

MAHARAJA'S COLLEGE, ERNAKULAM

(Govt. Autonomous -Affiliated to MG University, Kottayam)

UNDERGRADUATE PROGRAMMES (HONOURS)

SYLLABUS

MCE-UGP (Honours)

(2024 Admission Onwards)



Faculty : Science

BoS: Statistics

Programme: Statistics

Maharaja's College, Ernakulam

(Govt. Autonomous)

Park Avenue Road, Marine Drive

Ernakulam-682011, Kerala, India

Contents

Sl.No	Title	Page No
1	Preface	3
2	Board of Studies	4
3	Curricular Structure of the MCE –UG (Honours) Programme	5-6
4	MGU Programme Outcomes (POs)	7
5	Syllabus Frame work:MCE–UGP (Honours) Programme in	8
6	Syllabus Index	9-13
7	Syllabus: First Semester	14- 34
8	Syllabus: Second Semester	35 - 59
9	Syllabus: Third Semester	60 - 74
10	Syllabus: Fourth Semester	75 - 92
11	Syllabus: Fifth Semester	93- 95
12	Syllabus: Sixth Semester	96 - 98
13	Syllabus: Seventh Semester	99 - 113
14	Syllabus: Eighth Semester	-
15	Internship, Project & Online Courses	-

Preface

The syllabus is crafted following the guidelines of the New Education Policy (NEP) to gradually introduce a four-year undergraduate program. It aims to offer a thorough grasp of statistical principles and methods. Our goal is to equip students with the analytical and computational skills necessary for advanced statistical roles and further studies in Statistics and data science.

This curriculum provides various minor courses in Statistics to give students a broad understanding. It also includes opportunities for skill development, multidisciplinary studies, and additional value-added courses. These are designed to delve into Statistical Inference, Probability theory, and other key principles. Students are expected to conduct real-world data analysis, derive meaningful insights, and effectively communicate their findings.

Through practical projects and case studies, students will gain expertise in applying statistical methods across different domains, preparing them for diverse careers in academia, industry, and beyond. They will also enhance their programming skills with courses in tools like spreadsheets, R, and Python, essential for efficient analysis of large datasets.

In addition to core statistical training, the curriculum emphasizes skill enhancement, interdisciplinary studies, and supplementary courses. Students will explore areas such as Computer Science, Economics, and Psychology, fostering a comprehensive understanding of how Statistics intersects with other fields to tackle complex challenges.

Overall, these programs are designed to offer ample opportunities for growth not only in Statistics but also to navigate and excel in a data-driven world.

HoD Statistics

Board of Studies in Statistics (UG)

Chairperson

1) Dr. Jayamol K. V., Associate Professor & HOD

Internal Members

1) Dr. James Kurian, Associate Professor

2) Dr. Angel Mathew, Associate Professor

3) Sri. Kaladharan P. V., Assistant Professor

4) Dr. Merlymole Joseph K. , Associate Professor

5) Dr. Bismi G. Nadh, Associate Professor

6) Dr. Maya S.S., Assistant Professor

Expert Committee

- 1) Dr. Sebastian George, Associate Professor & HoD, department of statistics, Kannur university
- 2) Dr. Abdul Sathar E. I., Professor, department of statistics, Kerala university
- 3) Dr. Rajesh G., Professor, department of statistics, Cochin University of Science and Technology.
- 4) Sri. Rupesh R. Senior Manager, Biostatistics Department Data Science, Safty and Medical, IQVIA RDS India Pvt. Ltd. Kochi
- 5) Sri. Sujith P., Assistant Professor, department of statistics, Sri. Achuthamenon Govt. College Kuttanellur, Trissur.

Curricular Structure of the MCE–UG (Honours) Programme

3 Year UG Degree–6 Semesters

No.	Course Type	No. of Courses	Total Credits
1	Foundation: Ability Enhancement Courses (AEC)	4	12
2	Foundation: Multi–disciplinary Courses (MDC)	3	9
3	Foundation: Skill Enhancement Courses (SEC)	3	9
4	Foundation: Value Addition Courses (VAC)	3	9
5	Discipline Specific Courses: Major (DSC A/DSE)	17	68
6	Discipline Specific Courses: Minor (DSC B&C)	6	24
7	Internship		2
	Total	36	133

4 Year UG Degree (Honours) –8 semesters
4 Year UG Degree (Honours with Research)– 8 Semesters

No.	CourseType	No. of Courses	Total Credits
1	Foundation :Ability Enhancement Courses (AEC)	4	12
2	Foundation :Multi–disciplinary Courses(MDC)	3	9
3	Foundation: Skill Enhancement Courses (SEC)	3	9
4	Foundation :Value Addition Courses (VAC)	3	9
5	Discipline Specific Courses : Major (DSC A/DSE)	17	68
6	Discipline Specific Courses : Minor (DSC B&C)	6	24
7	Discipline Capstone Courses: Major (DCC/DCE)	8	32
8	Research Project		12/8
9	Internship		2
	Total	44	177

Programme Outcomes (POs)

PO1	Critical Thinking and Analytical Reasoning
PO2	Scientific Reasoning and Problem Solving
PO3	Multidisciplinary/Interdisciplinary/Trans disciplinary Approach
PO4	Communication Skills
PO5	Leadership Skills
PO6	Social Consciousness and Responsibility
PO7	Equity, Inclusiveness and Sustainability
PO8	Moral and Ethical Reasoning
PO9	Networking and Collaborating
PO10	Lifelong Learning

Evaluation Scheme

Components	Marks (4 Credit)	Marks (3 Credit)
Continuous Internal Assessment (CIA)	30	25
End Semester Examination	70	50
Total	100	75

Syllabus Index

Name of the Major Subject: **STATISTICS**

Semester: 1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution /week			
					L	T	P	O
MCE1DSC STA100	Fundamentals of Statistics and Data Visualisation	DSC B	4	5	3		2	
MCE1DSC STA101	Fundamentals of Statistics	DSC B	4	5	3		2	
MCE1DSC STA102	Basic Statistics and Data Visualisation	DSC C	4	5	3		2	
MCE1DSC STA103	Business Statistics	DSC C	4	5	3		2	
MCE1DSC STA104	Fundamentals of Applied Statistics	DSC*	4	5	3		2	
MCE1MD CSTA100	Elementary Data Analysis Using Spread Sheets	MDC	3	4	2		2	
MCE1MD CSTA101	Fundamentals of Statistics & Computational Methods	MDC	3	4	2		2	

DSC*- For pathway two.

L — Lecture, T — Tutorial, P — Practical/Practicum, O — Others

Semester: 2

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/week	Hour Distribution /week			
					L	T	P	O
MCE2DSC STA100	Introduction to Statistical Modeling	DSC B	4	5	3		2	
MCE2DSC STA101	Random Variables and Probability Distributions	DSC B	4	5	3		2	
MCE2DSC STA102	Probability and Probability Distributions	DSC C	4	5	3		2	
MCE2DSC STA103	Quantitative Data Analysis for Business Research	DSC C	4	5	3		2	
MCE2DSC STA104	Exploratory Data Analysis Using R	DSC*	4	5	3		2	
MCE2MD CSTA100	Data Analysis using SPSS	MDC	3	4	2		2	
MCE2MD CSTA101	Biostatistics & Basic Computational Skills	MDC	3	4	2		2	

MCE2MD CSTA102	Statistics for Managerial Decision Making	MDC	3	4	2		2	
-------------------	---	-----	---	---	---	--	---	--

DSC*- For pathway two

Semester: 3

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MCE3DSCSTA 200	Data Analysis in Inferential Statistics Using R	DSC B	4	5	3		2	
MCE3DSCSTA 201	Statistical Research Techniques	DSC B	4	5	3		2	
MCE3VACST A200	Applied Statistical Analysis: Ethical Data Collection, Interpretation, and Decision Making in Society	VAC	3	3	3			
MCE3MDCST A200	Statistical Analysis of Related Data	MDC	3	3	3			
MCE3MDCST A201	Business Analytics Using Spreadsheets	MDC	3	3	3			

Semester: 4

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MCE4DSCST A200	Statistical Inference Using R	DSC C	4	5	3		2	
MCE4DSCST A201	Statistical Research Methods Using Softwares	DSC C	4	5	3		2	
MCE4DSCST A202	Basics of Multivariate Distributions	DSC*	4	5	3		2	
MCE4SECST A200	Basic Research Methodology	SEC	3	3	3			
MCE4SECST A201	Introduction to Spreadsheets and Latex Typing	SEC	3	3	3			

MCE4VACST A200	Ethical Dimensions in Statistical Machine Learning Through R/Python	VAC	3	3	3			
-------------------	--	-----	---	---	---	--	--	--

DSC*- For pathway two.

Semester: 5

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MCE5DSCS TA300	Sampling Techniques	DSC*	4	4	4		0	

Semester: 6

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MCE6DSCS TA300	Econometrics	DSC*	4	4	4		0	

Semester: 7

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
MCE7D SCSTA4 00	Measure and Probability Theory	DSC E	4	4	4		0	
MCE7D SCSTA4 01	Statistical Machine Learning	DSC B	4	4	4		0	
MCE7D SCSTA4 02	<i>Life Science Data Analysis Using R Software</i>	DSC B	4	4	4		0	
MCE7D SCSTA4 03	Statistical Distributions, Estimation and Hypothesis Testing	DSC B	4	4	4		0	

Pathway-1 : Minors


Minor-1	Name of the program	Sem	course Name	Type of the Course	Switching
1	Statistics	I	Fundamentals of Statistics and Data Visualisation	DSC B	Yes
		II	Introduction to Statistical Modeling	DSC B	
		III	Data Analysis in Inferential Statistics Using R	DSC B	
	Applied Statistics (Social Science)	I	Fundamentals of Statistics	DSC B	No
		II	Random Variables and Probability Distributions	DSC B	
		III	Statistical Research Techniques	DSC B	
2	Applied Statistics (Science)	I	Basic Statistics and Data Visualisation	DSC C	No
		II	Probability and Probability Distributions	DSC C	
		IV	Statistical Research Methods Using Softwares	DSC C	
	Business Statistics	I	Business Statistics	DSC C	No
		II	Quantitative Data Analysis for Business Research	DSC C	

		IV	Statistical Research Methods Using Softwares	DSC C	
--	--	----	--	-------	--

Pathway-2 : Minor

Name of the program	Sem	course Name	Type of the Course	Switching
Statistics for mathematical science	I	Fundamentals of Applied Statistics	DSC	Yes
	II	Exploratory Data Analysis Using R	DSC	
	III	Data Analysis in Inferential Statistics Using R	DSC B	
	IV	Basics to Multivariate Distributions	DSC	

SEMESTER 1

	MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)					
Programme	Minor for BSc/BA/B Com					
Course Name	Fundamentals of Statistics and Data Visualisation					
Type of Course	DSC B					
Course Code	MCE1DSCSTA100					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, probability theory, correlation, regression and their real-world applications. Additionally, spread sheet functions are used to address numerical challenges associated with the Topics discussed.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicu m	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Explain and understand the concepts of different types of data, sampling and sampling techniques.	U	1
2	Summarise data using various measures of central tendency, dispersion, skewness and kurtosis.	U	1

3	Analyse relationships between variables using scatter diagrams, correlation coefficients and regression analysis.	A, An	1
4	Develop skills in solving real-world problems through the application of regression techniques, particularly in predicting outcomes and understanding the limitations of predictions.	An, A	2, 3
5	Understand basic probability concepts including random experiments, samples pace and elementary ideas of probability.	U	2
6	Apply Bayes' theorem to update probabilities based on new information and evidence.	E	1
7	Understand how statistical concepts are relevant across disciplines, fostering interdisciplinary thinking.	U	2
8	Apply using spreadsheets to illustrate and analyse Statistical concepts, enhancing practical skills.	A, An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Types of data and variables: Concepts of primary data and secondary data, examples of univariate and bivariate data type, Diagrams and Graphs: Bar diagrams, pie diagram and frequency graphs.	2	1
	1.2	Scales of measurements: Ordinal, nominal, ratio and interval.	2	1,7
	1.3	Population and sample, Types of sampling: Non-probability and Probability sampling: Simple random sampling, systematic sampling, stratified random sampling and cluster sampling with real-life examples (derivations not required).	3	2
	1.4	Measures of central tendency: Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), median and mode (examples using raw data).	3	2
	1.5	Measures of dispersion: Range, Quartile Deviation (QD), Mean Deviation (MD) and Standard Deviation (SD), Coefficient of Variation (CV). (examples using raw data). Box Plot.	3	2
	1.6	Moments, skewness and kurtosis with examples using raw data. (derivations not required).	2	1,2
2	2.1	Correlation, scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient. (Only the concepts, problems and properties-without proof of the above topics).	8	3
	2.2	Regression: Two types of regression lines, formula and numerical problems.	7	4,7

3	3.1	Random experiment, sample space and event with examples.	4	5
	3.2	Elementary ideas of probability: Frequency, classical and axiomatic definitions with examples.	5	5
	3.3	Conditional probability, independence of events, total probability law, Bayes' theorem (without proof) with examples.	6	5,6,7
4	4.1	Introduction to spreadsheet	5	1
	4.2	Using spreadsheet solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	25	7,8
Module 5		Teacher Specific Content	Hrs	


Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i> Theory: 5 marks Quiz, Assignments Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i> Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9 \times 2 = 18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5 \times 6 = 30$). iii) Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Gupta, S.P. (2021). Statistical Methods, 46th Edition, Sultan Chand and

Sons:NewDelhi.

3. Beverly J. Dretzke.(2008). Statistics with Microsoft Excel,4th Edition, Pearson.
4. Medhi,J.(2006).Statistical Methods, 2nd Edition, New Age International Publishers.
5. Mukhopadhyay,P.(1999). Applied Statistics, New Central Book Agency Private Limited, Kolkata.

		MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)				
Programme	Minor for BSc/BA/B Com					
Course Name	Fundamentals of Statistics					
Type of Course	DSC B					
Course Code	MCE1DSCSTA101					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, probability theory, correlation, regression and their real-world applications. Additionally, spread sheet functions are used to address numerical challenges associated with the Topics discussed.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Explain and understand the concepts of different types of data, sampling and sampling techniques.	U	1
2	Summarise data using various measures of central tendency, dispersion, skewness and kurtosis.	U	1
3	Analyse relationships between variables using scatter diagrams, correlation coefficients and regression analysis.	A, An	1

4	Develop skills in solving real-world problems through the application of regression techniques, particularly in predicting outcomes and understanding the limitations of predictions.	An, A	2, 3
5	Understand basic probability concepts including random experiments, sample space and elementary ideas of probability.	U	2
6	Apply Bayes' theorem to update probabilities based on new information and evidence.	E	1
7	Understand how statistical concepts are relevant across disciplines, fostering interdisciplinary thinking.	U	2
8	Apply using spreadsheets to illustrate and analyse Statistical concepts, enhancing practical skills.	A, An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Types of data and variables: Concepts of primary data and secondary data, examples of univariate and bivariate data type, Diagrams and Graphs: Bar diagrams, pie diagram and frequency graphs.	2	1
	1.2	Scales of measurements: Ordinal, nominal, ratio and interval.	2	1,7
	1.3	Population and sample, Types of sampling: Non-probability and Probability sampling: Simple random sampling, systematic sampling, stratified random sampling and cluster sampling with real-life examples (derivations not required).	3	2
	1.4	Measures of central tendency: Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), median and mode (examples using raw data).	3	2
	1.5	Measures of dispersion: Range, Quartile Deviation (QD), Mean Deviation (MD) and Standard Deviation (SD), Coefficient of Variation (CV). Box Plot.	3	2
	1.6	Moments, skewness and kurtosis with examples using raw data. (derivations not required).	2	1,2
2	2.1	Correlation, scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient. (Only the concepts, problems and properties-without proof of the above topics).	8	3
	2.2	Regression: Least square theory, Two types of regression lines, formula and numerical problems.	7	4,7
3	3.1	Random experiment, sample space and event with examples.	4	5
	3.2	Elementary ideas of probability: Frequency, classical and axiomatic definitions with examples.		5

			5	
	3.3	Conditional probability, independence of events, total probability law, Bayes' theorem (without proof) with examples.	6	5,6,7
4	4.1	Introduction to spreadsheet	5	1
	4.2	Using spreadsheet solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	25	7,8

	Teacher Specific Content	Hrs	


Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	MODE OF ASSESSMENT <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical: 15 marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 60 marks</p> <p>i) Short answer type questions: Answer any 9 questions out of 12 ($9 \times 2 = 18$).</p> <p>ii) Short essay type questions: Answer any 5 questions out of 7 ($5 \times 6 = 30$).</p> <p>iii) Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$).</p> <p>Practical: 10 marks Problem solving skills: 10 marks,</p>

References

1. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Gupta, S.P. (2021). Statistical Methods, 46th Edition, Sultan Chand and

Sons:NewDelhi.

3. Beverly J. Dretzke.(2008). Statistics with Microsoft Excel,4th Edition, Pearson.
4. Medhi,J.(2006).Statistical Methods, 2nd Edition, New Age International Publishers.
5. Mukhopadhyay,P.(1999). Applied Statistics, New Central Book Agency Private Limited, Kolkata.

		MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)				
Programme	Minor for BSc/BA/B Com					
Course Name	Basic Statistics and Data Visualisation					
Type of Course	DSC C					
Course Code	MCE1DSCSTA102					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, probability theory, correlation, regression and their real-world applications. Additionally, spread sheet functions are used to address numerical challenges associated with the Topics discussed.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Explain and understand the concepts of different types of data, sampling and sampling techniques.	U	1
2	Summarise data using various measures of central tendency, dispersion, skewness and kurtosis.	U	1

3	Analyse relationships between variables using scatter diagrams, correlation coefficients and regression analysis.	A, An	1
4	Develop skills in solving real-world problems through the application of regression techniques, particularly in predicting outcomes and understanding the limitations of predictions.	An, A	2, 3
5	Understand basic probability concepts including random experiments, samples pace and elementary ideas of probability.	U	2
6	Apply Bayes' theorem to update probabilities based on new information and evidence.	E	1
7	Understand how statistical concepts are relevant across disciplines, fostering interdisciplinary thinking.	U	2
8	Apply using spreadsheets to illustrate and analyse Statistical concepts, enhancing practical skills.	A, An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT:Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Types of data and variables: Concepts of primary data and secondary data, examples of univariate and bivariate data type, Diagrams and Graphs: Bar diagrams, pie diagram and frequency graphs.	2	1
	1.2	Scales of measurements: Ordinal, nominal, ratio and interval.	2	1,7
	1.3	Population and sample, Types of sampling: Non-probability and Probability sampling: Simple random sampling, systematic sampling, stratified random sampling and cluster sampling with real-life examples (derivations not required).	3	2
	1.4	Measures of central tendency: Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), median and mode (examples using raw data).	3	2
	1.5	Measures of dispersion: Range, Quartile Deviation (QD), Mean Deviation (MD) and Standard Deviation (SD), Coefficient of Variation (CV). (examples using raw data). Box Plot.	3	2
	1.6	Moments, skewness and kurtosis with examples using raw data. (derivations not required).	2	1,2
2	2.1	Correlation, scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient. (Only the concepts, problems and properties-without proof of the above topics).	8	3
	2.2	Regression: Two types of regression lines, formula and numerical problems.	7	4,7
3	3.1	Random experiment, sample space and event with examples.	4	5
	3.2	Elementary ideas of probability: Frequency, classical and axiomatic definitions with examples.	5	5

	3.3	Conditional probability, independence of events, total probability law, Bayes' theorem (without proof) with examples.	6	5,6,7
4	4.1	Introduction to spreadsheet	5	1
	4.2	Using spreadsheets solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	25	7,8

Module 5	Teacher specific topics	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i> Theory: 5 marks Quiz, Assignments Practical: 15 marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i> Theory: 10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 60 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 7 questions out of 10 ($7 \times 2 = 14$). ii) Short essay type questions: Answer any 4 questions out of 6 ($4 \times 6 = 24$). iii) Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$). <p>Practical: 10 marks Problem solving skills: 10 marks,</p>

References

1. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Gupta, S.P. (2021). Statistical Methods, 46th Edition, Sultan Chand and Sons: New Delhi.

3. Beverly J. Dretzke.(2008). Statistics with Microsoft Excel,4th Edition, Pearson.
4. Medhi,J.(2006).Statistical Methods, 2nd Edition, New Age International Publishers.
5. Mukhopadhyay,P.(1999). Applied Statistics, New Central Book Agency Private Limited, Kolkata.



Programme	Minor for BSc/BA/B Com					
Course Name	Business Statistics					
Type of Course	DSC C					
Course Code	MCE1DSCSTA103					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, probability theory, correlation, regression and their real-world applications. Additionally, spread sheet functions are used to address numerical challenges associated with the Topics discussed.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Explain and understand the concepts of different types of data, sampling and sampling techniques.	U	1
2	Summarise data using various measures of central tendency, dispersion, skewness and kurtosis.	U	1

3	Analyse relationships between variables using scatter diagrams, correlation coefficients and regression analysis.	A, An	1
4	Develop skills in solving real-world problems through the application of regression techniques, particularly in predicting outcomes and understanding the limitations of predictions.	An, A	2, 3
5	Understand basic probability concepts including random experiments, samples pace and elementary ideas of probability.	U	2
6	Apply Bayes' theorem to update probabilities based on new information and evidence.	E	1
7	Understand how statistical concepts are relevant across disciplines, fostering interdisciplinary thinking.	U	2
8	Apply using spreadsheets to illustrate and analyse Statistical concepts, enhancing practical skills.	A, An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT:Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Types of data and variables: Concepts of primary data and secondary data, examples of univariate and bivariate data type, Diagrams and Graphs: Bar diagrams, pie diagram and frequency graphs.	2	1
	1.2	Scales of measurements: Ordinal, nominal, ratio and interval.	2	1,7
	1.3	Population and sample, Types of sampling: Non-probability and Probability sampling: Simple random sampling, systematic sampling, stratified random sampling and cluster sampling with real-life examples (derivations not required).	3	2
	1.4	Measures of central tendency: Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), median and mode (examples using raw data).	3	2
	1.5	Measures of dispersion: Range, Quartile Deviation (QD), Mean Deviation (MD) and Standard Deviation (SD), Coefficient of Variation (CV). (examples using raw data). Box Plot.	3	2
	1.6	Moments, skewness and kurtosis with examples using raw data. (derivations not required).	2	1,2
2	2.1	Correlation, scatter diagram, Karl Pearson's correlation coefficient, Spearman's rank correlation coefficient. (Only the concepts, problems and properties-without proof of the above topics).	8	3
	2.2	Regression: Two types of regression lines, formula and numerical problems.	7	4,7
3	3.1	Random experiment, sample space and event with examples.	4	5
	3.2	Elementary ideas of probability: Frequency, classical and axiomatic definitions with examples.	5	5

	3.3	Conditional probability, independence of events, total probability law, Bayes' theorem (without proof) with examples.	6	5,6,7
4	4.1	Introduction to spreadsheet	5	1
	4.2	Using spreadsheets solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	25	7,8

Module 5	Teacher Specific Topics.	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	MODE OF ASSESSMENT <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i> Theory: 5 marks Quiz, Assignments Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i> Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9 \times 2 = 18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5 \times 6 = 30$). iii) Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Gupta, S.C. and Kapoor, V.K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Gupta, S.P. (2021). Statistical Methods, 46th Edition, Sultan Chand and

Sons:NewDelhi.

3. Beverly J. Dretzke.(2008). Statistics with Microsoft Excel,4th Edition, Pearson.
4. Medhi,J.(2006).Statistical Methods, 2nd Edition, New Age International Publishers.
5. Mukhopadhyay,P.(1999). Applied Statistics, New Central Book Agency Private Limited, Kolkata.



Programme	Minor for BSc/BA/B Com					
Course Name	Fundamentals of Applied Statistics					
Type of Course	DSC B					
Course Code	MCE1DSCSTA104					
Course Level	100-199					
Course Summary	This course aims to introduce the concept of applied statistical tools time series analysis and index numbers.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand the importance of time series analysis in real life problems.	U, Ap	1, 2
2	Apply the concept of additive and multiplicative models in decomposing the components of a time series data.	U, A, Ap	1, 2
3	Estimate the trend component present in a time series.	A, An, E	1, 2
4	Estimate the seasonal and cyclical variations.	A, An, E	2

5	Forecast future values of a time series based on past data.	A	2
6	Understand the concepts of index numbers and its construction.	U	1
7	Explain the tests for index numbers, various formulae and their comparisons.	U, A & E	2
8	Apply R programming to solve numerical problems.	A	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to time series, real world examples, components of time series.	3	1
	1.2	Additive and Multiplicative models	2	1, 2
	1.3	Measurement of secular trend: Graphical method, Method of Semi Averages, Method of moving averages, Method of least squares (linear, quadratic and exponential).	5	1, 3
	1.4	Measurement of Seasonal Variation: Simple average method, Ratio to trend method, Ratio to moving average method.	5	1,4
2	2.1	Forecasting based on smoothing: Moving averages.	4	5
	2.2	Simple Exponential Smoothing	3	5
	2.3	Holt's exponential smoothing	3	3, 5
	2.4	Holt-Winter's exponential smoothing	3	4, 5
	2.5	Measures of forecast accuracy.	2	5
3	3.1	Index Numbers: Meaning and types of index numbers-Weighted and Unweighted index numbers.	3	6
	3.2	Laspeyre's, Paasche's, and Fisher's index numbers.	3	6
	3.3	Construction of Index Numbers: Methods of construction of price and quantity Indices.	4	6, 7
	3.4	Test on index numbers: Factor reversal test, Time reversal test.	3	7
	3.5	Consumer price index number and its uses.	2	6,7
4	4.1	Introduction to spreadsheet and R	5	8
	4.2	Using spreadsheet, and R solve numerical problems associated with, topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	25	8

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Cowpewart, Paul, S.P., and Andrew V. Metcalfe. (2009). Introductory time series with R.Springer Science & Business Media
2. Gupta,S.C. and. Kapoor,V.K. (2018). Fundamentals of Applied Statistics, Sultan Chand & Co. New Delhi.
3. Box, George EP, et al. (2015). Time series analysis: Forecasting and Control. John Wiley& Sons.
4. Mukhopadhyay, P. (1999). Applied Statistics, New Central Book Agency PrivateLimited, Kolkata.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Elementary Data Analysis Using Spreadsheets					
Type of Course	MDC					
Course Code	MCE1MDCSTA100					
Course Level	100-199					
Course Summary	This comprehensive course covers fundamental spreadsheet operations, including basic calculations, data entry, and manipulation using mathematical operators and built-in functions.					
Semester	1	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		2		1		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Explain the significance of spreadsheet applications	U	1, 2
2	Apply basic Mathematical formula in Spreadsheet	A	2
3	Demonstrate the predefined and conditional functions in spreadsheets.	A	2
4	Illustrate the basic plotting tools in spreadsheets.	A	1
5	Analyse the data using descriptive statistics tools in spreadsheet.	An	2
<p>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</p>			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Basics of Spreadsheets and data types, Entering data into cells, importing data from other formats and exporting data into other formats.	3	1
	1.2	Using mathematical operators (+, -, *, /), Using built-in functions (SUM, AVERAGE, MIN, MAX).	2	2
	1.3	Understanding cell references (relative vs. Absolute), Sorting data alphabetically or numerically or in a custom order, Filtering data based on specific criteria.	5	3
	1.4	Removing duplicates from datasets, Formatting Spreadsheets, Data validations, conditional formatting, conditional statements and vlookup and hlookup operators.	5	3
2	2.1	Importance of Data visualization in data analysis.	2	4
	2.2	Creating different types of charts and graphs such as bar charts, line graphs, pie charts, histograms and scatter plots. Adding labels, titles and legends. Interpretation of charts and Graphs	6	4
	2.3	Pivot tables and interpretations	3	3
	2.4	Computing measures of central tendency (Mean, Median and Mode) and dispersion (Standard deviation), Correlation.	4	5
3	3.1	Formatting data using spreadsheets incorporating all methods in module 1.	10	3
	3.2	Applying various Data visualisation techniques in real datasets.	10	4
	3.3	Using spreadsheets analyse various datasets with topics covered in the first two modules.	10	5

Module 4	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar
---------------------------------------	--

	<p>6. Group Assignments</p> <p>7. Authentic learning</p> <p>8. Presentation by students bygroup</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 10 marks Quiz, Assignments</p> <p>Practical: 8 marks Lab involvement, Practical Record, Viva voce</p> <p><i>Summative assessment</i></p> <p>Theory: 5 marks Written tests</p>
	<p>B. Semester End examination</p> <p>Theory: 35 marks</p> <p>i) MCQ: 10 questions (10*1=10).</p> <p>ii) Short essay type questions: Answer any 3 questions out of 5 (3*5=15).</p> <p>iii) Essay type questions: Answer any 1 question out of 2 (1*10=10).</p> <p>Practical: 17 marks Problem solving skills: 17 marks</p>

References

1. Manohar, H.L. (2017). Data Analysis and Business Modeling Using Microsoft Excel. Prentice Hall of India, New Delhi.
2. Dan Remenyi, George Onofrei, Joe English (2010). An Introduction to Statistics Using Microsoft Excel. Academic Publishing Ltd., UK
3. Neil J Salkind (2010). Excel Statistics, A Quick Guide. SAGE Publication Inc. New Delhi
4. Vijai Gupta (2002). Statistical Analysis with Excel. VJ Books Inc. Canada



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Fundamentals of Statistics & Computational Methods					
Type of Course	MDC					
Course Code	MCE1MDCSTA101					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, techniques for representing and summarizing data using measures of central tendency and dispersion.					
Semester	1	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any						
		2		1		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Define Statistics and its scope in various fields of study	U	1
2	Construct tables and diagrams to organise and summarize data efficiently for analysis.	A, An	1
3	Compute measures of central tendency including mean, median and mode to identify typical or central values within a data set	A, An	1,2
4	Summarise data using various measures of dispersion	An, A	1,2
5	Apply using spreadsheets to illustrate and analyze statistical concepts, enhancing practical skills.	A, An	1,2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Definition of Statistics, Scope of Statistics	3	1
	1.2	Concepts of statistical population and sample	3	1
	1.3	Collection of data	3	1
	1.4	Types of data	3	1
2	2.1	Scale of measurements	3	1,2
	2.2	Classification of data, Tabulation of data	3	1,2
	2.3	Diagrammatic representation of data	3	1,2
	2.4	Arithmetic Mean	2	1,2
	2.5	Median & Mode	3	2
3	3.1	Geometric Mean, Harmonic Mean	3	3
	3.2	Measures of Dispersion - Definition	3	3
	3.3	Absolute Measures of Dispersion	3	3
	3.4	Basics of MS Excel, Frequency distributions for organizing and summarizing data using MS-Excel	15	5
	3.5	Measures of Central Tendency-practical using MS-Excel	5	5
	3.6	Measures of Dispersion-practical using MS-Excel	5	5

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
---------------------------------------	---

Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 10 marks Quiz, Assignments</p> <p>Practical: 8 marks Lab involvement, Practical Record, Viva voce</p> <p><i>Summative assessment</i></p> <p>Theory: 5 marks Written tests</p>
	<p>B. Semester End examination</p> <p>Theory: 35 marks</p> <p>i) MCQ: 10 questions (10*1=10). ii) Short essay type questions: Answer any 3 questions out of 5 (3*5=15). iii) Essay type questions: Answer any 1 question out of 2 (1*10=10).</p> <p>Practical: 17 marks Problem solving skills: 17 marks</p>

References

1. Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Prem. S. Mann (2010). Introductory Statistics, 7th edition, Wiley
3. Mario F Triola, Elementary Statistics using Excel, (2018), 6 th edition

SEMESTER 2

	<h3 style="margin: 0;">MAHARAJA'S COLLEGE, ERNAKULAM</h3> <p style="margin: 0;">(Govt. Autonomous)</p>
---	--

Programme	Minor for BSc/BA/B Com					
Course Name	Introduction to Statistical Modeling					
Type of Course	DSC B					
Course Code	MCE2DSCSTA100					
Course Level	100-199					
Course Summary	To acquire the basic knowledge of theory of random variables, various probability functions and their applications. Also, spreadsheet functions are used to solve numerical problems associated with the topics discussed.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		3		1		75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Examine major components of random variable theory and distribution theory.	U	1
2	Develop skills required to effectively understand various distributions.	S	2
3	Analyse several applications and advantages of distributions.	An	2
4	Evaluate fitting procedure of distribution and its simulation using spread sheet.	A,E& S	2
<p>*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)</p>			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Univariate random variables in discrete and continuous cases.	2	1
	1.2	Probability mass function, probability density function and their properties, distribution function of a random variable: Definition and properties.	3	1
	1.3	Functions of random variable, transformations of random variable (univariate).	2	1
	1.4	Bivariate random variable, Joint probability mass function, joint probability density function and their properties, joint distribution function and its properties (Discrete case only) .	4	1
	1.5	Marginal and conditional distributions, Independence of random variables (Discrete case only).	6	1
2	2.1	Mathematical expectation, its properties and simple problems.	4	1
	2.2	Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), Mean Deviation and Variance in terms of expectation and evaluate simple problems.	5	1
	2.3	Moment generating function, elementary properties	2	1
3	3.1	Uniform distribution and Bernoulli distribution, Binomial distribution and its properties, simple problems.	3	2
	3.2	Poisson distribution and its properties, simple problems. Geometric distribution, its characteristics and lack of memory property.	4	2
	3.3	Continuous uniform distribution and its properties, Exponential distribution.	2	2
	3.4	Gamma distribution and their characteristics. Lack of memory property of exponential distribution.	3	2
	3.5	Normal distribution and its properties. Standard normal distribution and use of standard normal tables, problems.	5	3
4	4.1	Use spread sheet functions to solve numerical problems associated with topics covered in various modules. (A practical record with minimum 10 problems has to be submitted).	30	4

Module	Teacher Specific Content	Hrs	
5			

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Mukhopadhyay, P. (1996). Mathematical Statistics. New Central Book Agency (P) Ltd., Calcutta.
2. Beverly J. Dretzke. (2008). Statistics with Microsoft Excel, Fourth Edition, Pearson.
3. Gupta, S.C. and Kapoor, V.K.(2002). Fundamentals of Mathematical Statistics. Sultan Chand, New Delhi.
4. Bhat, B.R., Venkata Ramana, T. and Rao Madhava, K.S. (1977). Statistics: A Beginners Text Vol-2, New Age International (P)Ltd., New Delhi.
5. Goon, A.M., Gupta, N.K., and Das Gupta, B.(1999). Fundamentals of Statistics- Vol.2. World Press, Kolkata.
6. Rohatgi, V.K. and Saleh, A.M.E.(2001). An Introduction to Probability and Statistics. 2nd Edition. John Wiley & Sons, Inc, New York.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Random Variables and Probability Distributions					
Type of Course	DSC B					
Course Code	MCE2DSCSTA101					
Course Level	100-199					
Course Summary	To acquire the basic knowledge of theory of random variables, various probability functions and their applications. Also, spreadsheet functions are used to solve numerical problems associated with the topics discussed.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		3		1		75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Examine major components of random variable theory and distribution theory.	U	1
2	Develop skills required to effectively understand various distributions.	S	2
3	Analyse several applications and advantages of distributions.	An	2
4	Evaluate fitting procedure of distribution and its simulation using spread sheet.	A,E& S	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Univariate random variables in discrete and continuous cases.	2	1
	1.2	Probability mass function, probability density function and their properties, distribution function of a random variable: Definition and properties.	3	1
	1.3	Functions of random variable, transformations of random variable (univariate).	2	1
	1.4	Bivariate random variable, Joint probability mass function, joint probability density function and their properties, joint distribution function and its properties (Discrete case only) .	4	1
	1.5	Marginal and conditional distributions, Independence of random variables (Discrete case only).	6	1
2	2.1	Mathematical expectation, its properties and simple problems.	4	1
	2.2	Arithmetic Mean (AM), Geometric Mean (GM), Harmonic Mean (HM), Mean Deviation and Variance in terms of expectation and evaluate simple problems.	5	1
	2.3	Moment generating function, elementary properties	2	1
3	3.1	Uniform distribution and Bernoulli distribution, Binomial distribution and its properties, simple problems.	3	2
	3.2	Poisson distribution and its properties, simple problems. Geometric distribution, its characteristics and lack of memory property.	4	2
	3.3	Continuous uniform distribution and its properties, Exponential distribution.	2	2
	3.4	Gamma distribution and their characteristics. Lack of memory property of exponential distribution.	3	2
	3.5	Normal distribution and its properties. Standard normal distribution and use of standard normal tables, problems.	5	3
4	4.1	Use spread sheet functions to solve numerical problems associated with topics covered in various modules. (A practical record with minimum 10 problems has to be submitted).	30	4

Module	Teacher Specific Content: Basic concepts of the following:	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments
---------------------------------------	---

	<p>7. Authentic learning 8. Presentation by students by group</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i> Theory: 5 marks Quiz, Assignments Practical:15marks Lab involvement, Practical Record, Viva-voce <i>Summative assessment</i> Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <p>i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any 1 question out of 2 ($1*12=12$).</p> <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Mukhopadhyay, P. (1996). Mathematical Statistics. New Central Book Agency (P) Ltd., Calcutta.
2. Beverly J. Dretzke. (2008). Statistics with Microsoft Excel, Fourth Edition, Pearson.
3. Gupta, S.C. and Kapoor, V.K.(2002). Fundamentals of Mathematical Statistics. Sultan Chand, New Delhi.
4. Bhat, B.R., Venkata Ramana, T. and Rao Madhava, K.S. (1977). Statistics: A Beginners Text Vol-2, New Age International (P)Ltd., New Delhi.
5. Goon, A.M., Gupta, N.K., and Das Gupta, B.(1999). Fundamentals of Statistics- Vol.2. World Press, Kolkata.
6. Rohatgi, V.K. and Saleh, A.M.E.(2001). An Introduction to Probability and Statistics. 2nd Edition. John Wiley & Sons, Inc, New York.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Probability and Probability Distributions					
Type of Course	DSC C					
Course Code	MCE2DSCSTA102					
Course Level	100-199					
Course Summary	This course aims to introduce the concept of applied statistical tools and probability distributions					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any	Level 100 knowledge of Statistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Define random variables, compute their probabilities, and consequently develop probability and cumulative probability distributions.	U	1
2	Recognize and interpret moments of a distribution through mathematical expectation	U	1
3	Apply transformation of random variables to obtain new distributions.	A	2
4	Develop proficiency in handling probability problems using statistical software and analyzing probability distributions.	A	2
5	Communicate the solutions to probability problems effectively and enhance the ability to present information clearly and concisely	S	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C),			

Skill (S), Interest (I) and Appreciation (Ap)
--

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Random Variables-Discrete and Continuous, Probability Distributions- Probability Mass Function,	3	1
	1.2	Probability Density Function and Cumulative (distribution) function and their properties, Change of variables (Univariate only), Jacobian of transformation	3	2,3
	1.3	Mathematical Expectation, Expectation of a Random Variable, Moments in terms of Expectations,	3	2
	1.4	Moment Generating Functions (m.g.f.) and its properties. Characteristic Functions and its simple properties, Conditional Expectations	3	2
	1.5	Bivariate random variables- Definition- Discrete and Continuous, Joint Probability Density Functions, Marginal and Conditional Distributions, Independence of Random Variables.	3	3
2	1.1	Discrete Probability Distributions – Uniform: Geometric;	4	4
	2.2	Bernoulli; Binomial; Poisson; Hypergeometric;	5	4
	2.3	Fitting of Distributions (Binomial and Poisson). Properties – Mean, Variance, Moment Generating Functions	3	4
	2.4	Additive property; Recurrence relation for moments (binomial and Poisson), Lack of memory property of Geometric distribution	3	4
3	3.1	Continuous distributions – Uniform, Exponential	2	4
	3.2	Normal; Standard Normal – definitions, Cauchy Distribution (definition only), Mean, Variance, Moment Generating Function, Additive property.	3	4
	3.3	Lack of memory property of exponential distribution, Fitting of Normal distribution,	5	4
	3.4	Use of Standard Normal Tables for Computation of Various Probabilities. Problems from Normal Distribution	3	5
		Tchebycheff's Inequality and its applications, Weak Law of Large Numbers, Bernoulli's Law of Large Numbers, Central Limit Theorem- Lindberg-Levy form.	2	5
4		Basic training for the computer implementation	15	
		Problems from unit-1 using technology	5	
		Problems from the unit-2 using technology	5	
		Problems from the unit-3 using technology	5	

Module 5	Teacher Specific Content	Hrs	
----------	--------------------------	-----	--

--	--	--	--

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Sharma, J.K., Business Statistics, Pearson Education.
2. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House.
3. Gupta, S.P. & Gupta, Archana, Elementary Statistics, Sultan Chand and Sons, New Delhi.
4. Elhance D N, Elhance, Veena and Aggarwal B M, Fundamentals of Statistics, Kitab Mahal
5. Gupta,C Band Gupta, Vijay., An Introduction to Statistical Methods, Vikas Publishing House
6. Pillai, RSN and Bhagavathi., Statistics, S Chand & Co.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Quantitative Data Analysis for Business Research					
Type of Course	DSC C					
Course Code	MCE2DSCSTA103					
Course Level	100-199					
Course Summary	This course aims to introduce the concept of applied statistical tools time series analysis and index numbers.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		3		1		75
	Level 100 knowledge of Statistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Demonstrate proficiency in applying the concepts of matrices.	U	1
2	Understanding and evaluating the Time Series components forces affecting data.	U, E	1
3	Develop skills in interpreting index numbers and analyze data to help entrepreneurial decisions using critical thinking skills.	S	2
4	Understand various methods of collecting market related data and interpret them	A	2
5	Conduct a social survey and data analysis using Spreadsheet.	S	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		Matrix– addition and Subtraction	2	1
		Matrices - Multiplication	2	1
		Transpose of a matrix, Diagonal Matrix Identity Matrix, Scalar Matrix, Orthogonal Matrix, Adjoint of a matrix	2	1
		Determinants, Inverse of a matrix	4	1
		Application of matrices in business and commerce - (Simple problems)	5	1
2		Time Series Analysis –Meaning - Definition-Components of Time Series -Time series analysis- Utility of Time Series Analysis- Mathematical models-	4	2
		Determination of Trend- Freehand curve method-	3	2
		Method of semi-averages - Method of Moving Average-	4	2
		Method of Least Squares (first degree only)	4	2
3	3.1	Index Numbers: Meaning and types of index numbers-Weighted and Unweighted index numbers.	3	3
	3.2	Laspeyre’s, Paasche’s, and Fisher’s index numbers.	3	3
	3.3	Construction of Index Numbers: Methods of construction of price and quantity Indices.	4	3
	3.4	Test on index numbers: Factor reversal test, Time Reversal test.	3	3
	3.5	Consumer price index number and its uses.	2	4
4	4.1	Field Study – Collection of data– both primary and secondary for bivariate analysis	15	4
	4.2	Calculation of correlation co- efficient including using spreadsheet packages	5	4
	4.3	Predictions using Time series for business data	5	5
	4.4	Business Application of Probability	5	5

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <p>i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$).</p> <p>ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$).</p> <p>iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$).</p> <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Sharma, J.K., Business Statistics, Pearson Education.
2. Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House.
3. Gupta, S.P. & Gupta, Archana, Elementary Statistics, Sultan Chand and Sons, New Delhi.
4. Elhance D N, Elhance, Veena and Aggarwal B M, Fundamentals of Statistics, Kitab Mahal
5. Gupta,C Band Gupta, Vijay., An Introduction to Statistical Methods, Vikas Publishing House
6. Pillai, RSN and Bhagavathi., Statistics, S Chand & Co.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Exploratory Data Analysis Using R					
Type of Course	DSC					
Course Code	MCE2DSCSTA104					
Course Level	100-199					
Course Summary	This course introduces the methods for data preparation and data understanding. It covers essential exploratory techniques for understanding data by summarizing it through statistical methods and graphical methods. Supports to Summarize the insurers use of predictive analytics, data science and Data Visualization					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand data types and structure of R	U	1
2	Summarize the data using basic statistics.	A	2
3	Visualize the data using basic graphs and plots	A, An	2
4	Identify the outliers if any in the data set	An, A	2
5	Choose appropriate models for the data	A	2
6	Techniques for handling multi-dimensional data	A	1
7	Random number generations from distribution	E	1
8	Resembling from generated distributions	U	3

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

Skill (S), Interest (I) and Appreciation (Ap)
--

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to R programming: Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types. Transforming Data, Creating Variables - Numeric, Character and Logical Data - Vectors -Data Frames,	4	1
	1.2	R structures: Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages. R data sets	4	1
	1.3	Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files.	5	1
	1.4	Data manipulation: Data cleaning, dealing with missing observations in data, sub-setting, Extracting a subset of a data frame outlier identification	4	4
2	2.1	Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts, stacked plots, Box and Whisker Plots. Customize plot axes, labels, add legends, and add colours.	5	3
	2.2	Descriptive statistics in R: Measures of central tendency - Measures of variability - Skewness and kurtosis - Summary functions, describe functions, and descriptive statistics by group.	6	2
	2.3	Relation between variables: identification using scatter plot, QQ plot, construction of contingency tables, multidimensional data plotting and identification of distributions.	4	6
	2.4	Predictive Analytics: linear Regression model, The R Function lm, Non-Linear Least Square, multiple regression analysis, Scrutinizing the Residuals.	5	5
3	3.1	Generate and Visualize Discrete and continuous distributions using the statistical environment. Demonstration of	4	3

		CDF and PDF uniform and normal, binomial Poisson distributions		
	3.2	Distributions: Computing the probability and quantiles corresponding to a probability, p values	5	2
	3.3	Random numbers: Random number generation from the uniform and normal, binomial Poisson, etc. Distributions using R	5	6
	3.4	Distribution of generated random numbers: Checking normality, outliers, Matching a Density to Data, manipulation and study of the distributional properties of the generated random numbers	5	5
4	4.1	Random experiments: Replicate Random experiments using R and compute the probabilities and corresponding random numbers	4	6
	4.2	Visualization of CLT, sampling distribution, random walk etc. using R	4	5
	4.3	Sampling in R: Different sampling techniques, SRS (WR), SRS (WOR) in R, Probability sampling	3	6
	4.4	Re-sampling, bootstrap sampling in R	3	7

Module 5	Teacher Specific Content	Hrs	
5			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction * Min. 10)
	<ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Individual assignments 5. Interactive Instruction 6. Seminar 7. Group Assignments 8. Authentic learning 9. Presentation by students by group 10. group discussions

Assessment Types	MODE OF ASSESSMENT
	<p style="text-align: center;">A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p style="text-align: center;">B. Semester End examination</p> <p>Theory:60marks</p> <p>i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$).</p> <p>ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$).</p> <p>iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$).</p> <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Braun & Murdoch (2007), "A first course in statistical programming with R", Cambridge University Press, New Delhi.
2. Crawley, M. J. (2006), "Statistics - An introduction using R", John Wiley, London 32.
3. Dalgaard. P., Introductory Statistics with R, 2nd Edition. (Springer 2008)
4. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
5. Maria Dolores Ugarte , Ana F. Militino , Alan T. Arnholt "Probability and Statistics with R" 2nd Edition on, CRC Press, 2016.
6. Michael Akritas, " Probability & Statistics with R for Engineers and Scientists", 2nd Edition on, CRC Press, 2016.
7. Purohit, S.G.; Gore, S.D. and Deshmukh, S.R. (2015), "Statistics using R", second edition. Narosa Publishing House, New Delhi.
8. Shahababa B. (2011) , "Biostatistics with R", Springer, New York.
9. Venables W. N., Smith D.M. and the R Core Team, "An Introduction to R", 2013.
10. Roger R. Peng. D. And Lulu, (2016) Exploratory Data Analysis with R.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Data Analysis Using SPSS					
Type of Course	MDC					
Course Code	MCE2MDCSTA100					
Course Level	100-199					
Course Summary	This course intends to provide a sound understanding of data analysis and how it could be applied to different research activities. Students will learn data visualization techniques as well as how to perform basic statistical analysis and hypothesis testing using SPSS. By the end of the course, students will have the skills to effectively manage and analyze data, choose appropriate statistical techniques, and interpret results.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		2		1		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand the basic concepts of data analysis.	U	1, 2
2	Develop different graphs by using SPSS software	A	2
3	Develop in-depth understanding about the concept of descriptive statistics	A	2
4	Understand the fundamental concepts of testing of hypothesis and regression analysis.	U	1
5	Perform basic statistical analysis and its interpretation based on SPSS.	A, An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to data: Type of Scale of Measurements, Choosing appropriate scale and measurement to the data.	3	1
	1.2	Graphical Representation of Data: Pie chart, Bar chart, and Histogram.	2	1, 2
	1.3	Frequency Table, Measures of central tendency (Mean, Median and Mode) and dispersion (Standard deviation).	5	1, 3
	1.4	Cross-tabulation, Scatter diagram, Correlation (Karl Pearson's and Spearman's rank Correlation)	5	1, 2, 3
2	2.1	Testing of Hypothesis: Null and Alternative hypothesis, Type I and Type II errors, Significance level, p-value, One sample t test, Two sample independent t test, F test, Paired t test. One way ANOVA.	5	4
	2.2	Regression analysis: Simple and Multiple regression Analysis.	7	4, 5
	2.3	Chi square test for independence.	3	4, 5
3	3.1	Getting to know SPSS: Working with data file, SPSS windows, Menus.	3	1, 2
	3.2	Preparing the Data file: Creating data file, Defining the variables, data entry, modifying data file, import file.	4	1, 2
	3.3	Data handling: Recode variables, Transform variables, Split-select cases.	3	1, 2
	3.4	Using SPSS solve numerical problems associated with topics covered in the first two modules.	20	5

Module 4	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments
---------------------------------------	--

	<p>7. Authentic learning</p> <p>8. Presentation by students bygroup</p>
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 10 marks Quiz, Assignments</p> <p>Practical: 8 marks Lab involvement, Practical Record, Viva voce</p> <p><i>Summative assessment</i></p> <p>Theory: 5 marks Written tests</p>
	<p>B. Semester End examination</p> <p>Theory: 35 marks</p> <p>i) MCQ: 10 questions (10*1=10).</p> <p>ii) Short essay type questions: Answer any 3 questions out of 5 (3*5=15).</p> <p>iii) Essay type questions: Answer any 1 question out of 2 (1*10=10).</p> <p>Practical: 17 marks Problem solving skills: 17 marks</p>

References

1. Field, A. (2024). Discovering statistics using IBM SPSS Statistics. SAGE Publications Limited.
2. Greasley, P. (2007). Quantitative data analysis using SPSS: An introduction for health and social sciences. McGraw-Hill Education (UK).
3. George, D., & Mallery, P. (2019). IBM SPSS Statistics 26 step by step: A simple guide and reference. Routledge.
4. McCormick, K., & Salcedo, J. (2017). SPSS statistics for data analysis and visualization. John Wiley & Sons.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Biostatistics & Basic Computational Skills					
Type of Course	MDC					
Course Code	MCE2MDCSTA101					
Course Level	100-199					
Course Summary	This course helps to acquire basic knowledge of various types of data, presentation of data using diagrams and graphs measures of central tendency and dispersion. Besides, some basic knowledge of MS Office packages also discussed.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		2		1		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Define Statistics and its scope in biological field	U	1
2	Construct tables and diagrams to organise and summarize data efficiently for analysis.	A, An	1
3	Compute measures of central tendency like mean, median and mode and measures of dispersion like mean deviation, standard deviation, coefficient of variation	A, An	2
4	Understand the basics of MS Office package for analysis, report preparation and its presentation	U	2
5	Apply using spreadsheets to illustrate and analyze Statistical concepts, enhancing practical skills.	A, An	2
6	Prepare reports using the analysed data using MS Word	A	2

	and presentation of the report using MS Powerpoint		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Definition of Statistics Scope of Statistics in the field of biology	2	1
	1.2	Concepts of statistical population and sample, Collection of data	3	1
	1.3	Types of data and their classification	3	1
	1.4	Tabulation and Diagrammatic representation of data	5	1
2	2.1	Measures of Central Tendency-Mean, Median & Mode	6	2,3
	2.2	Measures of Dispersion-Mean deviation, Standard deviation, Coefficient of variation	6	2,3
	2.3	MS Word: Word processing using word editing tools, formatting tools, inserting tables, draw, inserting graphs and pictures	4	4
	2.4	MS Excel: Creating worksheet data entry, sorting, use of statistical tools (sum, mean, median, mode, variance) in Excel. Preparation of graphs (bar diagram, pie diagram and line graph)	5	4,5
3	3.1	MS PowerPoint: Creating a presentation, inserting tables, charts and pictures into slides, use of animation tools in PowerPoint	5	6
	3.2	Analysis using some collected data	15	5
	3.3	Preparation of reports using MS Word	3	6
	3.4	Presentation of the results using MS PowerPoint	3	6

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
	<ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group

Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 10 marks Quiz, Assignments</p> <p>Practical: 8 marks Lab involvement, Practical Record, Viva voce</p> <p><i>Summative assessment</i></p> <p>Theory: 5 marks Written tests</p>
	<p>B. Semester End examination</p> <p>Theory: 35 marks</p> <p>i) MCQ: 10 questions (10*1=10). ii) Short essay type questions: Answer any 3 questions out of 5 (3*5=15). iii) Essay type questions: Answer any 1 question out of 2 (1*10=10).</p> <p>Practical: 17 marks Problem solving skills: 17 marks</p>

References

1. Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Prem. S. Mann (2010). Introductory Statistics, 7th edition, Wiley
3. Mario F Triola, Elementary Statistics using Excel, (2018), 6 th edition



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Statistics for Managerial Decision Making					
Type of Course	MDC					
Course Code	MCE2MDCSTA102					
Course Level	100-199					
Course Summary	To make students aware of importance of managerial decisions and the use of Statistical theories in developing scientific decisions.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any						
	2			1		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	To make students aware of importance of managerial decisions and the use of Statistical theories in developing scientific decisions	U	1
2	Discuss the outcome of any payoff	A, An	1
3	Assessing the purpose of Inventory for smooth Business operations and critically evaluate ethical implications of statistical methods aligning with human values.	A, An	1,2
4	Explain the simulation of a real system	U, An, A	1,2
5	Describe the role of game theory in business and analyze data to help entrepreneurial decisions using critical thinking skills	A, An	1,2

6	Define probability and discuss expected values.	U, A, An	
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Environment Uncertainty and Conflict	2	1
	1.2	Decision Alternatives	3	1
	1.3	States of Nature	3	1
	1.4	Pay Off, Computation of Expected Monetary Value	3	1
2	2.1	Inventory Management.	5	1,2
	2.2	Parameters of Inventory management.	3	1,2
	2.3	Economic Order Quantity with and without lead time	3	1,2
	2.4	Simulation, Monte Carlo Method	4	3
3	3.1	Use of simulation in Inventory	3	3
	3.2	Game theory	4	3
	3.3	Strategy, Pay off, Pay off matrix,	5	4
	3.4	Pure and Mixed strategies, Value of game	5	4
	3.5	Saddle Point and solution, Principle of Dominance	10	5
	3.6	Solving 2x2 games, Graphical solution of 2xn and nx2 games	7	5

Module 5	Teacher Specific topics	Hrs	


Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
	<ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar

	6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) <i>Formative assessment</i> Theory: 10 marks Quiz, Assignments Practical: 8 marks Lab involvement, Practical Record, Viva voce <i>Summative assessment</i> Theory: 5 marks Written tests
	B. Semester End examination Theory: 35 marks i) MCQ: 10 questions (10*1=10). ii) Short essay type questions: Answer any 3 questions out of 5 (3*5=15). iii) Essay type questions: Answer any 1 question out of 2 (1*10=10). Practical: 17 marks Problem solving skills: 17 marks

References

1. G. Hansson, Sven Ove. Decision theory: A brief introduction. (2005) A truly interdisciplinary subject
2. Raiffa, Howard (1997). *Decision Analysis: Introductory Lectures on Choices Under Uncertainty*. McGraw Hill
3. Smith, J.Q. (1988). *Decision Analysis: A Bayesian Approach*. Chapman and Hall
4. Halpern, Joseph Y., 2003, *Reasoning About Uncertainty*, Cambridge, MA: MIT Press.
5. Peterson, Martin, 2009, *An Introduction to Decision Theory*, Cambridge: Cambridge University Press

SEMESTER 3

	MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)					
Programme	Minor for BSc/BA/B Com					
Course Name	Data Analysis in Inferential Statistics Using R					
Type of Course	DSC B					
Course Code	MCE3DSCSTA200					
Course Level	200-299					
Course Summary	This course covers key concepts in Statistics including sampling distribution, estimation of parameters, testing of hypothesis and non-parametric tests. Emphasis is placed on practical applications using R.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any	Level100knowledgeofStatistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different Sampling Distributions.	U	1
2	Describe estimation and methods.	U	1
3	Relate different parametric tests in testing the hypothesis.	An	1
4	Organize different non-parametric tests in testing the hypothesis.	An	1
5	Conduct data analysis using R/Python.	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C),			

Skill (S), Interest (I) and Appreciation (Ap)
--

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Statistic, parameter.	2	1
	1.2	Distribution of sample mean and variance.	2	1
	1.3	Normal distribution, Student's t-distribution.	5	1
	1.4	Chi-square distribution, F distribution.	4	1
	1.5	Inter-relationship between Normal, t , Chi-square and F distributions.	2	1
2	2.1	Estimation, point estimation and interval estimation.	2	2
	2.2	Desirable properties of a good point estimator.	2	2
	2.3	Methods of estimation–MLE, Method of moments.	4	2
	2.4	Testing of hypothesis:Statistical test, null and alternative hypothesis, types of errors, significance level, power, critical region, p value.	3	3
	2.5	Parametric test: Testing of population mean: One sample and two sample (z test,t-test), testing of population proportion (One sample and two sample), paired test. ANOVA (one way only).	4	3
3	3.1	Goodness of fit, Chi-Square test (independence of attributes).	4	4
	3.2	Sign test, median test.	5	4
	3.3	Kruskal Wallis H test, Wilcoxon test.	6	4
4	4.1	Introduction to R.	10	5
	4.2	Use R to solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	20	5

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <p>i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$).</p> <p>ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$).</p> <p>iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$).</p> <p>Practical:10marks Problem solving skills: 10 marks,</p>

References:

1. Rohatgi V.K. and Saleh, A.K. Md.E. (2009): An Introduction to Probability and Statistics.2nd Edition. (Reprint)John Wiley and Sons.
2. Gupta,S.P. (2021) Statistical Methods. Sultan Chandand Sons: NewDelhi.
3. Gupta,S.C.and Kapoor, V.K.(2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
4. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
5. Python for Everybody: Exploring Data Using Python3, ADS 2016.

Suggested Readings:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007) Introduction to the Theory of Statistics,3rd Edition., (Reprint), Tata Mc Graw-Hill Pub. Co.Ltd.
2. John E Freund, Mathematical Statistics, Pearson Edn, NewDelhi
3. Tilman M. Davies. (2016) The Book of R, A First Course in Programming and Statistics, No Starch Press.
4. WesMc Kinney, O'REILLY(2012). Python for Data Analysis



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Statistical Research Techniques					
Type of Course	DSC B					
Course Code	MCE3DSCSTA201					
Course Level	200-299					
Course Summary	This course covers key concepts in Statistics including sampling distribution, estimation of parameters, testing of hypothesis and non-parametric tests. Emphasis is placed on practical applications using R.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any	Level100knowledgeofStatistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different Sampling Distributions.	U	1
2	Describe estimation and methods.	U	1
3	Relate different parametric tests in testing the hypothesis.	An	1
4	Organize different non-parametric tests in testing the hypothesis.	An	1
5	Conduct data analysis using R/Python.	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C),			

Skill (S), Interest (I) and Appreciation (Ap)
--

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Statistic, parameter, sampling distributions and standard error.	2	1
	1.2	Distribution of sample mean and variance.	2	1
	1.3	Normal distribution, Student's t-distribution.	5	1
	1.4	Chi-square distribution, F distribution.	4	1
	1.5	Inter-relationship between Normal, t , Chi-square and F distributions.	2	1
2	2.1	Estimation, point estimation and interval estimation.	2	2
	2.2	Desirable properties of a good point estimator.	2	2
	2.3	Methods of estimation–MLE, Method of moments.	4	2
	2.4	Testing of hypothesis: Statistical test, null and alternative hypothesis, types of errors, significance level, power, critical region, p value.	4	3
	2.5	Parametric test: Testing of population mean: One sample and two sample (z test, t-test), testing of population proportion (One sample and two sample), paired test. ANOVA (basic ideas of one way only).	5	3
3	3.1	Goodness of fit test, Chi-Square test (independence of attributes).	4	4
	3.2	Sign test, median test, Wilcoxon test.	3	4
	3.4	Index numbers: weighted and unweighted index numbers. Cost of living index numbers	3	5
	3.5	Time series: components of time series and their estimation	3	5
4	4.1	Introduction to R.	10	5
	4.2	Use R to solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	20	5

Module	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any 1 question out of 2 ($1*12=12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References:

1. Rohatgi V.K. and Saleh, A.K. Md. E. (2009): An Introduction to Probability and Statistics. 2nd Edition. (Reprint) John Wiley and Sons.
2. Gupta, S.P. (2021) Statistical Methods. Sultan Chand and Sons: New Delhi.
3. Gupta, S.C. and Kapoor, V.K. (2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
4. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
5. Python for Everybody: Exploring Data Using Python3, ADS 2016.

Suggested Readings:

1. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007) Introduction to the Theory of Statistics, 3rd Edition., (Reprint), Tata Mc Graw-Hill Pub. Co.Ltd.
2. John E Freund, Mathematical Statistics, Pearson Edn, New Delhi
3. Tilman M. Davies. (2016) The Book of R, A First Course in Programming and Statistics, No Starch Press.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	VAC for BSc/BA/B Com					
Course Name	Applied Statistical Analysis: Ethical Data Collection, Interpretation, and Decision Making in Society					
Type of Course	VAC					
Course Code	MCE3VACSTA200					
Course Level	200-299					
Course Summary	Students will critically assess ethical implications in statistical analysis, communicate findings responsibly and synthesise information to make ethical decisions based on statistical outcomes. They will assess the reliability of statistical inferences in societal scenarios considering both the statistical significance and ethical implications of their findings.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any						
		3				45

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Demonstrate various data collection methods, sampling strategies, and statistical tools used for organising, summarising, and visualising data in societal contexts.	A	1
2	Apply statistical techniques such as hypothesis testing, correlation and regression analysis to real-world data.	A	1
3	Evaluate ethical considerations in data collection, statistical analysis and interpretation of results in societal contexts using statistical software packages.	E	8

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Nature of data, sampling strategies, questionnaire designing, data collection (primary/secondary) interview-designing, conduct and ethics.	3	1,3
	1.2	Classification of data, tabulation of data and scaling of data.	2	1
	1.3	Measures of central tendency (mean, median, mode), Measure of dispersion (Standard deviation).	3	2
	1.4	Visualisation of data: Histogram, frequency polygon and ogives.	3	2
	1.5	Concepts of correlation and regression.	2	1
	1.6	Theory of attributes: Introduction, independence of attributes, criterion of independence, association of attributes, Yule's coefficient of association, coefficient of colligation.	3	1
2	2.1	Parameter, statistic, statistical inference, null and alternative hypotheses, level of significance, p-value, large sample tests for single mean, difference of means and test for proportion (one sample and two samples).	6	2
	2.2	Small sample tests-t test of significance for single mean, difference in means, paired t - test for related samples.	5	2
	2.3	Chi square test for independence of attributes.	4	2
3	3.1	Working with real life data using statistical software packages, Introduction to R and R commander and its application. : Defining variables: Numeric and String Variables Assigning names and labels to variables and values - Entering Data.	5	1,2,3
	3.2	Ethical theories and principles in data science, Group discussions on ethical frameworks and their application in data analysis.	3	7,8

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p><i>Classroom Procedure (Mode of transaction)</i> Direct Instruction: Brainstorming lecture, E-learning, Interactive Instruction, Seminar, Group Assignments, Authentic learning, Presentation by students by group.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) <i>Formative assessment</i> Theory: 15 marks Quiz, Assignments <i>Summative assessment</i> Theory: 10 marks Two written tests.</p>
	<p><i>B. End Semester Examination(ESE)</i> Total: 50 marks i) Short answer type questions: Answer any 7 questions out of 10 (7*2=14). ii) Short essay type questions: Answer any 4 questions out of 6 (4*6=24). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12)</p>

References:

1. Powers, Daniel, and Yu Xie. (2008) Statistical methods for categorical data analysis. Emerald Group Publishing.
2. Kapoor, V.K. and Gupta, S.C. (2020): Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
3. Fox, J. (2005). The R Commander: A basic-statistics graphical user interface to R. Journal of Statistical Software,19(9):1–42.

Suggested Readings:

1. Davis, K.(2012) Ethics of Big Data: Balancing risk and innovation. " O'Reilly Media, Inc."
2. Chiang, Chin Long.(2003) Statistical methods of analysis. World Scientific.
3. Fox, J. (2007).Extending the R Commander by “plug-in” packages. R News,7(3):46–52



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	<i>Statistical Analysis of Related Data</i>					
Type of Course	MDC					
Course Code	MCE3MDCSTA200					
Course Level	200-299					
Course Summary	This course focuses on a fundamental aspect of data analysis and machine learning identifying and understanding the relationships or associations between variables. The curriculum covers the exploration of relationships among variables, considering various types of data scales such as nominal, ordinal, interval and ratio. Practical applications involve leveraging the Google Looker Studio and gretl for the computation and analysis of these relationships, providing students with a comprehensive skill set to navigate and interpret data across different scales.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3				45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand the basic concepts of Google Looker Studio and gretl.	U	1
2	Apply Google Looker Studio for visualising the relationship between related variables.	A	2
3	Analyze and interpret measures of associations and dependencies..	An	2
4	Utilise gretl for practical demonstration and problem-solving in association between related variables.	A	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Exploratory Time Series Data Analysis		15	
	1.1	Google Looker Studio - Understanding the user interface, navigating through dashboards and reports, connecting to various data sources, creating charts, graphs, and tables, customising visualisations for effective communication.	8	1
	1.2	Implementing filters and drill-downs in Google Looker Studio and analysing real-world datasets using Google Looker Studio.	5	1
	1.3	Gretl: Introduction, data entry and import, descriptive statistics and data exploration.	2	1,3
2	Correlation and Regression Analysis		15	
	2.1	Correlation: Definition, properties and range of correlation coefficient, invariance under linear transformation -Demonstration using gretl.	2	2,3
	2.2	Importance of scatter diagram and construction of scatter diagram using Google Looker Studio.	2	1,2
	2.3	Rank correlation: Definition and examples, solving problems using gretl, illustrating the situations where Pearson correlation coefficient and rank correlation is used using Google Looker Studio.	3	1,2,3
	2.4	Principle of least squares: Introduction and basic problems, demonstration using Google Looker Studio.	2	1,2
	2.5	Fitting of straight line and parabola using gretl with visual representation using google looker studio.	2	1,2,3
	2.6	Regression coefficients and regression lines: Basics and illustrations using gretl.	2	1,2,3
	2.7	Relationship between correlation coefficient and regression coefficients and validating the relationships using data, analysis of real data for regression.	2	1,2,3
3	Statistical Analysis Using gretl		15	
	3.1	Categorical data: Definition, examples, frequency distributions, contingency table.	3	2,3
	3.2	Visual representation of categorical data using different charts.	2	1
	3.3	Chi-square test for association between variables.	2	3
	3.4	Ordinal and logistic regression, Mantel- Haenszel test.	3	2,3

	3.5	Measures of associations and dependencies - Odds Ratio, Kendall's Tau.	5	2,3
--	-----	--	---	-----

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Direct Instruction: Brainstorming lecture, E-learning, Interactive Instruction, Seminar, Group Assignments, Authentic learning, Presentation by students by group.
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) <i>Formative assessment</i> Theory: 15 marks Quiz, Assignments <i>Summative assessment</i> Theory: 10 marks Two written tests.
	B. End Semester Examination(ESE) Total: 50 marks i) Short answer type questions: Answer any 7 questions out of 10 (7*2=14). ii) Short essay type questions: Answer any 4 questions out of 6 (4*6=24). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12)

References:

- Hurst, L. (2020). Hands On With Google Data Studio: A Data Citizen's Survival Guide. John Wiley & Sons.
- Arnold, J. (2023). Learning Microsoft Power Bi: Transforming Data Into Insights. O'Reilly Media.

Suggested Readings:

- Pulipati, S. and Kelly, N. (2022). Data Storytelling with Google Looker Studio: A hands-on guide to using Looker Studio for building compelling and effective dashboards
- Lucchetti, R. and Cottrell, A. .Gretl - Gnu Regression, Econometrics and Time-series Library by Gnu Regression, Econometrics and Time-series Library, Allin Cottrell.
- Agresti, A. (2013). Categorical Data Analysis. 3rd Edition, John Wiley & Sons Inc.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	MDC for BSc/BA/B Com					
Course Name	Business Analytics Using Spreadsheets					
Type of Course	MDC					
Course Code	MCE3DSCSTA201					
Course Level	200-299					
Course Summary	Analytics is the process of transforming data into insight for making better decisions. It involves specifying a question, problem, or decision and finding the right answers using data. Students are introduced to models, tools, and methods that are commonly used in each area of analytics. The course emphasizes model development and use of software tools to manage, report, and analyze data to achieve the best outcomes for a business.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3				45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Obtain and process data from existing data sources.	U	1, 2
2	Use descriptive techniques to summarize data.	A	2
3	Build forecasting models to predict future outcomes.	A	2
4	Apply prediction methods for numerical outcomes to data sets.	A	1
5	Apply several common techniques to visualize data.	An	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Obtaining & Processing Data	3	1
	1.2	Pivot Tables	2	2
	1.3	Cleaning Data Sampling	3	3
	1.4	Summarizing Data, Probability	3	3
2	2.1	Correlation & Regression	2	4
	2.2	Testing and ANOVA.	4	4
	2.3	Clustering Introduction and k-means clustering	3	3
	2.4	Other Clustering Methods, k-Nearest Neighbours	5	5
3	3.1	Data Visualization	6	3
	3.2	Time Series Forecasting Moving Averages Exponential Smoothing.	6	4
	3.3	Decision Trees.	3	5

Module 4	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz, Assignments</p> <p><i>Summative assessment</i></p>

	<p>Theory: 10 marks Two written tests.</p>
	<p><i>B. End Semester Examination(ESE)</i> Total: 50 marks i) Short answer type questions: Answer any 7 questions out of 10 (7*2=14). ii) Short essay type questions: Answer any 4 questions out of 6 (4*6=24). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12)</p>

References

1. James Evans (2017). Business Analytics. Pearson learning
2. Matthew North (2012) *Data Mining for the Masses*, Creative Commons Attribution License .
3. Neil J Salkind (2010). Excel Statistics, A Quick Guide. SAGE Publication Inc. New Delhi
4. Vijai Gupta (2002). Statistical Analysis with Excel. VJ Books Inc. Canada

SEMESTER 4

	<h2 style="margin: 0;">MAHARAJA'S COLLEGE, ERNAKULAM</h2> <p style="margin: 0;">(Govt. Autonomous)</p>
---	--

Programme	Minor for BSc/BA/B Com					
Course Name	Statistical Inference Using R					
Type of Course	DSC C					
Course Code	MCE4DSCSTA200					
Course Level	200-299					
Course Summary	This course equips students with a comprehensive understanding of different sampling distributions, estimation methods, parameter testing, and non - parametric testing for hypothesis evaluation. The practical aspect of the course involves hands- on experience in conducting data analysis using R or Python.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any	Level 100 knowledge of Statistics.					75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different sampling distributions.	U	1
2	Describe estimation and methods.	U	1
3	Relate different parametric tests in testing the hypothesis.	An	1
4	Organise different non-parametric tests in testing the hypothesis.	An	1
5	Conduct data analysis using R/Python.	E	2

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Statistic, parameter.	1	1
	1.2	Distribution of sample mean and variance.	2	1
	1.3	Normal distribution.	3	1
	1.4	Student's t-distribution.	2	1
	1.5	Chi- square distribution.	2	1
	1.6	F distribution.	2	1
	1.7	Inter-relationship between normal, t, Chi-square and F distributions.	3	1
2	2.1	Estimation, point estimation and interval estimation.	2	2
	2.2	Desirable properties of a good point estimator.	6	2
	2.3	Methods of estimation–MLE, method of moments.	7	2
3	3.1	Testing of hypothesis, Statistical test, null and alternative hypothesis, types of errors, significance level, power, critical region and p- value.	2	3
	3.2	Parametric test: Testing of population mean (One sample and two samples)(z test, t-test), paired t test.	6	3
	3.3	Testing of population proportion (One sample and two samples).	3	3
	3.4	ANOVA (one-way only).	2	3
	3.5	Chi-square test	2	3
4	4.1	Introduction to R/Python.	10	5
	4.2	UseR/ Python to solve numerical problems associated with topics covered in various modules. (A practical record with minimum 5 problems has to be submitted).	20	5

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9*2=18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5*6=30$). iii) Essay type questions: Answer any1 question out of 2 ($1*12=12$). <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Rohatgi V.K. and Saleh, A.K. Md.E.(2009):An Introduction to Probability and Statistics. 2nd Edition. (Reprint) John Wiley and Sons.
2. Gupta, S.P.(2021) Statistical Methods. Sultan Chand and Sons:New Delhi.
3. Gupta, S.C. and Kapoor,V.K. (2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
4. JohnE Freund, Mathematical Statistics, Pearson Edn, New Delhi
5. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
6. Tilman M. Davies.(2016) The Book of R,A First Course in Programming and Statistics,No Starch Press.
7. Python for Everybody:Exploring Data Using Python3,ADS2016.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Statistical Research Methods Using Softwares					
Type of Course	DSC C					
Course Code	MCE4DSCSTA201					
Course Level	200-299					
Course Summary	This course aims to equip students with a solid foundation in Research Methodology, Statistical Testing and Data Analysis.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		3		1		75
Pre-requisites, if any	Level 100 knowledge of Statistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different research methods in social science	U	1
2	Understand the statistical testing procedure in sociology	U	1
3	Illustrate the large sample tests	A	2
4	Describe the small sample tests	A	2
5	Conduct a social survey and data analysis using R/Python/Spreadsheet.	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Research design, Qualitative and quantitative research.	3	1
	1.2	Data collection methods & sampling techniques.	5	1
	1.3	Research reporting and Communication-Writing research proposal.	3	1
	1.4	Apply research methods to real-world social issues.	3	1
2	2.1	Parameter, statistic.	2	2
	2.2	Statistical hypothesis, Simple and composite hypothesis.	3	2
	2.3	Null and alternative hypotheses, type I and type II Errors.	3	2
	2.4	Critical region, size of the test, p value, power.	3	2
	2.5	Sociological research problems in Statistical perspective.	4	2
3	3.1	Large sample test: z test for single mean and equality of two means.	4	2
	3.2	Small sample test: t test for single mean and equality of two means, paired t test.	4	3
	3.3	ANOVA (one way only).	1	3
	3.4	Non- parametric tests: Testing association of attributes using Chi square test.	2	4
	3.5	Sign test, median test, Wilcoxon Ranked test-simple problems only.	4	4
	3.6	Applications of statistical tests in various fields.	1	4
4	4.1	Conduct a social survey and prepare a project report (Questionnaire, geographical and diagrammatic representation, analysis - Descriptive Statistics).	12	5
	4.2	Statistical analysis and interpretation of a social problem by using Spreadsheet / R programming.	18	5

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT <ol style="list-style-type: none"> A. Continuous Comprehensive Assessment (CCA) <p><i>Formative assessment</i></p>

	<p>Theory: 5 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory:60marks</p> <p>i) Short answer type questions: Answer any 7 questions out of 10 ($7*2=14$).</p> <p>ii) Short essay type questions: Answer any 4 questions out of 6 ($4*6=24$).</p> <p>iii) Essay type questions: Answer any 1 question out of 2 ($1*12=12$).</p> <p>Practical:10marks Problem solving skills: 10 marks,</p>

References

1. Rohatgi V.K. and Saleh, A.K. Md. E. (2009) An Introduction to Probability and Statistics, 2nd Edition. (Reprint) John Wiley and Sons.
2. Gupta, S.P. (2021) Statistical Methods. Sultan Chand and Sons: New Delhi.
3. Gupta, S.C. and Kapoor, V.K. (2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
4. Kothari, C. R. (2014) Research methodology, 2nd revised Edition, New Age International publications.
5. John E Freund, Mathematical Statistics, Pearson Edn, New Delhi
6. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
7. Python for Everybody: Exploring Data Using Python3, ADS 2016.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Basics to Multivariate Distributions					
Type of Course	DSC					
Course Code	MCE4DSCSTA202					
Course Level	200-299					
Course Summary	Students will proficient in conducting correlation and regression analysis understanding bivariate and multivariate distributions, interpreting results from the distribution of quadratic forms and applying these skills in practical scenarios using R/python software					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any						
		3		1		75

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Illustrate bivariate and multivariate data and analyse them.	U, A	1
2	Analysis the bivariate data using a scatter diagram.	A	2
3	Elucidate various types of correlation measures.	Ap	2
4	Construct regression models and estimates values of dependent variables	An, C	3
5	Describe bivariate distributions and obtain marginal and conditional distributions and examine the independence of rvs.	U, An, E	1
6	Obtain mathematical expectation and correlation.	A	2

7	Explain random vectors, mean vectors and dispersion matrix.	U	1
8	Apply multivariate normal distribution in real life situations.	U, A	2
9	Build characterizations of multivariate distribution	C	3
10	Obtain distribution of quadratic forms.	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	bivariate data , multivariate data, scatter diagram types of correlation-Karl Pearson, Spearman's rho and Kendall's tau.	8	1,2,3
	1.2	Curve fitting and regression analysis.	4	4
	1.3	Multiple linear regression, multiple correlation and partial correlation-their properties and related results.	3	4
2	2.1	Bivariate random vector, joint pmf, joint pdf and bivariate cdf, marginal and conditional distributions and independence of rvs	3	5
	2.2	mathematical expectation, conditional expectation, covariance and correlation	3	6
	2.3	Random vectors, mean vector and dispersion matrix	3	7
	2.4	Bivariate normal distribution: pdf, marginal distributions, marginal distributions, conditional distributions , properties characterizations and orthogonal transformations	4	5
	2.5	Multivariate normal distribution, :mgf, characteristic function, conditional distributions and independence	4	8,9
	2.6	Multinomial distribution and its basic properties	4	8
3	3.1	quadratic forms: types , independence, scalar quadratic forms properties.	4	10
	3.2	Distribution of quadratic forms, Cochran's theorem.	5	10
4	4.1	Practical using R/python. (A practical record with minimum 10 problems has to be submitted). 1. Multiple multiple correlation and regression 2. partial correlation 3. Curve fitting 4. Karl Pearson correlation coefficient 5. Spearmans rho 6. Kendall's tau 7. Multivariate normal distribution(variance –covariance matrix) 8. quadratic forms (positive definite) 9. Multinomial distribution	30	1,2, 3,4, 8,10

5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 5 marks Quiz, Assignments</p> <p>Practical: 15 marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks Two Written tests (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 60 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 9 questions out of 12 ($9 \times 2 = 18$). ii) Short essay type questions: Answer any 5 questions out of 7 ($5 \times 6 = 30$). iii) Essay type questions: Answer any 1 question out of 2 ($1 \times 12 = 12$). <p>Practical: 10 marks Problem solving skills: 10 marks,</p>

References

1. Gupta, S. C. and Kapoor, V. K. (2020). Fundamentals of Mathematical Statistics, 12th Edition, Sultan Chand and Sons.
2. Anderson, T.W. (2009). An Introduction to Multivariate Statistical Analysis, 3rd Edition, John Wiley.
3. Rencher, A.C. (1998). Multivariate Statistical Inference and Applications, 1st Edition, John Wiley-Interscience.
4. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
5. F. Mary Harin Fernandez (2022). R Programming Language Booknetz.
6. Rohatgi R.A and Wichern, D.W. (2013): An Introduction to Probability and Statistics. 2nd Edition. (Reprint) John Wiley and Sons.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	SEC for BSc/BA/B Com				
Course Name	Basic Research Methodology				
Type of Course	SEC				
Course Code	MCE4SECSTA200				
Course Level	200-299				
Course Summary	This course aims to equip students with a solid foundation in Research Methodology, Statistical Testing and Data Analysis.				
Semester	4	Credits		3	
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Course Details Total Hours Learning Approach
		3			
Pre-requisites, if any					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different research methods in social science	U	1
2	Understand the statistical testing procedure in sociology	U	1
3	Illustrate the large sample tests	A	2
4	Describe the small sample tests	A	2
5	Conduct a social survey and data analysis using R/Python/Spreadsheet.	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Research design, Qualitative and quantitative research.	3	1
	1.2	Data collection methods & sampling techniques.	3	1
	1.3	Research reporting and Communication-Writing research proposal.	3	1
	1.4	Apply research methods to real-world social issues.	2	1
2	2.1	Parameter, statistic, Statistical hypothesis, Simple and composite hypothesis.	2	2
	2.2	Null and alternative hypotheses, type I and type II Errors.	2	2
	2.3	Critical region, size of the test, pvalue, power.	2	2
	2.4	Sociological research problems in Statistical perspective.	3	2
	2.4	Large sample test: z test for single mean and equality of two means.	3	2
	2.5			
3	2.6	Small sample test: t test for single mean and equality of two means, paired t test.	4	3
	3.1	ANOVA (one-way only), Non-parametric tests: Testing association of attributes using Chi square test.	3	3,4
	3.2	Sign test, median test, Wilcoxon Ranked test-simple problems only.	5	4
	3.3	Applications of statistical tests in various fields.	1	4
	3.4	Conduct a social survey and prepare a project report (Questionnaire, geographical and diagrammatic representation, analysis-Descriptive Statistics).	4	5
3.5	Statistical analysis and interpretation of a social problem by using Spreadsheet/Python/R programming.	5	5	

Module 4	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
---------------------------------------	--

Assessment Types	<p style="text-align: center;">MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks Quiz, Assignments</p> <p>Practical:15marks Lab involvement, Practical Record, Viva-voce</p> <p><i>Summative assessment</i></p> <p>Theory:10marks Written tests</p>
	<p>B. Semester End examination</p> <p>Theory:50marks</p> <p>i) Short answer type questions: Answer any 7 questions out of 10($7*2=14$).</p> <p>ii) Short essay type questions: Answer any 4 questions out of 6($4*6=24$).</p> <p>iii) Essay type questions: Answer any 1 question out of 2($1*12=12$).</p> <p>Practical:35marks</p> <p style="padding-left: 40px;">Problem solving skills: 30 marks, Record:5 marks</p>

References

1. Rohatgi V.K. and Saleh, A.K.Md.E.(2009)An Introduction to Probability and Statistics, 2ndEdition. (Reprint) JohnWiley and Sons.
2. Gupta, S.P.(2021)Statistical Methods. Sultan Chand and Sons:NewDelhi.
3. Gupta, S.C. and Kapoor, V.K. (2020) Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
4. Kothari, C.R.(2014) Research methodology, 2nd revised Edition, New Age International publications.
5. John E Freund, Mathematical Statistics, Pearson Edn,NewDelhi
6. Sudha G Purohit, Sharad D. Gore, Shailaja Deshmukh (2019) Statistics using R, 2nd Edition, Narosa Publishing House.
7. Python for Everybody:Exploring Data Using Python3, ADS 2016.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	SEC for BSc/BA/B Com				
Course Name	<i>Introduction to Spread sheets and LaTeX Typing</i>				
Type of Course	SEC				
Course Code	MCE4SECSTA201				
Course Level	200-299				
Course Summary	To get basic knowledge and skills of data analysis using spreadsheets and be able to create printed materials with professional quality using LaTeX.				
Semester	4	Credits		3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	
Pre-requisites, if any					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Illustrate how to present data in a presentable format using pictures, tables and create well-presented documents.	U	1
2	Analyze the data and compare the distributions with statistical believes.	A	2
3	Elucidate new conclusions, if any, shown by the data based on the thorough analysis.	An	2
4	Critically examine and compare the results of the data analysis.	A	2
5	Describe the data based on the analysis using the spreadsheet.	U	1
6	Explain how to create documents and powerpoints.	U	1
7	Build documents using LaTeX.	C	1
8	Appraise the need for presenting data and documents suitable for different situations.	E	1

***Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)**

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
Spreadsheet and Data				
1	1.1	Basics of spreadsheet and data types, creation of worksheets, editing, formatting and saving.	3	1
	1.2	Introduction to functions in a spreadsheet, if function, freeze panes, vlookup, hlookup, sorting, filtering.	5	1,2
	1.3	Pivot tables, Statistics in spreadsheets, conditional formatting, data validation.	2	1,3
	1.4	Data visualisation, Statistical analysis using spreadsheets.	3	4,5
Basics of LaTeX				
2	2.1	Introduction to LaTeX interfaces, understanding Latex compilation, basic syntax.	3	7
	2.2	Writing equations, matrices, tables. Page Layout: Titles, abstract, chapters, sections, references, equatio references, citation.List Making Environments.	4	7
	2.3	Table of contents, generating commands, figure handling numbering, list of figures,list of tables, generating index	4	
	2.4	Classes: Article, book, report, beamer, slides. Applications to: Writing articles / Projects.	4	
	2.5	Presentation using beamer.	2	6,8
Statistical Computing using spreadsheet and LaTeX.				
3	3.1	(Exercises based on the above concepts. Both spreadsheet & LaTeX).	15	2,6,7,8
Module 4	Teacher Specific Content		Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction) Direct Instruction: Brainstorming lecture, E-learning, Interactive Instruction, Seminar, Group Assignments, Authentic learning, Presentation by students by group.</p>
Assessment Types	<p>MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) <i>Formative assessment</i> Theory: 15 marks Quiz, Assignments <i>Summative assessment</i> Theory: 10 marks Two written tests.</p>
	<p>B. End Semester Examination(ESE) Total: 50 marks i) Short answer type questions: Answer any 7 questions out of 10 (7*2=14). ii) Short essay type questions: Answer any 4 questions out of 6 (4*6=24). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12)</p>

References:

1. Excel 2022: From Basic to Advanced. (2022). George Wahlberg.
2. Stefan Kottwitz: LATEX Cookbook. (2015). Packt Publishing.
3. David F. Griffiths and Desmond J. Higham. (2016). Learning LATEX (2nd edition) Siam.

Suggested Readings:

1. Excel Formulas and Functions. (2020). Basics: Step-by-Step Guide with Examples for Beginners (Excel Academy Book 2) Adam Ramirez .
2. Excel 2022 : Three books-in-one: a to z mastery guide on excel basic operations, excel formulas, functions, pivot tables & dashboards (2022). Joe Webinar.
3. M.R.C. van Dongen:LATEX and Friends (2012). Springer-Verlag Berlin Heidelberg.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	VAC for BSc/BA/B Com					
Course Name	<i>Ethical Dimensions in Statistical Machine Learning Through R/Python</i>					
Type of Course	VAC					
Course Code	MCE4VACSTA200					
Course Level	200-299					
Course Summary	The course delves into the crucial intersection of ethics and data analysis tools. Students examine real-world ethical dilemmas and learn strategies to mitigate biases and ensure responsible data handling within software-driven analyses. The course also introduces statistical machine learning and enables the student to up-skill his technical presentation skills.					
Semester	4	Credits		3	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum		Others
		3				45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	To critically analyze summarising data and testing a hypothesis.	An	1
2	To familiarise the basic concepts of model building and Statistical Machine Learning.	S	2
3	To articulate and present, both orally and in written form, the ethical implications of real life data using R/Python.	Ap	8
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Basic on data collection, questionnaire preparation, interview methods for collecting data, organising and cleaning data.	2	1
	1.2	Descriptive statistics, correlation and scatter plot. Visualisation of data: Histogram, frequency polygon and ogives.	3	1
	1.3	Theory of attributes: Introduction, independence of attributes, criterion of independence, association of attributes, Yule's coefficient of association and coefficient of colligation	4	1
	1.4	Small sample tests: t test and F test-t test of significance for single mean, difference in means, paired t - test for related samples, F test of significance for equality of population variances, chi- square test.	6	1
2	2.1	Regression, simple linear regression, multiple linear regression and logistic regression.	4	1,2
	2.2	Bayesian inference: Prior, posterior, map, regularisation in Bayesian setup, introduction to mcmc (markov chain monte carlo).	5	2
	2.3	Classification, introduction, example of supervised learning, classification model, classification learning steps, common classification algorithms- KNN, decision tree, random forest models, support vector machine.	6	2
3	3.1	Ethical theories and principles in data science, group discussions on ethical frameworks and their applications in data analysis.	6	3
	3.2	Introduction to R/ Python	4	1,3
	3.3	Presentation on the implemented data analysis using real life data using R/Python.	5	1,2,3

Module 4	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
	<ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar

	6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) <i>Formative assessment</i> Theory: 15 marks Quiz, Assignments <i>Summative assessment</i> Theory: 10 marks Written tests
	B. Semester End examination Theory: 50 marks i) MCQ: 10 questions (10*1=10). ii) Short essay type questions: Answer any 5 questions out of 7 (5*6=30). iii) Essay type questions: Answer any 1 question out of 2 (1*10=10).

References:

1. Wickham, Hadley, Mine Cetinkaya-Rundel, and Garrett Grolemund.(2023). R for data science. " O'Reilly Media, Inc."
2. V.K.Kapoor and S.C.Gupta (2010). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.
3. Chiang, Chin Long.(2003). Statistical methods of analysis. World Scientific.

Suggested Readings:

1. Davis, Kord. (2012). Ethics of Big Data: Balancing risk and innovation." O'Reilly Media, Inc."
2. Powers, Daniel, and Yu Xie.(2008). Statistical methods for categorical data analysis. Emerald Group Publishing.
3. Sugiyama, Masashi.(2015). Introduction to statistical machine learning. Morgan Kaufmann.

SEMESTER 5

	<h3 style="margin: 0;">MAHARAJA'S COLLEGE, ERNAKULAM</h3> <p style="margin: 0;">(Govt. Autonomous)</p>
---	--

Programme	Minor for BSc/BA/B Com					
Course Name	Sampling Techniques					
Type of Course	DSC					
Course Code	MCE5DSCSTA300					
Course Level	300-399					
Course Summary	The course explores in detail the basic concepts of sampling techniques and their implementations using Excel/R					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		4		0		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Summarize probability and non-probability sampling	U & An	1
2	Carry out a large-scale sample survey	A	2
3	Illustrate various sampling techniques.	U	1
4	Obtain unbiased estimators of population mean and their	A & E	2

	variance and interpret		
5	Construct confidence intervals for population mean	C	2
6	Determine sample size based on desired accuracy	E	2
7	Perform different types of allocations in stratified random sampling	A & An	2
8	Compare different types of sampling schemes	An	3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Census and sampling, types of sampling: probability and non-probability sampling, advantages and disadvantages.	6	1
	1.2	Principal steps in a sample survey, sampling and non-sampling errors, organisational aspects of sample survey	6	2
	1.3	Simple random sampling with and without replacement (SRSWR and SRSWOR), procedures of selecting a sample, unbiased estimates of the population mean and population total-their variances and estimates of the variances, confidence interval for population mean and total, simple random sampling for attributes.	6	3,4 &5
	1.4	Determination of the sample size		6
2	2.1	Stratified random sampling, estimation of the population mean and population total: their variances and estimates of the variances.	6	4
	2.2	Proportional allocation and Neyman allocation of sample sizes, cost function: optimum allocation, comparison with simple random sampling.	6	7
	2.3	Linear and circular systematic sampling, estimates of the population mean and population total.	6	3,4 & 9
	2.4	Comparison of systematic sampling, SRS and stratified random sampling for a population with a linear trend.	6	8
3	3.1	Cluster sampling, clusters with equal sizes, estimation of population mean and total: their variances and estimates of the variances.	6	3,4 & 9
	3.2	Multistage sampling, estimation of the population mean and its standard error.	6	3,4 & 9
4	4.1	Simulate sampling scenarios mentioned in the above modules using Excel/R packages and perform Statistical inferences on the sample data	6	3,4 & 9

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks, Seminar: 5 marks</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks</p> <p>Two written tests: 10 marks (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 70 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30). ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).

References

1. Cochran, W.G. (2007). Sampling Techniques, (3rd Edition.), John Wiley and Sons.
2. Mukhopadhyay, P. (2013). Theory and Methods of Survey Sampling, (2nd Edition.), Prentice Hall of India.

Suggested Readings:

1. Gupta, S.C. and. Kapoor, V.K. (2018). Fundamentals of Applied Statistics, Sultan Chand & Co. New Delhi.
2. Singh, D. and Choudhary, F.S. (2020) Theory and Analysis of Sample Survey Designs, (2nd Edition.), New Age International Publishers. Prentice- Hall of India.
3. Sampath. (2005). Sampling Theory and Methods, (2nd Edition.), Alpha Science International

Limited.

4. Sukhatme,P.V., Sukhatme,B.V., Sukhatme, S. and Asok, C. (1954).Theory of Sample surveys with applications , IASRI, Delhi.

SEMESTER 6

	MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)
---	---

Programme	Minor for BSc/BA/B Com					
Course Name	Econometrics					
Type of Course	DSC					
Course Code	MCE6DSCSTA300					
Course Level	300-399					
Course Summary	To acquire the basic knowledge of econometric models and its applications. Also learn tests and solutions of multicollinearity and hetroscedasticity concepts					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
Pre-requisites, if any		4		0		60

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Apply the challenges of emperical modeling in economics and business	A	2

2	Analyze economic data by using regression analysis	An	2
3	Explain theoretical background for the standard methods used in empirical analyses, like properties of least square estimators and the statistical testing of hypotheses.	A	2
4	Describe the concept of structural econometric models and their applications in econometric modeling	U	1
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Demand and supply functions, elasticity of demand, equilibrium of market.	3	1
	1.2	Production functions - homogeneous functions, elasticity of production.	3	1
	1.3	Input - output analysis. Leontief's open and closed models.	6	1
2	2.1	Simple linear regression models, Multiple linear regression models.	6	2
	2.2	Estimation of the model parameters, tests concerning the parameters, confidence intervals.	5	2
	2.3	Prediction, heteroscedasticity, tests concerning the parameters, confidence intervals.	5	2
3	3.1	Multicollinearity – consequences,	5	3
	3.2	Farrar_ Glauber test, remedial measures. Residual Analysis.	5	3
	3.3	Aitken's generalised least square method, tests for autocorrelation, consequences, and estimation procedures.	6	3
4	4.1	Stochastic regressors, errors in variables, use of Dummy variables in regression.	5	4
	4.2	Use of Dummy variables in regression, polynomial regression models in one variable,	6	4
	4.3	Basic ideas of logistic regression and stepwise regression.	5	4

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students bygroup
Assessment Types	MODE OF ASSESSMENT <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks, Seminar: 5 marks</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks</p> <p>Two written tests: 10 marks (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 70 marks</p> <p>i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30).</p> <p>ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28).</p> <p>iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).</p>

References

1. Johnston J. (1984) Econometric Methods (Third edition), McGraw Hill, New York.
2. Montgomery D.C., Peck E.A. and Vining G.G. (2007) Introduction to Linear Regression Analysis, John Wiley, India.
3. Gujarati D (2009) Basic Econometrics, Fifth edn McGraw Hill.
4. Apte P.G. (1990) Text book of Econometrics, Tata McGraw Hill.
5. Theil H. (1982) Introduction to the Theory and Practice of Econometrics, John Wiley.

SEMESTER 7

	MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)
---	---

Programme	Minor for BSc/BA/B Com					
Course Name	<i>Measure and Probability Theory</i>					
Type of Course	DSC					
Course Code	MCE7DSCSTA400					
Course Level	400-499					
Course Summary	The course explores in detail the fundamental concepts of Measure Theory and Probability, random variables, distribution functions and their properties, This course provides a basis to introduce higher statistical theory and applications					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		4		0		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Synthesise limit of a sequence of sets and obtain them for sequence of sets.	U , An	1
2	Construct sigma fields and Borel fields.	An , E	2

3	Understand measure theory and identify probability as a measure.	Ap , C	4
4	Compare Lebesgue, Lebesgue-Stieltjes Integral and Riemann Integrals.	U, C	1,3
5	Evaluate properties of probability.	An, E	2
6	Explain Measurable functions and identify random variables as q measurable functions.	A	1
7	Analyse the properties of distribution function.	An	2
8	Obtain empirical distribution function.	E	1
9	Identify mathematical expectations as Lebesgue integral	E	2
10	Understand and apply various inequalities	U, A	1
11	Evaluate various modes of stochastic convergence	E	2
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	<i>Measure Theory</i>		15	
	1.1	Finite and countable operations on sets	2	1
	1.2	Sequences of sets, monotone sequence and limit of a sequence of sets.	2	2
	1.3	Field and sigma field, monotone class, generated sigma field, minimal sigma field, Borel field of \mathbb{R} and of \mathbb{R}^n	3	3,4
	1.4	Measurable space, measure, measure space, finite and sigma finite measures, monotone and continuity properties of measures, Counting measure, Lebesgue measure and Probability measure.	5	3,4
	1.5	Caratheodory Extension theorem (statement only) Lebesgue Stieltjes measures and distribution functions.	3	3,4
2	<i>Measurable Functions and Integration</i>		15	
	2.1	Measurable functions and their properties, indicator functions, simple functions, measurable functions as limit of simple functions.	4	6
	2.2	Integrals of indicator function, simple function and measurable functions	3	4
	2.3	Basic integration theorems. Monotone convergence theorem, Fatou's Lemma, Bounded convergence	4	4

		theorem and Lebesgue dominated convergence theorem,		
	2.4	Lebesgue and Lebesgue-Stieltjes Integral, comparison of Lebesgue and Riemann Integral.	4	4
3	Probability Theory		15	
	3.1	Discrete and Continuous probability spaces and their properties, monotone, continuity and other properties.	4	5
	3.2	Conditional probability, multiplication theorem, total probability and Bayes' theorem. Independence of events.	3	5
	3.3	Borel 0-1 criterion. Random variable, vector and sequence of random variables, properties of random variables and vectors, distribution of random variables. Distribution function and its properties.	3	5
	3.4	Jordan decomposition theorem, Correspondence theorem (statement only), Independence of random variables.	3	5
	3.5	Mathematical expectation, moments and its properties	2	5
4	Inequalities and Stochastic Convergence		15	
	4.1	Basic, Chebychev's, Markov's, Liapounov's, Jensen's, Cr, Cauchy-Swartz's, Holder's, Minkowski's and Chebychev's inequalities.	4	6
	4.2	The four modes of convergence-convergence almost surely, convergence in probability, convergence in distribution and convergence in rth mean of a sequence of random variables, properties, counter examples and their inter-relationships.	6	7,8
	4.3	Weak and complete convergence of distribution functions. Helly-Bray Lemma and Helly- Bray Theorem (statements only).	5	9

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks, Seminar: 5 marks</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks</p> <p>Two written tests: 10 marks (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 70 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30). ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).

References:

1. Ash R.B. and Doleans-Dade C.A. (2000). Probability and measure theory, Academic Press.
2. Bhat B.R. (1999). Modern Probability theory, Third Edition, Wiley Eastern Ltd, New Delhi.
3. Laha R.G. and Rohatgi V.K. (1979). Probability theory, John Wiley.

Suggested Readings:

1. Basu A.K. (2012). Measure Theory and Probability, Second Edition, PHI Learning Pvt. Ltd, New Delhi.
2. Billingsley P. (2012) Probability and Measure, Anniversary edition, Wiley Eastern ltd.
3. Loeve M. (1977) Probability Theory, Fourth edition, Springer-Verlag.
4. Rohatgi V.K. and Saleh M. (2015) An introduction to probability and statistics, Third edition, Wiley.
5. Robert G. Bartle (2001), A Modern Theory of Integration, American Mathematical Society (RI).



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Statistical Machine Learning					
Type of Course	DSC					
Course Code	MCE7DSCSTA401					
Course Level	400-499					
Course Summary	The course explores in detail the advanced concepts Machine learning, Artificial Neural Networks, Bayesian Learning and Ensemble Learning. This course provides a basis to introduce higher statistical theory and applications					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum	Others	
		4		0		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Apply Machine learning	U & An	1
2	Create Artificial Neural Networks	An & E	2
3	Apply Bayesian Learning	A & E	3
4	Analyse Naive Bayes Classifier	C	2
5	Analyse Ensemble Learning	An & E	1
8	Apply using spreadsheets to illustrate and analyse	A, An	2

	statistical concepts, enhancing practical skills.		
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Machine learning, difference between machine learning and Statistics, Decision Tree Learning, Appropriate Problems for Decision tree learning, Basic decision tree algorithm	15	1
	1.2	Hypothesis space in decision tree learning, inductive bias in decision tree learning, issues in decision tree learning, Supervised and Unsupervised learning.,	5	2
2	2.1	Artificial Neural Networks: Neural network representation, Appropriate problems for neural network learning	8	3
	2.2	perceptron, multilayer networking, and Backpropagation algorithm	7	3
3	3.1	Bayesian Learning: Bayes theorem and concept of learning, ML and least squared error hypothesis	3	4
	3.2	ML hypothesis for predicting probabilities, minimum length description principle	3	4
	3.3	Bayes' optimal classifier, Gibbs Algorithm, Naive Bayes Classifier, Bayesian Belief Networks	3	4
	3.4	Ensemble Learning: Boosting Procedures, The AdaBoost Algorithm	3	5
	3.5	Initial analysis, margin explanation, Statistical view, Multiclass Extension, Noise Tolerance, Two Ensemble Paradigms, The Bagging Algorithm, Random Tree Ensembles- Random Forest.	3	5
4	4.1	Statistical Analysis using R and Python (Record should be submitted with minimum 5 problems)	10	1
5		Teacher Specific content.		

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks, Seminar: 5 marks</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks</p> <p>Two written tests: 10 marks (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 70 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30). ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).

References:

1. Tom Mitchell. (1997). Machine Learning, McGraw Hill. (For Modules 1to 3)
2. Zhi-Hua Zhou (2012). Ensemble Methods Foundations and Algorithms, Chapman & Hall/CRC (For third Module)
3. Pratap Dangeti. (2017). Statistics for Machine Learning Techniques for exploring supervised, unsupervised, and reinforcement learning models with Python and R, Packt Publishing; 1st Edition.

Suggested Readings:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Springer, Second Edition.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	<i>Life Science Data Analysis Using R Software</i>					
Type of Course	DSC					
Course Code	MCE7DSCSTA402					
Course Level	400-499					
Course Summary	This course on Lifetime Data Analysis provides a comprehensive exploration of statistical methods crucial for understanding the dynamics of time-to-event data, offering invaluable insights across various disciplines. As we delve into life tables, survival analysis, and regression models, participants will acquire essential skills to analyse and interpret lifetime data. Understanding the nuances of these techniques is paramount, as it equips individuals to uncover patterns, make predictions, and derive meaningful conclusions from diverse datasets, enhancing their ability to make informed decisions in real-world scenarios.					
Semester	7	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum		Others
		4		0		
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Utilise R for the practical preparation of life tables, demonstrating proficiency in data manipulation and statistical programming.	A	1
2	Assess the significance and practical implications of survival analysis, including the computation and	An	2

	interpretation of survival functions.		
3	Demonstrate the ability to fit and assess regression models for lifetime data, applying statistical techniques to evaluate model performance.	Ap , C	4
4	Evaluate the survival data and make interpretations out of it	E	3,4
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Life tables, Censoring and Truncation		15	
	1.1	Life tables: Description of different columns of the life table preparation of life tables using R.	3	1
	1.2	Definition of survival analysis, survival function, hazard function and cumulative hazard function.	4	2
	1.3	Censoring and truncation: Definition and various types.	4	2
	1.4	Generating censored and truncated data using R.	4	2
2	Statistical Methods in Lifetime Data		15	
	2.1	Introduction to Kaplan-Meier estimator for survival curves, Implementation of the Kaplan-Meier estimator in real-life datasets, Log-rank test for comparing survival curves. Practical application of the Log-rank test for group comparison.	5	2
	2.2	Introduction to Exponential and Weibull distributions as parametric models.	3	2,3
	2.3	Understanding the concept of Maximum Likelihood Estimation (MLE) in the context of parametric survival models.	4	1,2
	2.4	Introduction to alternative parametric models such as Gompertz and Log-Normal distributions.	3	2,3
3	Cox Proportional Hazards Model		15	
	3.1	Cox Proportional Hazards Model: Interpretation and assumptions.	2	3
	3.2	Cox Proportional Hazards Model: Model fitting and assessment.	2	3
	3.3	Handling Categorical Variables: Handling categorical variables in the context of Cox Proportional Hazards Model dummy coding or stratification for	3	5

		incorporating categorical predictors.		
	3.4	Introduce the concept of time-dependent covariates and how they can be accommodated in the Cox model.	2	3
	3.5	Elaborate on the assumption of proportional hazards and how to test and assess it, provide guidance on what to do if the assumption is violated.	3	3
	3.5	Compare models using statistical metrics such as Akaike Information Criterion (AIC) or likelihood ratio tests.	3	3
	Diagnostic Plots		15	
4	4.1	Introduce diagnostic plots, such as Schoenfeld residuals, to assess the goodness-of-fit of the Cox model, discuss interpretation and implications of diagnostic plots.	6	3
	4.2	Implementing the Cox model using popular statistical software like R.	4	1,3
	4.3	Examples of real-world applications of the Cox Proportional Hazards Model in various fields	5	1,3

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Interactive Instruction 5. Seminar 6. Group Assignments 7. Authentic learning 8. Presentation by students by group
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks,</p>

	Seminar: 5 marks Summative assessment Theory: 10 marks Two written tests: 10 marks (5 marks each)
	B. Semester End examination Theory: 70 marks i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30). ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).

References

1. Field, A., Miles, J., & Field, Z. (2012). *Discovering statistics using R*. SAGE Publications.
2. David G. Kleinbaum, Mitchel Klein (2012). *Survival Analysis: A Self-Learning Text*, Third Edition. Springer-Verlag New York
3. Moore, D.F. (2016) *Applied Survival Analysis Using R. Use R*. Springer, Berli.

Suggested Readings

1. Elisa T. Lee, John Wenyu Wang (2003) *Statistical Methods for Survival Data Analysis*, Third Edition (Wiley Series in Probability and Statistics).
2. Manual of R Package Lifetable <https://cran.r-project.org/web/packages/LifeTables/LifeTables.pdf>.



MAHARAJA'S COLLEGE, ERNAKULAM (Govt. Autonomous)

Programme	Minor for BSc/BA/B Com					
Course Name	Statistical Distributions, Estimation and Hypothesis Testing					
Type of Course	DSC					
Course Code	MCE7DSCSTA403					
Course Level	400-499					
Course Summary	This course introduces different commonly used probability distributions. It covers essential statistical techniques for understanding limit theorems, estimation and testing. Supports to distinguish different situations useful for hypothesis testing.					
Semester	7	Credits		4	Total Hours	
Course Details	Learning Approach	Lecture	Tutorial	Practical/ Practicum		Others
		4	0	0		60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
<i>Upon the completion of the course, student will be able to:</i>			
1	Understand different probability distributions commonly used	U	1
2	Understand the important limit theorems in statistics	U, A	2
3	Apply limit theorems to different sample functions	A, An, E	2
4	Understand and apply the theory of estimation	U, A	2
5	Understand the theory of testing of hypothesis	A	2
6	Apply hypothesis testing and confidence interval construction to data	A, An, E	3
7	Evaluate different hypothesis testing situations	E	3

8	Apply hypothesis testing in real life situations	Ap	3
*Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Distributions: Log Normal, Pareto, Cauchy, Folded Normal Distribution, Half Normal Distribution, Gamma Probability Distribution Beta Distribution, Weibull distribution	6	1
	1.2	Limit theorems: Chebyshev's Theorem-Law of Large Numbers, Central Limit Theorem	3	1
	1.3	Sampling Distributions: Sample Proportion of Success, Binomial Distribution. Normal as a Limiting Case of Binomial Distribution, Sampling Distribution of Sample Mean	4	1
	1.4	Distribution of Selected Test Statistics: Z, Chi Square, t, F-Distributions	3	4
2	2.1	Estimation: Point Estimation and interval estimation	4	3
	2.2	Properties: Properties of point Estimators, Unbiasedness, Consistency, Efficiency, and Sufficiency.	5	2
	2.3	Asymptotic Properties: Asymptotic Unbiasedness, Robustness	3	6
	2.4	Confidence interval: Confidence Interval Estimation and its properties	4	5
3	3.1	Methods of estimation: Method of Moments and Maximum Likelihood Estimation.	3	3
	3.2	Crammer-Rao Lower Bound .	2	2
	3.3	Testing of Hypothesis: Types of Errors; Significance Level, Size and Power of a Test.	3	6
	3.4	Neyman-Pearson Lemma, Design and Evaluation of Tests, Critical region, p-value.	3	5
4	4.1	Parametric Tests: Testing of- Single Proportion, equality of two Proportions, equality of more than two Proportions.	4	6
	4.2	Parametric Tests: Testing of- Single Mean, Equality of Two Means; Oneway ANOVA.	4	5
	4.3	Parametric Tests: Testing of- Single Variance; Equality of Two Variances	3	6

	4.4	Non Parametric Tests: Test for the Independence of Two Variables.	3	7
--	-----	---	---	---

Module 5	Teacher Specific Content	Hrs	

Teaching and Learning Approach	<p>Classroom Procedure (Mode of transaction * Min. 10)</p> <ol style="list-style-type: none"> 1. Direct Instruction 2. Brainstorming lecture 3. E-learning 4. Individual assignments 5. Interactive Instruction 6. Seminar 7. Group Assignments 8. Authentic learning 9. Presentation by students by group 10. group discussions
Assessment Types	<p>MODE OF ASSESSMENT</p> <p>A. Continuous Comprehensive Assessment (CCA)</p> <p><i>Formative assessment</i></p> <p>Theory: 15 marks</p> <p>Quiz: 5 mark, Two Assignments: 10 marks, Seminar: 5 marks</p> <p><i>Summative assessment</i></p> <p>Theory: 10 marks</p> <p>Two written tests: 10 marks (5 marks each)</p>
	<p>B. Semester End examination</p> <p>Theory: 70 marks</p> <ol style="list-style-type: none"> i) Short answer type questions: Answer any 10 questions out of 12 (10*3=30). ii) Short essay type questions: Answer any 4 questions out of 6 (4*7=28). iii) Essay type questions: Answer any 1 question out of 2 (1*12=12).

References

Select Readings

- 1) Kandethody M. Ramachandran and Chris P. Tsokos, (2019), Mathematical Statistics with Applications in R, Academic Press London
- 2) William G. Cochran, (1977), Sampling Techniques, John Wiley & Sons

Other Readings

- 3) Charles B. Moss, (2015), *Mathematical Statistics for Applied Econometrics*, CRC Press Taylor & Francis
- 4) Hugo A. Keuzenkamp, (2004), *Probability, Econometrics and Truth: The Methodology of Econometrics*, Cambridge University Press
- 5) Ramu Ramanathan, (1993), *Statistical Methods in Econometrics*, Academic Press Inc.
- 6) Sharon L Lohr, (2019), *Sampling Design and Analysis*, CRC Press Taylor & Francis
- 7) A L Nagar and R K Das (1983), *Basic Statistics*, Oxford University Press
- 8) Mood, A M., F A Greybill and D C Boes (2001), *Introduction to Theory of Statistics*, McGraw Hill.