish, Bowley and Fisher's method	
	4	Test of adequacy of index numbers formulae: Unit test, time reversal test and factor reversal test	
5	**Open End (Practical)**		**12**
	Numerical computation of the above concepts using MS Excel.		

Essential Readings:

1. Gupta, S. P. (2021). ***Statistical Methods***, Sultan Chand & Sons, New Delhi.
2. Gupta, S. C. & Kapoor, V. K. (1994). ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, New Delhi.
3. Elhance, D.N., Veena E. and Aggarwal, B. M. (2010). ***Fundamentals of Statistics***, Kitab Mahal, Allahabad.

Suggested Readings:

1. John E. Freund (1980). ***Mathematical Statistics***, Prentice Hall of India, New Delhi.
2. Gupta, S. C. &Kapoor, V. K. (1980). ***Fundamentals of Mathematical Statistics***, Sultan Chand & Sons, New Delhi.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**10**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**100**

MULTI-DISCIPLINARY COURSES

SEMESTER I

MDC1 – MULTI-DISCIPLINARY COURSE

KU1MDCSTA141: BASICS OF STATISTICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	**MULTI-DISCIPLINARY**	100 – 199	KU1MDCSTA141	3	45

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1½

Course Description: This course covers fundamental mathematical concepts such as number systems, equations, and progressions, along with an introduction to statistics including data types, measurement scales, and methods of data collection and presentation.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the concepts and properties of numbers including integers, rational and irrational numbers.	U
2	Apply ratio and proportion concepts in solving real-world problems.	A
3	Demonstrate proficiency in using laws of indices and logarithms in mathematical calculations.	R
4	Solve linear and quadratic equations and apply arithmetic and geometric progressions to practical situations.	E
5	Analyse and interpret statistical data, including differentiating between quantitative and qualitative data types and understanding various measurement scales.	An

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓		✓		✓
CO 2		✓	✓		✓		✓
CO 3		✓		✓			✓
CO 4	✓			✓		✓	
CO 5		✓	✓		✓	✓	

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Elementary Mathematics – I**	8
	1	Number system – Integers, rational and irrational numbers	
	2	Ratio and proportion	
	3	Laws of indices	
	4	Logarithm	
2		**Elementary Mathematics – II**	7
	1	Equations – Solution of linear and quadratic equations	
	2	Arithmetic and geometric progression	
	3	Simple and compound growth rate	
	4	Profit and loss, Market equilibrium	

3	**Introduction to Statistics**		**8**
	1	Statistics: Definition, nature and scope of statistics in various streams	
	2	Different types of data: quantitative, qualitative, geographical and chronological	
	3	Scales of measurement of data: nominal, ordinal, interval and ratio scale	
	4	Time series, cross sectional and longitudinal data	
4	**Statistical Methods**		**7**
	1	Collection of data: Primary and Secondary and their sources	
	2	Presentation of data: classification and tabulation of data	
	3	Diagrammatic Representation: Line diagram, bar diagrams and pie diagrams	
	4	Graphical presentation: Histogram, frequency polygon, frequency curve and ogives	
5	**Open End**		**15**
	Practical using MS Excel		
	History of Statistics, Data entry using MS Excel, Understanding the usage of various statistical and mathematical functions in Excel, Preparation of diagrams explained in Module 4 by Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta S. C. and Kapoor, V. K. (2002): ***Fundamentals of Mathematical Statistics***, Sultan Chand & Co.
2. Gupta S. C. (2018): ***Fundamentals of Statistics***, Himalaya Publishing House.
3. B L Agrawal (2013): ***Basic Statistics***, New Age International Publishers.
4. Yule and Kendall (1984): ***An Introduction to the Theory of Statistics***, Charles Gtiffin & Co, London.
5. Spiegel, M.R (2000): ***Theory and Problem of Statistics***, McGraw Hill, London.

Suggested Readings:

1. Mood A. M., Gray bill F. A., Bose D. C. (2007): ***Introduction to the theory of statistics*** - Tata Magraw Hill.

2. Goon A. M., Gupta M. K., Das Gupta. B. (1999): ***Fundamentals of Statistics***, Vol. I, World Press, Calcutta.
3. Croxton. F. E and Cowden. D. J (1973): ***Applied General Statistics***, Printice Hall of India.

Assessment Rubrics:

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**5**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**75**

SEMESTER II

MDC2 – MULTI-DISCIPLINARY COURSE

KU2MDCSTA151: INTRODUCTION TO DATA ANALYSIS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	**MULTI-DISCIPLINARY**	100 – 199	KU2MDCSTA151	3	45

Learning Approach (Hours/Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	-	-	25	50	75	1½

Course Description: This course provides a comprehensive understanding of statistical measures including central tendency, dispersion, correlation analysis, and regression analysis with practical applications and examples.

Course Prerequisite: HSE level Mathematics/Statistics Courses

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand and calculate various measures of central tendency including the arithmetic mean, median, mode, and quartiles, deciles, and percentiles.	U
2	Calculate and interpret measures of dispersion such as range, quartile deviation, mean deviation, standard deviation, and coefficient of variation to assess the spread of data.	R
3	Analyse relationships between variables using correlation techniques including scatter diagrams, Karl Pearson's correlation coefficient, and Spearman's rank correlation coefficient.	An
4	Apply regression analysis techniques to model relationships between variables, including understanding regression types, fitting regression lines, and interpreting regression coefficients.	A
5	Evaluate and interpret statistical summaries obtained from measures of central tendency, dispersion, correlation, and regression analysis to draw meaningful conclusions from data.	E

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7
CO 1	✓		✓			✓	✓
CO 2		✓			✓		
CO 3	✓		✓		✓		✓
CO 4		✓		✓			✓
CO 5	✓		✓		✓		✓

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Measures of Central Tendency**		8
	1	Arithmetic mean	
	2	Median	
	3	Mode	
	4	Quartiles, Deciles and Percentiles	
2	**Measures of Dispersion**		8
	1	Range	
	2	Quartile deviation	
	3	Mean deviation	
	4	Standard deviation and coefficient of variation	
3	**Correlation Analysis**		7
	1	Definition and types of correlation	
	2	Scatter Diagram	
	3	Karl Pearson's correlation coefficient	
	4	Spearman's rank correlation coefficient (without tie)	
4	**Regression Analysis**		7
	1	Definition and types of regression	
	2	Regression lines	

	3	Fitting of regression equations, examples	
	4	Properties of regression coefficients	
5	**Open End**		**15**
	Practical using MS Excel		
	Analysis of data using concepts explained in Module 1 to 4 by Ms Excel, Preparation and submission of a report.		

Essential Readings:

1. Gupta S. C. and Kapoor, V. K. (2002): ***Fundamentals of Mathematical Statistics***, Sultan Chand & Co.
2. Gupta S. C. (2018): ***Fundamentals of Statistics***, Himalaya Publishing House.
3. B L Agrawal (2013): ***Basic Statistics***, New Age International Publishers.

Suggested Readings:

1. Mood A. M., Gray bill F. A., Bose D. C. (2007): ***Introduction to the theory of statistics*** - Tata Magraw Hill.
2. Goon A. M., Gupta M. K., Das Gupta. B. (1999): ***Fundamentals of Statistics***, Vol. I, World Press, Calcutta.

Assessment Rubrics:

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	**5**
b)	Test Paper-2	**5**
c)	Assignment	**5**
d)	Seminar	**-**
e)	Book/ Article Review	-
f)	Viva-Voce	**-**
g)	Field Report/Practical	**10**
Total		**75**