Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE
(AUTONOMOUS)
VYASARPADI, CHENNAI - 600 039
(Accredited by NAAC at level "B")

B. Sc (Statistics)

FOR CANDIDATES ADMITTED FROM 2022-23 ONWARDS
Syllabus

Under Choice Based Credit System

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)

DEPARTMENT OF STATISTICS
Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE(AUTONOMOUS)
VYASARPADI, CHENNAI - 600 039

Based on UGC – Learning Outcomes-Based Curriculum Framework
Course Structure under Choice Based Credit System
(For the candidates admitted from the academic year 2022-2023 onwards)

Sem. No	Part No.	Course	Subject code	Course Title	Ins. Hrs/Week	Credit	Exam Hrs	Marks		Total
								Int	Ext	
I	I	LC - I	22UAFTA1	General Tamil – I	6	3	3	25	75	100
	II	ELC - I	22UACEN1	Communicative English - I	4	3	3	50	50	100
	III	CC - I	22UASTC1	Descriptive Statistics	6	4	3	25	75	100
	III	CCP *	Even Sem.	**Computational statistics - I**	3	-	-	40	60	100
	III	AC - I	22UASTA1	Mathematics for Statistics	7	5	3	25	75	100
	IV	NME - I		Non Major Elective-I Subjects offered by the other department	2	2	3	25	75	100
	IV	SBE - I	22UAPPS1	Professional English for Physical Sciences – I	2	3	3	50	50	100
				Total	**30**	**20**				
II	I	LC - II	22UBFTA2	General Tamil – II	6	3	3	25	75	100
	II	ELC - II	22UBCEN2	Communicative English - II	4	3	3	50	50	100
	III	CC - II	22UBSTC1	Probability Theory	6	4	3	25	75	100
	III	CCP - III	22UBSTC2	**Computational statistics - I**	3	4	3	40	60	100
	III	AC - II	22UBSTA2	Real Analysis and Matrix Algebra	7	5	3	25	75	100
	IV	NME - II		Non Major Elective-II Subjects offered by the other department	2	2	3	25	75	100
	IV	SBE - II	21UBPPS2	Professional English for Physical Sciences – II	2	3	3	50	50	100
				Total	**30**	**24**				
III	I	LC - III	22UCFTA3	General Tamil - III	6	3	3	25	75	100
	II	ELC - III	22UCLTS1	Language Through Literature – I	4	3	3	50	50	100
	III	CC - IV	22UCSTC1	Probability Distributions	5	4	3	25	75	100
	III	CEC - I	*	One from the Elective-I Subjects	4	5	3	25	75	100
	III	AC - III	22UCSTA1	Numerical Methods	7	4	3	25	75	100
	IV	EVS	22UCEVS1	Environmental Studies	2	2	3	25	75	100
	IV	SBE - III	22UCSBE3	SS III – Personality Enrichment	2	3	3	40	60	100
				Total	**30**	**24**				

IV	I	LC - IV	22UDFTA4	General Tamil - IV	6	3	3	25	75	100
	II	ELC - IV	22UDLTS2	Language Through Literature – II	4	3	3	50	50	100
	III	CC - V	22UDSTC1	Statistical Estimation Theory	6	5	3	25	75	100
	III	CCP - VI	22UDSTC2	**Computational statistics - II**	3	4	3	40	60	100
	III	AC - IV	22UDSTA2	'C' Language for Statistics	4	4	3	25	75	100
	III	ACP - V	22UDSTA3	**Programming in C language andNumerical Methods**	3	2	3	40	60	100
	IV	VBE	22UDVBE1	Value Based Education	2	2	3	25	75	100
	IV	SBE - IV	22UDSBE4	SS IV- Computer Basics and Office Automation / Android Programming (for CS)	2	3	3	40	60	100
	V	Extension	22UDEXT1	Extension Activities	-	1	-	-	-	-
				Total	**30**	**27**				
V	III	CC-VII	22UESTC1	Sampling Techniques	5	4	3	25	75	100
	III	CC-VIII	22UESTC2	Testing of Statistical Hypothesis	6	5	3	25	75	100
	III	CC-IX	22UESTC3	Statistical Quality Control	6	4	3	25	75	100
	III	CC-X	22UESTC4	Operations Research	5	4	3	25	75	100
	III	CEC - II	**	One from the Elective-II Subjects	6	5	3	25	75	100
	IV	SBE - V	22UESBE5	Programming in 'R'	2	2	3	40	60	100
				Total	**30**	**24**				
VI	III	CC-XI	22UFSTC1	Design of Experiments	6	4	3	25	75	100
	III	CC-XII	22UFSTC2	Applied Statistics	6	5	3	25	75	100
	III	CC-XIII	22UFSTC3	Stochastic Processes	7	5	3	25	75	100
	III	CCP-XIV	22UFSTC4	**Computational statistics - III**	3	4	3	40	60	100
	III	CEC-III	***	One from the Elective-III Subjects	6	5	3	25	75	100
	IV	SBE-VI	22UFSBE6	Data Analysis Using MS-Excel and SPSS	2	2	3	40	60	100
				Total	**30**	**25**				
				Total Credits	**180**	**144**				

CORE ELECTIVE COURSES:

Elective-I (Any one subject of the following Core Elective chosen by the candidate)		**Elective-II** (Any one subject of the following Core Elective chosen by the candidate)		**Elective-III** (Any one subject of the following Core Elective chosen by the candidate)	
***Sub. Code**	**Core Elective Courses**	****Sub. Code**	**Core Elective Courses**	*****Sub. Code**	**Core Elective Courses**
22UCSTE1A	Demography and Vital Statistics	22UESTE2A	Reliability theory and Survival Analysis	22UFSTE3A	Resource Management Techniques
22UCSTE1B	Managerial Economics	22UESTE2B	Regression Analysis	22UFSTE3B	Data Mining
				22UFSTE3C	Python Programming for statistics

The following Non-Major Elective Courses offered by the Department of Statistics to other departments.

NON-MAJOR ELECTIVE COURSE:

I Semester (Any one subject of the following Non Major Elective chosen by the candidate)		**II Semester** (Any one subject of the following Non Major Elective chosen by the candidate)	
@Sub. Code	**Non Major Elective**	**@@Sub. Code**	**Non Major Elective**
22UASTN1A	Statistics for Beginners	22UBSTN2A	Statistics in Real Life
22UASTN1B	Mathematical Statistics – I	22UBSTN2B	Mathematical Statistics - II

SEMESTER-I

B.Sc., Degree Programme in Statistics

First Semester				
Course Title		**Descriptive Statistics**		
Course Code		**22UASTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –I	**Core**	**4**	**6**	**25+75**

Course Objective: To introduce the basic concepts of statistics and apply the statistical techniques in various fields.

UNIT– I: STATISTICSINTRODUCTION (18 Hours)

Introduction to Statistics – Definition, Functions of Statistics, Applications of Statistics, Limitations, Collection of Data – Primary and Secondary Data, Methods of Collecting Primary Data, Preparation of Questionnaire and Schedule, Sources of Secondary Data, Measurement of Scale – Nominal, Ordinal, Interval and Ratio, Classification and Tabulation – Introduction, Meaning and Objectives of Classification, Objects and Types of Classification, Formation of a Discrete and Continuous Frequency Distribution, Tabulation of Data, Parts of a Table, General Rules and Types of Tables.

UNIT– II:DIAGRAMS&GRAPHS (18 Hours)

Diagrammatic and Graphical Representation – Introduction, Significance of Diagrams and Graphs, General Rules for Constructing Diagrams, Types of Diagrams, Graphs and Graphs of Frequency Distribution, Box Plot, Measures of Central Value – Introduction, Types of Averages, Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, Relationship Among the Averages.

UNIT– III: VARIATION &SKWENESS (18 Hours)

Measures of Dispersion – InterquartileRange or the Quartile Deviation and its Coefficient, Mean Deviation and its Coefficient, Standard Deviation, Coefficient of Variations, Lorenz Curve, Skewness, Moments and Kurtosis – Introduction, Measures of Skewness, Moments and Measures of Kurtosis

UNIT– IV: CORRELATION & REGRESSION (18 Hours)

Correlation – Introduction, Types of Correlation, Methods of Studying Correlation – Scatter Diagram Method, Karl Pearson's Coefficient of Correlation, Coefficient of Determination, Properties of the Coefficient of Correlation, Rank Correlation Coefficient, Concurrent Deviation Method, Multiple and Partial Correlation (Concepts and Simple Problems, No Derivations). Regression – Introduction, Uses of Regression, Difference Between Correlation and Regression Analysis, Regression Lines, Regression Equations, Regression Equations for grouped data, Limitations of Regression Analysis.

UNIT – V:CURVE FITTING & ASSOCIATION OF ATTRIBUTES **(18 Hours)**

Curve Fitting – Introduction, Principle of Least Squares, Fitting a Straight Line, Fitting a Second Degree polynomial, Fitting a Curve of the Form $Y = ae^{bx}$, Fitting a Curve of the Form $Y = ab^{x}$, Fitting a Curve of the Form $Y = ax^{b}$. Association of Attributes – Introduction, Difference Between Correlation and Association, Notation and Terminology, Consistency of Data, Association and Disassociation, Methods of Studying Association, Association of Two Attributes, Partial Association,

Books for Study:

- Hogg, R.V. and Craig, A.T. (1998): Introduction to Mathematical Statistics, 4th ed. Academic Press.
- Hoel, P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
- Goon, AM., Gupta M.K and .Dasgupta B (1991): Fundamentals of Statistics, Vol.1, World Press, Calcutta.
- Bhat B.R, Srivenkataramana T, and Madhava K.S,(1996) Statistics: A Beginner's text Vol. I, New Age International (P) Ltd.
- Gupta,S.P.:Statisticalmethods,Sultan Chand & Sons PvtLtd.New Delhi.

Books for Reference:

- G.U.Yule and M.G. Kendall (1956): An introduction to the theory of Statistics, Charles Griffin.
- M.R. Spiegel (1961): Theory and problems of statistics, Schaum's outline series.
  Snedecor .G.W. and Cochran W.G. (1967): Statistical methods, Iowa State University Press.
- Anderson, T.W. and Sclove SL. (1978): An introduction to statistical analysis of data, Houghton Miffin/co.
  Croxton FE, and Cowden D.J. (1973) Applied General Statistics, Printice Hall of India.
- SC Gupta & VK Kapoor Fundamental of Mathematical Statistics

Web Resources:

https://www.youtube.com/watch?v=B_kWOlxxQYo
https://www.youtube.com/watch?v=69oJW0HkOOk
http://arif.works/wp-content/uploads/2020/09/Course-notes-descriptive-statistics.pdf
http://subasish.github.io/pages/stat_courses/des_stat.pdf
http://web.mit.edu/~17.871/www/2015/02descriptive_stats_2015.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Classify and summarise the statistical data of discrete and continuous frequency distribution	K2
CO2	Construct diagrammatic and graphic representation to demonstrate the real life problems	K3 , K2
CO3	Analyse and Interpret the inferences from the mathematical calculations	K4, K2
CO4	Compare the relationship to obtain the qualitative and quantitative measures	K4
CO5	Categorise the concept of the association of attributes and obtain the qualitative measures between two attributes	K4
K1 – Remembering,**K2**– Understanding ,**K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating.		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**2**	**2**	**1**	**1**
	CO2	**3**	**3**	**3**	**2**	**2**	**2**
	CO3	**3**	**3**	**2**	**3**	**2**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**1**
	CO5	**3**	**2**	**3**	**1**	**3**	**2**
	Total	**15**	**14**	**12**	**10**	**10**	**9**
	Average	**3**	**2.8**	**2.4**	**2**	**2**	**1.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

First Semester				
Course Title		**Mathematics for Statistics**		
Course Code		**22UASTA1**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC –I	**Allied**	**5**	**7**	**25+75**

CourseObjective: To represent the concepts of mathematics and apply their rules with precise statistical treatment.

UNIT – I: PARTIAL FRACTIONS **(21 hours)**

Partial Fractions- Form of partial functions. Series- Binomial, Exponential and Logarithmic series.

UNIT – II: THEORY OF EQUATIONS **(21 hours)**

Theory of Equations- polynomial equations with real coefficients-imaginary and irrational roots- solving equations with related roots- equations with given numbers as roots-equations whose roots are symmetric functions of roots of a given equation.

UNIT – III:DIFFERENTIATION **(21 hours)**

Trigonometric Functions, Product Rule, Quotient Rule and Function of a Function Rule. (No Derivations)- Only Simple Problems. Inverse Trigonometric Function, Logarithmic Differentiation, and Differentiation of Implicit Function and Jacobian Transformations (No Derivations).Only Simple Problems.

UNIT – IV: INTEGRATION **(21 hours)**

Rules for Integration, Integration by Substitution – I, II, III.(Only Simple Problems). Integration by Partial Fractions and Integration by Parts.

UNIT – V:GAMMA& BETA FUNCTIONS **(21hours)**

Recurrence Formula forΓn, Relationship Between Beta and Gamma Functions. (Simple Problems)

BOOKS FOR STUDY:

- Duraipandian, P., and Udayabaskaran, S. (2008): Allied Mathematics (Vol 1) S. CHAND Publications.
- Duraipandian, P., and Udayabaskaran, S. (2008): Allied Mathematics (Vol 2), Muhil Publications.

Books for study and reference:

- Narayanan and T.K.ManickavachagamPillai – Ancillary Mathematics Book II
- Narayanan and T.K.ManickavachagamPillai (1996) Calculus (Vol I & II)
- Shanti Narayanan : Differential and Integral Calculus , Chand & Co.

Web Resources:

https://www.abdn.ac.uk/ncs/documents/mathons.pdf
https://www.pbte.edu.pk/text%20books/dae/math_113/Chapter_04.pdf
https://www.rtu.ac.in/expert/app/documents/kjangid%40rtu.ac.in_21829122020100843am.pdf
https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMT1302.pdf
https://www.youtube.com/watch?v=knaVFUT2LsM
https://www.youtube.com/watch?v=s_7dMfUAqZk

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Demonstrate simple problem with integration	**K2**
CO2	Describe the various methods of integration and solve the problem	**K2**
CO3	Define the concept of partial fraction	**K1**
CO4	Solve the polynomial equation with real and imaginary roots and developing their analytical skills	**K3**
CO5	Compare Beta and Gamma function. Illustrate the examples for the concepts of differentiation and integration	**K2**
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing ,**K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	2	2	2	2		
	CO2	2	2	2	2	1	2
	CO3	2	3	2	2		2
	CO4	3	3	2	2	1	2
	CO5	3	3	2	2		
	Total	12	13	10	10	2	6
	Average	2.4	2.6	2	2	0.4	1.2

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER-II

B.Sc., Degree Programme in Statistics

Second Semester				
Course Title		**Probability Theory**		
Course Code		**22UBSTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –II	**Core**	**4**	**6**	**25+75**

Course Objective: To understand the concepts of Probability theory and introduce Random variables in developing fields.

UNIT- I: PROBABILITY INTRODUCTION (18 Hours)

Basic Terminology: Random experiment - Sample point -Sample space –Events - Algebra of events, Operations on events - Classical and empiricalapproach to probability - Axiomatic approach to probability– simple problems.

UNIT–II: BASIC THEOREMS IN PROBABILITY (18 Hours)

Some theorems of Probability - Addition theorem of probability.Booles Inequality, Conditional probability Multiplication theorem of probability IndependenteventsBayes theorem- applications - Problems.

UNIT–III: RANDOM VARIABLES (18 Hours)

Random Variable – Discrete and Continuous, Distribution Function, Probability Mass Function, Probability Density Function and their properties, Joint, Marginal Density Function, Conditional Distribution Function and Conditional Probability Density Function, Stochastic Independence. Transformation of One – Dimensional and Two – Dimensional Random variable – Simple problems

UNIT–IV: MATHEMATICAL EXPECTATION (18 Hours)

MathematicalExpectation– Definition and Properties, Variance – Definition and Properties, Cauchy Schwartz Inequality. Conditional Expectation - Chebychev's Inequality – Simple Problems.

UNIT – V: M.G.F & CHARACTERISTIC FUNCTION (18 Hours)

Moment Generating Function, Characteristic Function, Cumulants, Probability Generating Function – Definition and Properties, Inversion Theorem and Uniqueness Theorem Statements, Concepts only.

Books for Study:

- A.M.Mood, F.A. Graybill and D.C. Boes (1974): Introduction to the theory of Statistics, International student ed. McGraw Hill.
- Hogg, R.V. and Craig, A.T. (1998): Introduction to Mathematical Statistics, 4th ed. Academic Press.
- A.M.Goon, M.K.Gupta& B. Dasgupta (1980): An outline of Statistical theory, Vol. I, 6th revised, World Press.
- SC Gupta & VK Kapoor Fundamental of mathematical Statistics

Books For Reference:

- Rohatgi, V.K. (1984): An introduction to probability theory and mathematical statistics.
- P.G.Hoel (1971): Introduction to Mathematical Statistics, Asia publishing house.
- Murry R. Spiegal (1982): Theory and problems of Probability and Statistics, Schaum's outline series, McGraw Hill.
- Seymour Lipshutz (1982): Theory and problems of probability, Schaum's outline series, McGraw Hill.
- MarekFisz (1961): Probability theory and Mathematical Statistics, John Wiley.
- K.L.Chung (1983): Elementary probability theory with stochastic processes, Springer International student edition.
- William.Feller (1968): An introduction to probability theory and its applications, Vol. I, 3rd ed., John Wiley & Sons.

Web Resources:

https://www.youtube.com/watch?v=8hhPCl7ibFo
https://www.youtube.com/watch?v=mrCrjeqJv6U&list=PLbMVogVj5nJQWowhOG0-K-yI-bwRRmm3C
http://isl.stanford.edu/~abbas/ee178/lect01-2.pdf
http://users.stat.umn.edu/~helwig/notes/ProbabilityTheory_slides.pdf
https://abrarrazakhan.files.wordpress.com/2014/04/mcq-probability-wiht-correct-answers.pdf
https://www.d.umn.edu/~zliu/math3611/c04_mathexp.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
C01	Ability to distinguish between random and non random experiment	K4
CO2	Outline their knowledge to conceptualise the probabilities of events including axiomatic approach	K2
CO3	Recall the concept of discrete and continuous random variables and their probability distributions including expectations and moments	K1
CO4	Differentiate MGF and characteristic function and solve complex problems	K3
C05	Concepts of conditional probability and Bayes theorem to develop analytical skills	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating.		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

		PROGRAMME SPECIFIC OUTCOMES (PSO)					
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
COURSE OUTCOMES (CO)	**CO1**	**2**	**3**	**2**	**2**	**1**	**1**
	CO2	**2**	**2**	**3**	**2**	**1**	**2**
	CO3	**3**	**3**	**3**	**2**	**1**	**1**
	CO4	**3**	**3**	**3**	**2**	**1**	**1**
	CO5	**3**	**3**	**3**	**2**	**1**	**1**
	Total	**13**	**14**	**14**	**10**	**5**	**6**
	Average	**2.6**	**2.8**	**2.8**	**2**	**1**	**1.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Second Semester				
Course Title		**Computational Statistics - I**		
Course Code		**22UBSTC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP –III	**Core Practical**	**4**	**3**	**40+60**

NOTE: Candidates are to answer any four out of six questions. All questions carry equal marks.

Course Objectives:

The main objectives of this course are to:

- Data preparation and obtaining summary measures from statistical data
- Develop Computing Skills using appropriate Descriptive Statistics.
- Enable the students to fit data for different graphical and diagrammatic representation

1. Construction of Univariate& Bivariate Frequency Distribution.

2. Diagrammatic Representation

- Simple Bar Diagram
- Sub-divided Bar Diagram
- Multiple Bar Diagram
- Percentage Bar Diagram
- Pie – Diagram

3. Graphical Representation

- Histogram, Frequency Polygon, Frequency Curve
- Ogive Curve
- Mode – Graphical Method
- Lorenz Curve

4. Measures of Central Tendency

- Mean, Median, Mode, Geometric Mean and Harmonic Mean (Raw Data)
- Mean, Median, Mode, Geometric Mean and Harmonic Mean (Discrete Data)
- Mean, Median, Mode, Geometric Mean and Harmonic Mean (Continuous data)

5. Measures of Dispersion

- Range
- Quartile Deviation
- Mean Deviation
- Standard Deviation
- Coefficient of Variation

6. Measures of Skewness&Kurtosis

- Karl Pearson's Coefficient of Skewness
- Bowley's Coefficient of Skewness
- Kelly's Coefficient of Skewness
- Skewness& Kurtosis Based on Moments

7. Correlation Analysis

- Karl Pearson's Coefficient of Correlation (Univariate and Bivariate)
- Spearman's Rank Correlation
- Partial and Multiple Correlation Coefficient

8. Regression Analysis

- Method of Least Squares
- Regression Equations
- Regression Coefficients
- Correlation using Regression Coefficients

9. Curve Fitting

- Fitting of a Straight Line
- Fitting of Second Degree Parabola
- Fitting of Power Curve $Y = ax^b$
- Fitting of an Exponential Curve $Y = ae^{bx}$

10. Association of Attributes

- Observed and Expected Frequency Method
- Proportion Method
- Yule's Coefficient of Association
- Coefficient of Contingency
- Coefficient of Colligation

11. Marginal and Conditional Distributions

Two – Dimensional Discrete Random Variable

12. Determination of the rank and Inverse of a non-Singular matrix

13. Solutions for system of linear equation.

14. Determination of characteristic roots and characteristic vectors.

15. Verification of Cayley Hamilton theorem.

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Tabulate and classify uni-variate and bi-variate frequency distribution	K4
CO2	Distinguish the bar diagram and histogram	K4
CO3	Interpret the results for correlation and regression lines	K2
CO4	Apply measures of skewness to grouped and ungrouped data and Recall the curve fitting	K1, K3
CO5	Explain the concept of the Cayley – Hamilton theorem	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing ,**K5**–Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	2	2	2	1	2	1
	CO2	2	2	1	1	2	1
	CO3	3	2	3	2		2
	CO4	3	2	2	2		2
	CO5	2	2		1		1
	Total	12	10	8	7	4	7
	Average	2.4	2	1.6	1.4	0.8	1.4

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

B.Sc., Degree Programme in Statistics

Second Semester				
Course Title		**Real Analysis and Matrix Algebra**		
Course Code		**22UBSTA2**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC –II	**Allied**	**5**	**7**	**25+75**

Course Objective: Torepresent the concepts of mathematics and apply their rules with precise statistical treatment.

UNIT – I: SEQUENCE INTRODUCTION (21 hours)

Functions, Real –Valued Functions, Equivalence, Countability, Real Numbers, Least Upper Bounds. Sequences of Real Numbers: Definition of Sequence and Subsequence, Limit of a Sequence, Convergent Sequences, Divergent Sequences, Bounded Sequences, Monotone Sequences.

UNIT – II: OPERATIONS ON SEQUENCE& SERIES (21 hours)

Sequences of Real Numbers- Operations on Convergent Sequences, Operations on Divergent Sequences, limit Superior and Limit Inferior, Cauchy Sequences. Convergence and Divergence, Series with Non – Negative Terms, Alternating Series, Conditional Convergence and Absolute Convergences.

UNIT – III: RIEMANN INTEGRAL (21 hours)

Riemann Integral- Definition- properties- Derivatives- Rolle's Theorem, Darboux Property, The Law of Mean, Fundamental Theorems of Calculus- First and second. Improper integrals.

UNIT – IV:TYPES OF MATRICES (21 hours)

Theory of Matrices: Definition- Types of matrices- square, Row, Column, Diagonal, Scalar, and Unit Matrix. Transpose and Conjugate of Matrix.Symmetric, Skew symmetric and Hermitian matrix.Singular, Non- singular and Orthogonal Matrix.Related simple problems.

UNIT – V: OPERATIONS ON MATRIX (21 hours)

. Rank of a matrix- Elementary transformations- Working rule to find the Rank of a matrix. Vectors- Linear dependence and independence of vectors- Consistency of non- homogeneous linear equations- Homogeneous equations- Eigen values and eigen vectors- Cayley –Hamilton theorem- Inverse of a matrix.

BOOKS FOR STUDY:

- Richard R. Goldberg, (1970): Methods of Real Analysis, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
- Duraipandian, P., and Udayabaskaran, S. (2008): Allied Mathematics (Vol 1), S. CHAND Publications.
- S. G. Venkatachalapathy (2007) :Allied Mathematics, Margham Publications. (For Unit IV and V)

Books for study and reference:

- Gold berg R.R (1970) : Methods of Real Analysis, Oxford and IBH
- Apostol. T.M (1985) Mathematical Analysis, Narosa publications
- 3 Bartle. R.G &Shebert, D.R.(1982) : Introduction to Real Analysis, Wiley Eastern & Sons
- Narayanan and T.K.ManickavachagamPillai (1996) Calculus (Vol I & II)

Web Resources:

https://www.math.lsu.edu/~sengupta/4031f06/IntroRealAnalysNotes.pdf
http://www.cs.lewisu.edu/~harsyram/RealAnalysisWorkbook2020.pdf
https://www.youtube.com/watch?v=md5UCR7mcIY&list=PLbMVogVj5nJSxFihV-ec4A3z_FOGPRCo-
https://www.youtube.com/watch?v=jqU0q21PHEQ&list=PLbMVogVj5nJQnzk6Sn9o6RTpu4Evx0LOT
https://ncerthelp.com/cbse%20notes/class%2012/maths/Mathematics%20Notes%20and%20Formula%20for%20Class%2012%20chapter%203.%20Matrices%20.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Describe fundamental properties of Real numbers that leads to the formal development of Real Analysis	K2
CO2	Explain the theoretical basis of sequences including theorem and proof	K2
CO3	Demonstrate the basic theory of sequences and evaluate the mathematical problems	K2
CO4	Examine the simple techniques for testing the convergence of series and construct rigorous mathematical proof of basic results in real analysis	K4
CO5	To construct a data set with the acquired knowledge of Matrices.	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**2**	**2**	**3**	**3**	**1**	**1**
	CO2	**2**	**2**	**3**	**3**		**1**
	CO3	**3**	**3**	**3**	**3**	**1**	**2**
	CO4	**3**	**3**	**3**	**3**		
	CO5	**3**	**3**	**3**	**3**	**1**	**2**
	Total	**13**	**13**	**15**	**15**	**3**	**6**
	Average	**2.6**	**2.6**	**3**	**3**	**0.6**	**1.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER-III

B.Sc., Degree Programme in Statistics

Third Semester				
Course Title		**Probability Distributions**		
Course Code		**22UCSTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –IV	**Core**	**4**	**5**	**25+75**

Course Objective: To introduce discrete and continuous distributions and apply their concepts in the growth of an assortment of fields.

UNIT – I: BINOMIAL & POISSON DISTRIBUTION (15 Hours)

Discrete Probability Distributions – Bernoulli Distribution – Definition, Moments, Binomial Distribution – Definition, Moments, Mode, Moment Generating Function, Additive Property, Characteristic Function, Cumulants, Recurrence Relation for the Probabilities - Poisson Distribution – Definition, Moments, Mode, Moment Generating Function, Characteristic Function, Cumulants, Additive Property, Recurrence Formula for the Probabilities.

UNIT – II:UNIFORM, GEOMETRIC & NEGATIVE BINOMIAL (15 Hours)

Discrete Uniform Distribution – Definition - Moments. Geometric Distribution – Definition, Lack of Memory, Moments, M.G.F. Negative Binomial Distribution – Definition, Moment generating function and cumulants and moments. Fitting of Binomial, Poisson and Negative Binomial Distribution.Definition of Hyper Geometric distribution.

UNIT – III:NORMAL DISTRIBUTION (15 Hours)

Continuous Probability Distributions – Normal Distribution – Definition, Normal Distribution as a Limiting Form of Binomial Distribution, Chief Characteristics, Mode, Median, M.G.F, Cumulant Generating Function, Moments, A Linear Combination of Independent Normal Variates, Points of Inflexion of Normal Curves, Mean Deviation about the Mean, Importance of Normal Distribution and Fitting of Normal Distribution. Rectangular (Uniform) distribution – moments, M.G.F – Characteristic function.

UNIT – IV: GAMMA & BETA DISTRIBUTION (15 Hours)

Gamma Distribution – Definition, MGF, CGF, Additive Property.Exponential Distribution – Definition - MGF.Beta Distribution of First Kind – Definition, Constants.Beta Distribution of Second Kind.Relationship between Gamma and Beta distributions. – Definition, Constants. Cauchy Distribution – Definition - Characteristic Function, Moments.

UNIT – V: CENTRAL LIMIT THEORM & ORDER STATISTICS **(15 Hours)**

Approximation of Binomial – Poisson – Normal distribution.Central Limit Theorem, De – Moivre's Laplace Theorem, Lindeberg – Levy Theorem(statement only) Order Statistics – Definition, Cumulative Distribution Function of a Single Order Statistic, Probability Density Function (p.d.f) of a Single Order Statistic, Joint p.d.f. of Two Order Statistics,

Book for Study :

Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Book for Reference :

- Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics,
- Pearson Education Asia, India.
- Mood, AM. Graybill, F.A. and Boes, D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.
- Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical
- theory, Vol.I, 6th revised ed. World Press limited, Calcutta.
- Hoel, P.G. (1971) : Introduction to mathematical Statistics, Asia publishing house.
- Rohatgi, V.K. (1984) An introduction to probability theory and mathematical statistics, Wiley Eastern.
- Degroot, M.H. (1975): Probability and Statistics, Addison – Wesley
- MarekFisz (1961): Probability theory and Mathematical statistics, John Wiley.
- Spiegal, M.R. (1982): Theory and problems of probability and statistics, Schaum's outline series, McGraw Hill
- Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods 6th edition, Oxford IBH Publishing Co.
- Wilks, S.S. (1962): Mathematical statistics - John Wiley & Sons.

Web Resources:

https://www.youtube.com/watch?v=6x1pL9Yov1k
https://www.youtube.com/watch?v=ggImvELUfxI
https://ronlevygroup.cst.temple.edu/courses/2016_fall/biost5312/lectures/biostat_lecture_03.pdf
https://coconino.edu/resources/files/pdfs/academics/sabbatical-reports/kate-kozak/chapter_5.pdf
https://web.stanford.edu/class/archive/cs/cs109/cs109.1208/lectureNotes/LN09_continuous_rv.pdf
https://www3.nd.edu/~rwilliam/stats1/x21.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Label and classify the basic assumptions of several importance discrete and continuous probability distributions	K1 K2
CO2	List out the importance of various distributions to real life problems	K1
CO3	Study the probability pattern of big data for further analysis	K4
CO4	Ability to identify and label the distribution for classification techniques	K3, KI
C05	To study the relationship between the distributions	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**2**	**2**	**2**	**2**	**2**	**3**
	CO2	**3**	**3**	**2**	**3**	**3**	**2**
	CO3	**3**	**3**	**3**	**3**	**2**	**2**
	CO4	**2**	**2**	**2**	**3**	**3**	**3**
	CO5	**3**	**2**	**2**	**2**	**1**	**1**
	Total	**13**	**12**	**11**	**13**	**11**	**11**
	Average	**2.6**	**2.4**	**2.2**	**2.6**	**2.2**	**2.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Third Semester				
Course Title		**Demography and Vital Statistics**		
Course Code		**22UCSTE1A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –I	**Elective**	**5**	**4**	**25+75**

Course Objective: To introduce the concepts of Demography and apply their techniques in the field of population studies.

UNIT – 1: DEMOGRAPHY SOURCES (12 hours)

Sources of Demographic data – Civil Registration- Population Census – Measurement of Population – Rates and Ratios of vital events.

UNIT – 2:MEASUREMENT OF MORTALITY (12 hours)

Mortality measurements- Crude Death rate- Specific Death rate- Age specific Death rate- Merits and Demerits. Infant Mortality rate- Standardized Death rate- Direct and Indirect. Related simple problems.

UNIT -3:MEASUREMENT OF FERTILITY (12 hours)

Fertility- Measures of fertility- Crude Birth rate-General fertility rate- Specific fertility rate- Age Specific Fertility rate-Total fertility rate. Measurement of population growth- Pearle's vital index.Net reproduction rate- Gross reproduction rate.Related simple problems.

UNIT - 4: LIFE TABLE (12 hours)

Life table –assumptions- Structure - Construction – Relationship between function of the life table – Uses of Life table - abridged life table (Concept only)

UNIT – 5:POPULATION ESTIMATION (12 hours)

Stationary Population -Stable Population and Force of Mortality (Definition only) - Gompertz and Markham law and its use.

Books for Study and Reference:

- Srivastava, O.S (1983): A text book Demography, Vikas Publishing
- Bogue, Donald, . J: Principles of Demography, (1976), John Wiley, New York.
- Fundamentals of Applied Statistics (Chapter – Vital Statistics), S.C. Gupta and V.K. Kapoor, Sultan chand& Sons

Web Resources:

https://www.youtube.com/watch?v=pgmRT8VBwRA&list=PLFW6lRTa1g80WOAEi_LA2IKZu-eUlzEQq
https://www.youtube.com/watch?v=bIPmAwDd4Wo&list=PLE594cUfEJ8pSbGrNzrUoSoT9WstpUI1E
https://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Handbooks/crvs/Series_F7-E.pdf
https://ncert.nic.in/textbook/pdf/lesy102.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Explain the various basic concepts of vital statistics	K2
CO2	Construction of Life table for the purpose of calculation of Insurance premiums and death benefits	K3
CO3	Classify the various methods of measuring fertility and mortality	K4
CO4	Applying Laws to forecast the techniques	K3
CO5	List out the advantages and disadvantages of various measures for comparative purpose	K1
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**2**				**1**	
	CO2	**2**	**3**	**3**	**2**	**1**	**3**
	CO3	**2**					
	CO4	**3**	**3**	**3**	**2**	**1**	**3**
	CO5	**2**		**1**	**2**	**1**	**1**
	Total	**11**	**6**	**7**	**6**	**4**	**7**
	Average	**2.2**	**1.2**	**1.4**	**1.2**	**0.8**	**1.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Third Semester				
Course Title		**Managerial Economics**		
Course Code		**22UCSTE1B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –I	**Elective**	**5**	**4**	**25+75**

Course Objective:
The purpose of this course is to apply economic concepts and techniques in evaluating business decisions.

UNIT- I: DEMAND **(12 hours)**
Scope and methods of Managerial Economics – Laws of demand, Demand schedule (Individual and Market) - Demand function - Factors influencing the demand - Exception to the law of demand – Elasticity of demand with respect to price and income - Factors affecting the elasticity of demand - Partial elasticity of demand with respect to price - Simple problems in elasticity of demand.

UNIT -II:SUPPLY **(12 hours)**
Supply - Factors affecting the supply of a commodity - Relation between demand and supply – Utility - Concept of utility - Concept of human wants - Maximization of utility - Marginal and total utility - Law of diminishing marginal utility - Indifference curves and map - Properties of indifference curve - Price line.

UNIT -III:COST ANALYSIS **(12 hours)**
Cost Analysis – Different types of cost - Total, average and marginal cost functions - Relation between average and marginal costs - Problems related to total, average and marginal costs – Revenue - Total, average and marginal revenue functions and their relationship - Simple problems related to maximization of total revenue

UNIT -IV:MARKET STRUCTURE **(12 hours)**
Market Structure – Definition of Market - Perfect completion - Pure competition - Monopolistic competition and duopolistic competition (Only concept) - Profit maximization – Profit function - Cournot solution to monopoly problem for maximization problem - Joint monopoly and discriminating monopoly - Problems related to profit maximization under monopoly. Duopoly - Conjectural variation and reaction curves - Simple maximization problem under duopoly.

UNIT -V:PRODUCTION FUNCTION **(12 hours)**
Theoretical Production functions – Mathematical definition of production function - Constant product curves (Isoquant) - Average and marginal productivity - Homogenous production functions – Properties of linearly homogeneous production function – Cobb Douglas production function – C. E. S. production function.

Books for Study:

- Varma and Agarwal (1998): Managerial Economics, Sultan Chand and Company, New Delhi.
- Mehta and Madhnani (2001):
- Mathematics for Economists, Sultan Chand and Company, New Delhi (Chapters 6, 8, and 9)
- . Dr.S. Shankarn Managerial Economics
- Varshney and maheswari Managerial Economics
- K.P.M.SundaramBusniess Economics

Web Resources:

https://www.youtube.com/watch?v=ycyMktNFZ88&list=PLPjSqITyvDeV84Qiruw4xVWGQPTctrlhg
https://www.sxccal.edu/wp-content/uploads/2020/01/MBA-ManagerialEconomics-1stYear.pdf
https://www.iare.ac.in/sites/default/files/IARE_ME_LN_0.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	KLEVEL
CO 1	Develop the Knowledge of the basic concepts of supply and demand	K3
CO 2	Examine how changes in demand and supply affect markets	K4
CO 3	Distinguish between Monopoly and Duopoly	K4
CO 4	Ability to identify the relationship between production and costs	K3,K4
CO 5	Compare Total revenue and marginal revenue functions	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO 1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	2	1				
	CO2	2	2	2	1	1	1
	CO3	3	3			1	1
	CO4	2	2	2	2	1	
	CO5	2	2		1	2	2
	Total	11	10	4	4	5	4
	Average	2.2	2	0.8	0.8	1	0.8

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc Degree Programme in Statistics

Third Semester				
Course Title		**Numerical Methods**		
Course Code		**22UCSTA1**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC –III	**Allied**	**4**	**7**	**25+75**

Course Objective: To introduce the concepts of Numerical methods and illustrate with numerical examples.

UNIT –I:INTERPOLATION WITH EQUAL INTERVALS (21 hours)

Finite differences-forward and backward differences, operators E and Δand their basic properties, Interpolation with equal intervals: Newton's forward and backward differences-simple problems.

UNIT –II: INTERPOLATION WITH UNEQUAL INTERVALS (21 hours)

Interpolation with unequal intervals: Divided differences and their properties, Newton's divided differences formula and Lagrange's formula for interpolation-simple problems.

UNIT-III:CENTRAL DIFFERENCE INTERPOLATION (21 hours)

Central difference interpolation formula-gauss forward and backward differences formulae-Stirling, Bessel's Everett's central difference formula.

UNIT –IV:INVERSE INTERPOLATION (21 hours)

Inverse interpolation-Lagrange's method-iteration of successive approximation method-simple problems.Numerical differentiation- Numerical differentiation upto 2^{nd} order only simple problems.

UNIT –V: NUMERICAL INTEGRATION (21 hours)

Numerical integration-Trapezoidal rule-Simpsons $1/3^{rd}$ and $3/8^{th}$ rule-Weddle's rule-Euler's summation formula.Numerical method of solution of ordinary differential equations-Taylor's series method-Euler method and RungaKuttaup to second order –simple problems.

Books for Reference:

- Calculus of finite differences and Numerical analysis by Gupta-Malik, Krishna PrakastanMandir, Meerut.
- Numerical methods in Science and Engineering by M.K. Venkataraman, National publishing house, Chennai.
- Numerical Analysis by B.D. Gupta, Konark publishing.
- Calculus of finite differences and Numerical Analysis by Saxena,
- Numerical mathematics by M.M.Ramasamy and Palaniappan.

Web Resources:

https://caculocollege.in/wp-content/uploads/2020/04/Interpolation_and_Extrapolation.pdf
http://cosmos.phy.tufts.edu/~danilo/AST16/Material/InterpolationExtrapolation.pdf
https://www.youtube.com/watch?v=Lp2MdAvk2MY
https://www.youtube.com/watch?v=TSDwGQ1AyzI
https://www.youtube.com/watch?v=0rtaUUonwkU

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Examine the solution for Algebraic and Transcendental equation	K4
CO2	Solve the simultaneous linear algebraic equations, finite difference and interpolation for equal interval	K3
CO3	Construct and extrapolate interpolation with unequal intervals	K3
CO4	Compare the various operators used for interpolation and extrapolation	K4
CO5	Ability to solve ordinary differential equation and numerical integration problem.	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	3	2	2		1
	CO2	3	3	2	1		
	CO3	3	3	2	2	1	1
	CO4	3	3	2	2		
	CO5	3	3	2	2	1	1
	Total	15	12	10	9	2	3
	Average	3	2.4	2	1.8	0.4	0.6

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

SEMESTER- IV

B.Sc., Degree Programme in Statistics

Fourth Semester				
Course Title		**Statistical Estimation Theory**		
Course Code		**22UDSTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC – V	**Core**	**5**	**6**	**25+75**

Course Objective: Increase the knowledge of Sampling distributions. Introduce Chi-square, t and F distribution. Emphasize on the Concept of Point Estimation and Interval Estimation.

UNIT –I : SAMPLING DISTRIBUTION **(18 Hours)**

Sampling distribution: t, F, Chi-square (χ^2) distribution.
Chi-square distribution – Introduction; derivation of density- M.G.F, cumulants; additive property of chi-square, characteristic function mode, skewness. Theorems based on ratio, addition of two independent chi-square random variable. Application of chi-square.

UNIT – II: t AND F DISTRIBUTION **(18 Hours)**

Introduction – t distribution - student's- t distribution derivation of students t. Fisher- t – derivation of density-constants of 't' limiting form of 't' –critical values. Application of't'-distribution. F- distribution-introduction-Derivation of Snedecor-F; constants of F-distribution-simple application. Relationship between t and F, F and χ^2.Small sample test based on t, F and χ^2

UNIT –III:CHARACTERISTICS OF ESTIMATOR **(18 Hours)**

Theory of Estimation – Introduction-characteristics of a good estimator-consistency-invariance property, theorem based on sufficient condition for consistent estimator, Unbiasedness –simple application. Efficient Estimators – Efficiency of estimators - Most Efficient estimator-simple application. Minimum Variance Unbiased Estimator (MVU), Theorem based on (MVU).

UNIT –IV : SUFFICIENT ESTIMATOR **(18 Hours)**

Sufficiency – Definition; Invariance property - Neyman Fisher Factorization theorem-simple application. Cramer-Rao inequality –Minimum Variance Bound (MVB) –condition for (MVBU)-simple application.

UNIT – V: METHOD OF ESTIMATION **(18 Hours)**

Methods of Estimation.Point Estimation - Method of Maximum Likelihood Estimation; Minimum Variance; Method of Moments; Method of Least Squares.Interval Estimation - Confidence Interval and Confidence Limits. Problems based on Poisson and Normal.

NOTE: Numerical Problems can be avoided in the question paper as this paper has a Practical Component.

Book for Study:

Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Book for Reference:

- Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics,
- Mood, AM. Graybill, F.A. and Boes, D.C. (1974) :
- Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical
- theory, Vol.I, 6th revised ed. World Press limited, Calcutta.
- Hoel, P.G. (1971) : Introduction to mathematical Statistics, Asia publishing house.
- Rohatgi, V.K. (1984) An introduction to probability theory and mathematical statistics, Wiley Eastern.
- Degroot, M.H. (1975): Probability and Statistics, Addison – Wesley
- MarekFisz (1961): Probability theory and Mathematical statistics, John Wiley.
- Spiegal, M.R. (1982): Theory and problems of probability and statistics, Schaum's outline series, McGraw Hill
- Snedecor, G.W. and Cochran, W.G. (1967): Statistical methods 6th edition, Oxford IBH Publishing Co.
- Wilks, S.S. (1962): Mathematical statistics - John Wiley & Sons.

Web Resources:

https://www.youtube.com/watch?v=SeT3TbMXQ8A
https://www.youtube.com/watch?v=lQ1ec1nQvKM
http://shiacollege.org/uploads/econtent/T-distribution.pdf
http://shiacollege.org/uploads/econtent/F-Distribution.pdf
http://shiacollege.org/uploads/econtent/Chi%20Square%20Distribution.pdf
https://www.youtube.com/watch?v=3KPi3cwMIP0

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Explain and estimate the parametric values	K2
CO2	Demonstrate the concept of parameter, statistic and sampling distributions	K2
C03	Compare various estimation techniques	K2
C04	Define the sampling distribution of t,F and chisquare	K1
C05	The concept of blackwelisation will equip the estimator for an unknown parameter. Leads to obtain an upper bound for the parameter through Cramer Rao Inequality. Make inferences using t, F and chi-square distribution	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**– Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**2**	**2**	**2**	**2**
	CO2	**3**	**2**	**1**	**2**		**1**
	CO3	**3**	**2**	**2**	**1**	**2**	**3**
	CO4	**3**	**2**	**1**	**3**	**1**	**3**
	CO5	**2**	**3**	**2**	**2**	**1**	**3**
	Total	**14**	**12**	**8**	**10**	**6**	**12**
	Average	**2.8**	**2.4**	**1.6**	**2**	**1.2**	**2.4**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fourth Semester				
Course Title		**Computational Statistics - II**		
Course Code		**22UDSTC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CCP –VI	**Core**	**4**	**3**	**40+60**

NOTE: Candidates are to answer any four out of six questions. All questions carry equal marks

COURSE OBJECTIVES:

- Demonstrate the students to give hands on training to apply the procedure of hypothesis testing and interpret the results
- Enable the students to fit data for different distributions.

1. Fitting of Distribution (Two questions compulsory)

- Fitting of Binomial distribution
- Fitting of Poisson distribution
- Fitting of Negative Binomial distribution
- Fitting of Normal distribution.

2. Chi – Square Test

- Test for Population Variance
- Test for Goodness of Fit
- Test for Independence of Attributes

3. t – Test

- Test of Significance for Single Mean
- Test of Significance for Difference of Two Independent Samples
- Paired t – Test
- Test of Significance for Observed Sample Correlation Coefficient

4. F – Test

- Test of Significance for Equality of Variances

5. Methods of Estimation

- Method of Maximum Likelihood Estimation

- Method of Moments
- Confidence interval for Mean and variance

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Choose the appropriate test statistics for testing the significance for small samples	K3
CO2	Find the expected frequencies based on theoretical frequencies	K1
CO3	Compare the independent samples and dependent samples in testing procedure	K2
CO4	Estimate the parameter by using different methods and interpret the result	K2, K4
CO5	Identify the test for independence of attributes	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**	**3**	**1**	**3**
	CO2	**3**	**3**	**2**	**3**	**1**	**1**
	CO3	**3**	**3**	**3**	**3**		
	CO4	**3**	**3**	**3**	**2**	**2**	**3**
	CO5	**3**	**3**	**3**	**2**		
	Total	**15**	**15**	**14**	**13**	**4**	**7**
	Avg	**3**	**3**	**2.8**	**2.6**	**0.8**	**1.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

B.Sc., Degree Programme in Statistics

Fourth Semester				
Course Title		**C Language for Statistics**		
Course Code		**22UDSTA2**		
Course No	**Course Category Core / Elective/Allied**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
AC –IV	**Allied**	**4**	**4**	**25+75**

Course Objective: To expose the mathematical concepts and apply their techniques programming in 'C' language.

UNIT -I:DATA TYPES & OPERATORS (12 hours)

Introduction to"C"- variables- data types-declarations, type conversions, increment and decrement, Bitwise, Logical and Assignment operators.

UNIT-II:CONTROL AND LOOPING STATEMENTS (12 hours)

Expression and conditional expressions, control structures, If-Else, SWITCH, WHILE,FOR and DO WHILE loop structures. Break continue, GO and Label statements. Function, function returning, Non-integers, Function arguments-Static and register variables.

UNIT-III:ARRAYS AND STRINGS (12 hours)

Arrays and Strings-Array Declaration,Multi-dimensional Arrays - Strings/Character Arrays, Array initialization-Pointers and addresses. - Pointers and Arrays-Pointer to function.

UNIT-IV:STRUCTURES AND FUNCTIONS (12 hours)

Structures and functions, Array of structures Fields - Unions-type definition standard input and output –formatted output-output-Access to the standard library.

UNIT-V:FILE HANDLING (12 hours)

File Access,File handling in C-File descriptions-Error handling-'Low level i/o-Read and Write'.Open,Create,Close,Unlike-Random Access-seek and I seek.

Books for Study and Reference:

1. Balagurusamy,E.(1997):ANSI 'C'Programming,Tata-McGraw hill Publishers Ltd.
2. YaswantKanetkar(1997): Let Us 'C',BPB Publications, New Delhi.
3. Bruce,H.Hunter:Introduction to 'C'

Web Resources:

https://www.youtube.com/watch?v=XTiIiI-LOY8&list=PLEAYkSg4uSQ2k6GwNhpgSHodGT8wfvgwu
https://www.vssut.ac.in/lecture_notes/lecture1424354156.pdf
https://www.iare.ac.in/sites/default/files/lecture_notes/C%20LECTURE%20NOTES%20FULL_1.pdf
https://www-personal.acfr.usyd.edu.au/tbailey/ctext/ctext.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define basics of "c" language. Enumerate and describe basic operators and expression	K1
CO2	Manipulating Input and output operations. Apply looping in 'c' programming	K3
CO3	Acquaint with various concept and components related to "c" programming language and structure of 'c' program	K2
CO4	'c' programming with basic notions of developing simple program and visualizing graphics in 'c'	K3
CO5	Utilize the concepts of multidimensional arrays and pointers to store and recall multiple variables in a data set.	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)					
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	3	1	3		
	CO2	3	3	2	3		
	CO3	3	3	2	3		1
	CO4	3	3	2	3	2	
	CO5	3	3	2	3	1	1
	Total	15	15	9	15	3	2
	Average	3	3	1.8	3	0.6	0.4

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fourth Semester				
Course Title		**Programming in 'C' Language and Numerical Methods**		
Course Code		**22UDSTA3**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
ACP –V	**Allied**	**2**	**3**	**40+60**

1. **String Manipulation:**

- Counting the no. of vowels, consonants, words, white spaces in a line of text and array of lines
- Reverse a string & check for palindrome.
- Substring detection, count and removal

2. Matrix Manipulation:

- Addition& Subtraction
- Multiplication
- Transpose, and trace of a matrix
- Determinant of a Matrix
- Inverse of Matrix

3. Solution of polynomial equation-Newton Raphson method

4. Solution of system of simultaneous equation-Gauss elimination method.

5. Lagrange interpolation.

6. Numerical integration by Trapezoidal,Simpson's and Weddle's rules.

7. Generation of Fibonacci Sequence.

8. Basic Statistics

- **Average of 'n' numbers**
- **Median**
- **Variance and S.D**
- **Correlation coefficient**

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Acquaint with various concept and components related to "c" programming language and structure of 'c' program	K2
CO2	'c' programming with basic notions of developing simple program and visualizing graphics in 'c'	K3
CO3	Utilize the concepts of multidimensional arrays and pointers to store and recall multiple variables in a data set.	K3
CO4	Compare the various operators used for interpolation and extrapolation using 'C' programming	K4
CO5	Ability to solve ordinary differential equation and numerical integration problem using 'C'	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**1**	**3**		
	CO2	**3**	**3**	**2**	**3**		
	CO3	**3**	**3**	**2**	**3**		**1**
	CO4	**3**	**3**	**2**	**3**	**2**	
	CO5	**3**	**3**	**2**	**3**	**1**	**1**
	Total	**15**	**15**	**9**	**15**	**3**	**2**
	Average	**3**	**3**	**1.8**	**3**	**0.6**	**0.4**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

SEMESTER- V

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Sampling Techniques**		
Course Code		**22UESTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –VII	**Core**	**4**	**5**	**25+75**

Course Objective: To introduce the concepts of Sampling and apply their techniques in various fields.

UNIT - I: SAMPLE SURVEY (15 Hours)

Sample survey –Basic concepts of Sample Survey - The principal steps in a Sample survey, Principles of Sample Survey (Validity, Statistics regularity and optimization)-sampling unit – Sampling frame – census – merits and demerits.Preparation of schedules and questionnaire. Sampling distribution and standard error – sample mean(s), variances and proportions.

UNIT -II:SAMPLING ERROR (15 Hours)

Sampling error and Non – Sampling errors: – Determination of sample size relationship of sampling errors with sample size. Non – Sampling errors – sources and types – biased and variable errors – Incomplete frame and missing units – Nonresponse and response error.Types of Sampling.

UNIT - III: SIMPLE RANDOM SAMPLING (15 Hours)

Simple Random Sampling – Probability of a Selecting any Specified Unit in the Sample, Selection of Simple Random - Simple random sampling with and without replacement - Properties - Unbiased estimate of the mean, variance of population - Estimation of standard error from a sample - Merits and Demerits of Simple Random Sampling, Simple Random Sampling of Attributes, Size of Simple Random Sample for Specified Precision.

UNIT -IV: STRATIFIED RANDOM SAMPLING (15 Hours)

Stratified Random Sampling – Principal Advantages of Stratified Random Sampling, Allocation of Sample Size – Proportional Allocation, NeymanOptimum Allocation. Comparison of Stratified Random Sampling with Simple Random Sampling without Stratification, Efficiency of Stratified Random Sampling over Simple Random Sampling, Estimation of Gain in Precision due to Stratification, Determination of Number of Strata

UNIT – V: SYSTEMATIC SAMPLING (15 Hours)

Systematic Sampling – Variance of the Estimated Mean -Comparison of Systematic sampling with simple random sampling - Systematic Sampling vs. Stratified Random Sampling, Systematic Sampling in the Presence of General Linear Trend, Merits and Demerits of Systematic Sampling. Concept of Cluster Sampling, Multistage Sampling, Quota Sampling.

Books for Study:

William, G. Cochran (1984): Sampling techniques, Wiley Eastern.

Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons

Books for Reference:

- Des Raj (1976): Sampling theory, Tata McGraw Hill,
- Daroga Singh &Chaudhary, F.S. (1986): Theory and Analysis of Sample Survey Designs. Wiley Eastern.
- Sukhatme P.V. et al (1984): Sample survey methods and its applications, Indian Society of Agricultural Statistics, New Delhi.
- Murthy, M.N. (1967): Sampling theory and methods, Statistical Publishing Society, Calcutta.
- Sampath S. (1999): Sampling theory and methods. New Age International Ltd.
- Engineering Updates

Web Resources:

https://cs.fit.edu/~jpmcgee/classes/CSE5800/SamplingTechniques.pdf
https://www.youtube.com/watch?v=sKtoW5cXt14
https://www.youtube.com/watch?v=PpidnVCcXk4

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course Outcome	K LEVEL
CO1	Define the sample survey and list the types of sampling	**K1**
CO2	Classify and solve the comparison of Stratified random sampling with SRSWOR &SRSWR	**K2**
CO3	Basic knowledge of complete enumeration of sample and principle steps in sample survey	**K3**
CO4	Categorizevarious statistical sampling scheme such as simple random sampling, stratified and systematic sampling.	**K4**
CO5	Define the sample survey, select appropriate sampling techniques and estimate the parameters of different allocation techniques.	**K1, K3**
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**2**		**2**		**1**	**1**
	CO2	**3**	**2**	**2**	**2**	**1**	**1**
	CO3	**2**	**2**	**2**	**3**	**3**	**3**
	CO4	**1**	**2**	**2**	**2**	**2**	**2**
	CO5	**3**	**2**	**3**	**2**	**3**	**2**
	Total	**11**	**8**	**11**	**9**	**10**	**9**
	Average	**2.2**	**1.6**	**2.2**	**1.8**	**2**	**1.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Testing of Statistical Hypothesis**		
Course Code		**22UESTC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –VIII	**Core**	**5**	**6**	**25+75**

Course Objective: To introduce the concepts of statistical inference and apply in various decision-making fields.

UNIT – I: STATISTICAL HYPOTHESIS INTRODUCTION (18 Hours)

Introduction, Statistical Hypothesis – Simple and Composite, Test of a Statistical Hypothesis, Null Hypothesis, Alternative Hypothesis, Critical Region, Two Types of Errors, Level of Significance, Power of the Test. Steps in Solving Testing of Hypothesis Problem, Optimum Test Under Different Situations – Most Powerful Test, Uniformly Most Powerful Test. Neyman J. Pearson, Lemma.

UNIT – II: LIKELIHOOD RATIO TEST (18 Hours)

Likelihood Ratio Test – Likelihood Ratio Test –definition, parameter space likelihood criterion, Properties of Likelihood Ratio Test. Test for Single Mean of a Normal Population, Test for the Equality of Means of Two Normal Populations, Test for Single Variance of Normal Populations, Test for Equality of Two Variance of a Normal Populations.

UNIT – III: LARGE SAMPLE TEST (18 Hours)

Large sample test - Test for Single Proportion, Difference of Proportion, Single Mean, Difference of Mean, Difference of Standard Deviation.

UNIT – IV : NON-PARAMETRIC TEST (18 Hours)

Non Parametric Methods – Introduction - Advantages and Drawbacks of Non – Parametric Methods, Basic Distribution, Wald – Wolfowitz Run Test, Test for Randomness, Median Test, Sign Test, Mann – Whitney – Wilcoxon U – Test – Simple Problems.

UNIT – V: SEQUENTIAL PROBABILITY RATIO TEST (18 Hours)

Sequential Analysis – Introduction, Sequential Probability Ration Test (SPRT), Operating Characteristic (OC) Function of SPRT, Average Sample Number (ASN). To obtain SPRT criterion for discrete and continuous distribution. (Bernoulli,Normal population).

Books for study and Reference:

- Mood, A.M. Graybill, F.A. and Boes, D.C. (1974) Introduction to the theory of Statistics, Tata McGraw Hill, New Delhi.
- Hogg, R.V. and Craig, A.T. (1972) Introduction to Mathematical Statistics, 3/e, Amerind, New Delhi.
- Goon, A.M. Gupta, M.K. and Das Gupta, B. (1980) An outline of Statistical Theory, Vol.I, World Press,Calcutta.
- Hoel, P.G. (1971) Introduction to Mathematical Statistics, Wiley, New York.
- Rohatgi, V.K and Saleh A. K MD.E. (2001) An Introduction to Probability and Statistics, Wiley, India.
- Spiegel, M.R., and Ray,M.(1980): Theory and Problems of Probability and Statistics, Schaum's Outline Series, McGraw Hill, New York.
- Gupta, S.C, and Kapoor, V. K. (1982) Fundamentals of Mathematical Statistics, Sultan Chand &Sons, New Delhi.
- Hogg, R. V. Tanis, E. and Zimmerman, D (2014) Probability and Statistical Inference, Pearson, New Delhi.

Web Resources:

https://www.youtube.com/watch?v=IEP3swFeauE
https://www.cse.iitk.ac.in/users/nsrivast/HCC/lec07-09.pdf
http://math.ucdenver.edu/~ssantori/MATH2830SP13/Math2830-Chapter-08.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course Outcome	K LEVEL
CO1	Framing the hypothesis for solving the problems with the critical values and identify the confidence limits.	K3
CO2	Develop the most powerful test for simple hypothesis Vs simple hypothesis for practical problems	K3 K4
CO3	List the properties of Likelihood Ratio test	K1
CO4	Explain Parametric and Non- parametric test	K2
CO5	Summarize the procedure for hypothesis testing in Research methodology	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** – Analysing , **K5**–Evaluating , **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**	**1**		**3**
	CO2	**3**	**3**	**2**			**2**
	CO3	**2**	**1**			**1**	
	CO4	**2**	**1**		**1**	**1**	**1**
	CO5	**3**	**2**	**2**	**2**	**2**	**2**
	Total	**13**	**10**	**7**	**4**	**4**	**8**
	Average	**2.6**	**2**	**1.4**	**0.8**	**0.8**	**1.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Statistical Quality Control**		
Course Code		**22UESTC3**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –IX	**Core**	**4**	**6**	**25+75**

Course Objective: To equip the concepts of Statistical Quality Control and apply their quality assessment techniques in various fields.

UNIT -I: SQC INTRODUCTION (18 Hours)

Statistical Quality Control : Introduction, Basis of Statistical Quality Control, Statistical Quality Control (Definition), Benefits of Statistical Quality Control, Need in Industry - Causes of Quality variation control charts - Use of the Shewhart - control chart – process control and product control, control Limits, Specification and tolerance limits - 3 sigma control limits - warning limits - applications - Simple Problems.

UNIT -II: CONTROL CHART FOR VARIABLES (18 Hours)

Tools for Statistical Quality Control: Control chart for variables - X chart - R chart - σ chart - purpose - Basis of sub grouping - plotting X and R results - Determining the trial control limits - Interpretation of control charts X and R - Simple Problems.

UNIT - III: CONTROL CHART FOR ATTRIBUTES (18 Hours)

Control chart for attributes - Purpose - p chart - np chart - construction of p and np chart – Interpretation of p chart. -choice between chart for P and chart for np - construction of c-chart – applications of c chart–Natural Tolerance Limits and specification Limits. Modified control limits - Problems.

UNIT - IV: ACCEPTANCE SAMPLING PLAN (18 Hours)

Acceptance Sampling Inspection Plans - AQL, LTPD, Process Average Fraction Defective, Producer's risk and consumer's risk -Rectifying Inspection Plans, AOQL, OC curve, ASN and Average Amount of Total Inspection.Sampling Inspection Plans for Attributes, Introduction to Single Sampling Plan, Double Sampling Plan– Single sampling Vs Double sampling plans. (concepts only)

UNIT - V: VARIABLE SAMPLING PLAN (18 Hours)

Variable sampling plans – sigma known and sigma unknown – Determination of n and k for one sided specification – OC curve – simple problems.

Books for Study:

- Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.
- Gupta, R.C.(1974): Statistical Quality Control.

- Montgomery, D.C. (1983): Introduction to Statistical Quality Control, John Waley& Sons.
- Ekambaram, S K. (1963): Statistical basis of Acceptance sampling, Asia Publishing House.

Books For Reference:

Grant, E,L. and Laven Worth, R.S.: Statistical Quality Control, McGraw Hill.

Web Resources:

http://ie.sharif.edu/~qc/Introduction%20to%20statistical%20qulity%20control,%206th%20edition.pdf
https://www.youtube.com/watch?v=qb3mvJ1gb9g
https://www.youtube.com/watch?v=TbPUiJKyxqw
https://www.msuniv.ac.in/Download/Pdf/a135ed2926a84a1

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Explain the importance of SQC in industry	K2
CO2	To identify various causes of variations to control the outliers	K3
CO3	Choose an appropriate sampling plan for Attributes	K3
C04	Construct and examine control charts and interpret the process control	K3
C05	Compare the known sigma and unknown sigma in VSP	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	1		2	1	
	CO2	3	2	2			
	CO3	3	3	2	1		2
	CO4	3	3	2	1		2
	CO5	3	2	2	1	1	2
	Total	15	11	8	5	2	6
	Average	3	2.2	1.6	1	0.4	1.2

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

FifthSemester				
Course Title		**Operations Research**		
Course Code		**22UESTC4**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –X	**Core**	**4**	**5**	**25+75**

Course Objective: To introduce the concepts of Operations Research and apply their techniques in various optimization fields.

UNIT –I : OR & LPP INTRODUCTION (15 Hours)

Introduction, Origin and Development of O.R., Nature and Features of O.R., Scientific Method in O.R., Modelling in Operations Research, Advantages and Limitations of Models. Linear Programming Problem – Introduction, Linear Programming Problem, Mathematical Formulation of the Problem, Graphical Solution Method, General Linear Programming Problem, Canonical and Standard Forms of LPP.

UNIT –II: METHODS TO SOLVE LPP (15 Hours)

Simplex Method - Introduction, Slack and Surplus variables. The Computational procedure - Uses of Artificial Variables– Two-phase method and Big – M method–Degeneracy in LPP. Duality in Linear Programming ,Primal – Dual Pair, Formulating a Dual Problem, Primal – Dual Pair in Matrix Form, Duality and Simplex Method, Economic Interpretation of Duality.

UNIT –III: TRANSPORTATION & ASSIGNMENT (15 Hours)

Transportation problem- Introduction, LP formulation of the Transportation- Balanced and Unbalanced -Finding anInitial Basic Feasible Solution- Test for optimality – Degeneracy in Transportation problem – Transportation Algorithm (MODI method) – some exceptional cases.

Assignment Problem – mathematical formulation of the problem, Hungarian method of solving assignment problem-Unbalanced Assignment problems - Travelling salesman problem.

UNIT –IV : SEQUENCING & GAME THEORY (15 Hours)

Sequencing Problem – Introduction, Problem of Sequencing, Basic Terms Used in Sequencing, Processing n Jobs Through Two Machines, Processing n Jobs Through k Machines, Processing 2 Jobs Through k Machines.

Games and Strategies – Introduction, Two – Person Zero – Sum Games, Some Basic Terms, The Maximin – Minimax Principle, Games Without Saddle Points – Mixed Strategies, Graphic Solution of 2 X n and m X 2 Games, Dominance Property.

UNIT – V: NETWORK ANALYSIS (15 Hours)

Network Scheduling – Introduction, Network: Basic Concepts, Logical Sequencing, Rules of Network Construction, Critical Path Method –Total float, free float and Independent float. Probability Considerations in PERT – Three time estimates. Distinction between PERT and

CPM, Applications of Network TechniquesAdvantages of Network Techniques, Limitations and Difficulties in Using Network.

Note : The proportion of theory and problem is 30:70

Books for Study and Reference:

- Handy A. Taha (1996): Operations Research, 6 ed. Prentice Hall of India
- Kanti Swamp et al: Operations Research, suichand and Sons, New Delhi.
- Goel& Mittal (1982): Operations Research, PragatiPrakashan, Meerut.
- Gupta R.K.(1985): Operations Research, Krishna Prakashan, Mandir, Meerut.
- Schaum's outline series : Operations Research.
- Frederick S.Hillier& Gerald J.Lieberman: (1987) Operations Research, CBS publishers & Distributors, Delhi.
- Sharma J.K. (2001): Operations Research. Theory and applications, Macmillan India Ltd.
- Sharma J.K. (2002): Operations Research. Problems and solutions, Macmillan India Ltd.

Web Resources:

https://web.itu.edu.tr/topcuil/ya/OR.pdf
https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX
https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course Outcome	K LEVEL
CO1	Recall the models in OR	**K1**
CO2	Develop the mathematical model for primal – dual problem	**K3**
CO3	Maximize and minimize the function of linear model	**K4**
CO4	Distinguish the models between Assignment and Transportation problems and prioritize the order of jobs in sequencing	**K4**
CO5	Disseminate the project and construct the network model. Design the basic concept of game theory, saddle point and fair game	**K3**
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO 1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**					
	CO2	**3**	**2**	**2**	**2**	**2**	**2**
	CO3	**3**		**1**	**1**	**1**	**1**
	CO4	**3**	**1**	**1**	**1**	**1**	
	CO5	**3**	**2**	**2**			**1**
	Total	**15**	**5**	**6**	**4**	**4**	**4**
	Average	**3**	**1**	**1.2**	**0.8**	**0.8**	**0.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Reliability Theory and Survival Analysis**		
Course Code		**22UESTE2A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –II	**Elective**	**5**	**6**	**25+75**

Course Objective:
To introduce the basic concepts of Survival analysis and Reliability theory and apply these techniques in various fields.

UNIT- I: INTRODUCTION (18 Hours)

Concept of reliability, components and systems, coherent systems, reliability of coherent systems. Life distributions, reliability function, hazard rate, Standard life time distribution.

UNIT -II :ESTIMATION OF PARAMETERS (18 Hours)

Estimation of parameters- IFR and DFR distributions. Reliability of system with independent components.- Basic idea of maintainability.

UNIT III :SYSTEM RELIABILITY (18 Hours)

System reliability: series, parallel - parallel-series and series-parallel configurations. k out of n systems. Two component system reliability by markov analysis.

UNIT IV:SURVIVAL ANALYSIS (18 Hours)

Survival Analysis: Concepts of time, Order and random Censoring, likelihood in these cases. Life distributions - Exponential, Gamma, Weibull, Lognormal.

UNIT V: LIFE TABLE (18 Hours)

Life tables, Failure rate, mean residual life and their elementary properties. Ageing classes and their properties, Bathtub Failure rate - Estimation of survival function-Kaplan-Meier Estimator.

Books for Reference:

1. Miller, R G. (1981) Survival Analysis, Wiley, New York.
2. Cox, D R. and Oakes, D. (1984). Analysis of Survival Data, Chapman & Hall, New York.
3. Gross, A.J. and Clark, V.A. (1975). Survival distribution: Reliability applications in the Biomedical Sciences, Wiley, New Delhi.
4. Kalbfleisch, J D. and Prentice, R.L.(1980). The Statistical Analysis of Failure Time Data, wiley, New York.
5. Lawless, J.F. (1982). Statistical Models and Methods of Life Time Data, Wiley, New York.

6. Barlow R.E and Proscan, F. (1985). Statistical Theory of Reliability and Life testing Models, Marcel Dekker, New York.
7. Bain, L.J and Englehard, M. (1991). Statistical Analysis of Reliability and life Testing models, Marcel Dekker.
8. Sinha, S.K. (1979), Reliability and Life Testing, Wiley Eastern, New Delhi.

Web Resources:

https://vardhaman.org/wp-content/uploads/2021/03/Reliability-Engineering.pdfhttp://woodm.myweb.port.ac.uk/q/reliability.pdf
https://mathweb.ucsd.edu/~rxu/math284/slect1.pdf
https://faculty.washington.edu/yenchic/18W_425/Lec5_survival.pdf
https://www.youtube.com/watch?v=lZrjZlRssHk
https://www.youtube.com/watch?v=n-YMzb6xTsA&list=PLOnJQiDsowogZnvfY3HUR34pjrH7hZLpD

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course Outcome	Knowledge Level
CO 1	Define concept of Reliability and Hazard failure rate	K1
CO 2	Estimating the parameters, IFR,DFR distribution	K4
CO 3	Recall the Markov analysis	K1
CO 4	Outline the concept time and censoring in survival analysis	K2
CO 5	List out the elementary properties of life tables and estimation of survival function	K1,K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO 1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**1**	**3**	**2**	**2**	**1**	
	CO2	**3**	**3**	**3**	**1**		**1**
	CO3	**2**	**3**	**1**	**3**	**2**	
	CO4	**2**	**3**	**2**	**3**	**3**	**2**
	CO5	**2**	**3**	**3**	**2**	**1**	**3**
	Total	**10**	**15**	**11**	**11**	**7**	**6**
	Average	**2**	**3**	**2.2**	**2.2**	**1.4**	**1.2**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)
Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Regression Analysis**		
Course Code		**22UESTE2B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –II	**Elective**	**5**	**6**	**25+75**

Course Objective:

- To expose the students to the wide areas of its applications
- To introduce the vital area of regression models applicable in a wide variety of situations.

UNIT- I : SIMPLE LINEAR REGRESSION (18 hours)

Introduction to Regression –Assumptions of Linear Regression.LSE of parameters. Mathematical and Statistical Equation – Meaning of Intercept andSlope – Error term – Measure for Model Fit –R^2 – MAE – MAPE – Testing Significance of Model Coefficients, Confidence interval for model coefficients.

UNIT -II: MODEL DIAGNOSTICS (18 hours)

Model diagnostics - Mean predicted value, Testing normality of error term, QQ-plot, PP- plot, Anderson Darling, Kolmogrov Smirnov

UNIT - III: MULTIPLE LINEAR REGRESSION (18 hours)

Introduction to Multiple Linear Regression Model, Partial Regression Coefficients, Testing of Significance overall significance of Overall fit of the model, Testing for Individual Regression Coefficients, Estimating R^2 , MAE and MAPE

UNIT- IV: DUMMY VARIABLE (18 hours)

Dummy Variable trap, Study of Interaction Effects, Varying Intercept and Slope using dummyvariable, Detection and Removal of Outliers

UNIT - V : ERROR TESTING` (18 hours)

Study of Normality of Error Term using graphical and testing procedures, TestingforMulticollinearity using VIF, Testing for assumption of Homoscedasticity.

Books for Study:

Gujarati, D.(2004): Introduction to Econometrics. McGraw Hill, New Delhi.

Books for Reference:

Montgomery,D.C. ,Peck E.A, & Vining G.G.(2003). Introduction to Linear Regression Analysis. John Wiley and Sons,Inc.NY

Web Resources:

https://www.youtube.com/watch?v=OQV8WmUdeIo&list=PLbMVogVj5nJSpj5sl-8tdKARg1lw2wEa-
https://open.umich.edu/sites/default/files/downloads/interactive_lecture_notes_12-regression_analysis.pdf
http://spartan.ac.brocku.ca/~jvrbik/MATH3P82/notes.pdf
http://www.uop.edu.pk/ocontents/gujarati_book.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Understand the components of prediction model	K2
CO2	Study the linear relationship between regression and predicted variables.	K4
CO3	Identify the models violations and transformation of variables	K3
CO4	Relate the model accuracy with MAE, MAPE, R^2	K2
CO5	Acquire knowledge about latent variables by introducing the dummy variables for categorical regressors.	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**2**	**2**		**1**		**1**
	CO2	**2**	**3**	**2**	**2**	**1**	**1**
	CO3	**3**	**3**	**2**	**2**	**1**	
	CO4	**3**	**3**	**2**	**1**		**1**
	CO5	**3**	**3**	**3**	**2**	**1**	
	Total	**13**	**14**	**9**	**8**	**3**	**3**
	Average	**2.6**	**2.8**	**1.8**	**1.6**	**0.6**	**0.6**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Fifth Semester				
Course Title		**Programming in 'R'**		
Course Code		**22UESBE5**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
SBE V	**SBE**	**2**	**2**	**40+60**

Course Objective:

To impart efficient Data Handling Techniques

To equip students to Statistical Programming Skills based on real life examples and datasets

UNIT-I: R INTRODUCTION **(6 hours)**

Overview of R Environment – R editor – Workspace – Data type – Importing and Exporting Data – Basic Computational Ideas – Merges in R

UNIT -II: MATRIX MANIPULATION USING R **(6 hours)**

Matrix Determinant – Inverse – Transpose – Trace – Eigen Values and Eigen Vectors – Construction of Bar, Pie, Histogram, Line Chart, Box Plot, Scatter Plot

UNIT -III: PARAMETRIC TESTING USING R **(6 hours)**

Parametric testing of Statistical Hypothesis – One Sample t test –two group - t test – paired t test – one way ANOVA- two way ANOVA.

UNIT -IV: CORRELATION AND REGRESSION **(6 hours)**

Simple Correlation - Linear Regression –Testing for Individual Regression Coefficients – Outliers Detection – Dealing with Multicollinearity.

UNIT -V: NON-PARAMETRIC TESTING **(6 hours)**

Non Parametric testing of Statistical Hypothesis –Sign Test – Wilcoxon – Mann-Whitney – KruskalWalli's test.

Books for Study& References:

1. Learning Statistics using R By RndallE.Schumacker, Sage Publication
2. R for Everyone By Jared P.Lander, Pearson Education
3. Learn R for Applied Statistics, Hui, Apress, 2020
4. Beginning Data Science in R – Data Analysis visualization, Mailund, Apress, 2017

Web Resources:

https://www.gpcet.ac.in/wp-content/uploads/2018/08/R-PROGRAMMING-LECTURE-NOTES-1-30.pdf

https://www.stats.ox.ac.uk/~evans/Rprog/LectureNotes.pdf

https://www.youtube.com/watch?v=dN2m8irACSw&list=PLivwQpaBnnb8xeOMiIdwVQhTYeAmFBzsT

https://www.youtube.com/watch?v=lyFDNkbsQuE

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	To motivate the students to understand the fundamentals of R programming.	K2,K4
CO2	Exhibit the knowledge of Statistical Programming Skills based on real life datasets	K1
CO3	To recall efficient Data Handling Techniques in R	K1
CO4	Understand R codes for statistical analytical techniques	K2
CO5	Analyse the real time data set by using R	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**			
	CO2	**3**	**3**	**3**	**2**	**1**	**3**
	CO3	**3**	**3**	**3**	**2**		**2**
	CO4	**3**	**3**	**3**	**3**	**1**	**2**
	CO5	**3**	**3**	**3**	**3**		**3**
	Total	**15**	**15**	**15**	**10**	**2**	**10**
	Average	**3**	**3**	**3**	**2**	**0.4**	**2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

Note:

- Practical classes with hands-on training in the course concepts and an opportunity to explorethe methods used in their discipline.
- All the students are expected to be regular and learn the practical aspects of the subject and develop the necessary skills to become professionals.
- Assessment is based on the ability of the student to actively participate in the successful conduct of prescribed practical work and draw appropriate conclusions.
- The student submits a record of practical work performed in each practical class.
- Out of a total of 100 marks for the practical work, 40 marks shall be allotted for Internal Evaluation and 60 marks for the End Semester Examination.

List of programs under Descriptive Statistics, Correlation, Regression and Test of significance

1. Draw the Diagrams and Graphs
2. Calculate the Measures of Central tendency, Dispersion, Skewness and Kurtosis
3. Calculate the correlation coefficient.
4. Calculate the regression equations.
5. Calculate multiple regressions.
6. Problems for the one sample Z – test for mean and proportion.
7. Problems for the two samples Z - test for mean and proportion.
8. Problems for the paired t-test.
9. Problems of t test for mean for one sample and two samples.
10. Problems of F test for equality of variances
11. Problems for the chi-square test independence of attributes.
12. Problems for the chi-square goodness of fit test.
13. Non Parametric tests: Sign test – Wilcoxon Mann-Whitney U test – Kruskal Wallis test

Distribution of Marks for University Examinations

Algorithm / Flowchart: 10 Marks

Writing the Program in the Main Answer Book : 20 Marks

Run the Program: 20 Marks

Display the Correct Output:10 Marks

SEMESTER- VI

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Design of Experiments**		
Course Code		**22UFSTC1**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CC –XI	**Core**	**4**	**6**	**25+75**

Course Objective: To introduce the concepts and basic principles of Design of Experiments and apply their techniques in Industrial, Agricultural and Biological fields.

UNIT - I: ANOVA **(18 Hours)**

Introduction of Analysis of Variance – Basic concepts – assumptions of ANOVA –Statistical Analysis of One-way classification, two -way classification(without interaction) Fixed effect model – Random Effect Model - Multiple range test, Newman Keul's test –Tukey's test.

UNIT - II: EXPERIMENTAL DESIGN INTRODUCTION **(18 Hours)**

Experimental Design : Introduction, Basic concepts of Experimental Design, Terminology in Experimental Designs – Basic Principles – Replication – Randomization and Local Control Techniques – Size of experimental unit – Fairfield smith's method of determining the size of experimental Units.

UNIT - III: CRD, RBD & LSD **(18 Hours)**

Linear Model and its classifications. Completely Randomized Design (CRD) and its analysis-Randomized Block Design (RBD) and its analysis-Latin Square Design(LSD) and its analysis. Advantages and dis-advantage of CRD, RBD and LSD.One and two missing observations in RBD and LSD.

UNIT - IV: FACTORIAL EXPERIMENT **(18 Hours)**

Factorial Experiments – Introduction, Analysis, Main and Interaction Effects of 2^2, 2^3 Factorial Experiments.Advantages of Factorial Experiments. Principle of Confounding – Complete & Partial Confounding in 2^3 Factorial Experiments

UNIT - V: BIBD **(18 Hours)**

BIBD – Definition – parameters of BIBD and their relationships – Incidence matrix – symmetric BIBD – Intra Block Analysis of BIBD – construction of BIBD.Definition of ANOCOVA.

Books for Study:

- Dass M.N and Giri N.C (1986) Design and Analysis of Experiments, Wiley Eastern, New Delhi.
- Kempthorne, (1956) Design and Analysis of Experiments, John Wiley. New York.

Books For Reference:

- Montgomery, D (1972) Design of Experiments, John Wiley and Sons
- Kapoor, V.K. and Gupta, S.P. (1978): Fundamentals of applied statistics, Sultan Chand & Sons.

Web Resources:

http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/502_06_Montgomery-Design-and-analysis-of-experiments-2012.pdf
https://www.youtube.com/watch?v=IEUTRhyoHNc&list=PLPjSqITyvDeWS9Lxp4jreGJ7eNsxHxJA8
https://www.ctanujit.org/uploads/2/5/3/9/25393293/_a.dean_d.voss_-_design_and_analysis_of_experiments.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define the basics of experimental Design	K1
CO2	Classify and analyse the linear models	K2,K4
CO3	Construct and layout the designs of CRD, RBD & LSD with interpretation and compare their efficiency between the design	K3,K4
CO4	Make use of various factors with various levels to construct the experiments	K3
CO5	Describe BIBD,Split Plot Design and Analysis of Covariance	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	2	2		1		
	CO2	3	1		3		2
	CO3	3	2	2	2	2	2
	CO4	3	3	2	1	1	
	CO5	3	2	1			
	Total	14	10	5	7	3	4
	Average	2.8	2	1	1.4	0.6	0.8

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30

Grand Total	75

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Applied Statistics**		
Course Code		**22UFSTC2**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External) 100**
CC –XII	**Core**	**5**	**6**	**25+75**

Course Objective: To interpret the concepts of Time series, Index numbers and Official Statistics and apply their tools in the various fields.

UNIT - I:TIME SERIES AND ITS COMPONENTS (18 hours)

Time series: Introduction-Components of time series - Additive and multiplicative models – uses of time series - Measurement of trend: Free hand method-Semi average method-Moving average method –Method of curve fitting by Principle of Least square – merits and demerits - Problems.

UNIT - II:MEASUREMENT OF SEASONAL VARIATION (18 hours)

Measurement of seasonal variations: Simple average method - Ratio to trend method - Ratio to moving average method - Link relative method – Merits and Demerits of these methods - Problems.

UNIT - III:INDEX NUMBERS (18 hours)

Index Numbers – Introduction – Basic problems involved in the construction of Index numbers –Construction of Index numbers-Unweighted and Weighted - Uses - Classification – Problems.

UNIT -IV:TEST FOR INDEX NUMBERS (18 hours)

Quantity Index numbers: Fixed and Chain base index numbers - Optimum test for index numbers - Time reversal test - factor reversal test - Cost of living index numbers.Problems.

UNIT -V:OFFICIAL STATISTICS (18 hours)

Official Statistics: Statistical System in India CSO and NSSO and its functions - Present structure of the Indian statistical system - Functions of a statistical system - Agricultural statistics - Industrial statistics - Trade statistics - Labour statistics - Transport and Communication statistics – Examples.

Books for Study:

- Kapoor,V.K and Gupta,S.C (1978); Fundamentals of Applied Statistics, Sultan chand& Sons.
- Saluja,M.R (1972): Indian official statistical systems: Statistical publishing society, Calcutta and The Indian Econometric Society, Hyderabad.

Books for Reference:

- Gupta, S.P (1999): Statistical Methods, Sultan & Sons, New Delhi.
- Croxton, F.E &Cowdon, D.J. (1973): Applied general statistics, Prentice Hall

Web Resources:

https://www.youtube.com/watch?v=YtLmLPI-7sE
https://www.youtube.com/watch?v=ldo4b-d2EYM
https://www.youtube.com/watch?v=0odTT2CZdN0&list=PLcOVZjNptNPKIcEaxHqoqT811YYm7CAsi

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Understand the components of time series	K2
CO2	Interpret the future values by summarizing past time series values	K2
CO3	Construct the different types of Index numbers	K3
CO4	Analyse the economic crisis by constructing various Index numbers	K4
CO5	Acquire knowledge about the function of NSSO, CSO	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**1**			**1**	
	CO2	**3**	**3**	**3**	**2**		**2**
	CO3	**3**	**3**	**3**	**2**		**3**
	CO4	**3**	**3**	**3**	**2**		**3**
	CO5	**3**	**2**	**1**		**2**	
	Total	**15**	**12**	**10**	**6**	**3**	**8**
	Average	**3**	**2.4**	**2**	**1.2**	**0.6**	**1.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Stochastic Processes**		
Course Code		**22UFSTC3**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External) 100**
CC –XIII	**Core**	**5**	**7**	**25+75**

Course Objective: familiarize the students with the stochastic Processes and Equip the students with the knowledge of Markov Processes.

UNIT - I: INTRODUCTION (21 hours)

Basic Concepts : Definition and examples of stochastic process, classification of general stochastic processes into discrete and continuous time, discreteand continuous state spaces, types of stochastic processes, elementary problems.

UNIT - II:MARKOV PROCESS (21 hours)

Markov chains: Definition and examples of Markov chain-Transition Probability Matrix-Chapman Kolmogrov equation-classification of states and chains. Definition – aperiodic – closed chains – absorbing – irreducible – persistent – transient – ergodic. First Entrance theorem (Statement only)

UNIT –III:MARKOV CHAIN (21 hours)

Basic limit theorem of Markov chain (statement only) - stationary probability distribution, applications.Ergodic theorem – problems

UNIT -IV:POISSON PROCESS (21 hours)

Markov Process with discrete state space-Poisson Process- definition – Postulates for poisson process – Properties of Poisson Process.

UNIT - V:BIRTH –DEATH PROCESS (21 hours)

Pure birth process- Yule-furry Process. Birth and death Process- Definition - Extinction Probability.

Books for Study and Reference:

- Karlin, S. and Taylor, H.M. (1975): A first course in Stochastic processes, Academic press.
- Hoel, P.M.G., Port, S.C. and Stone, C.J. (1991): Introduction to Stochastic processes, Universal Book Stall.
- Parzen, E. (1962): Stochastic processes, Holden-Day.
- Cinlar, B. (1975) Introduction to Stochastic processes, Prentice Hall.
- Adke, S.R. and Manjunath, S.M. (1984): An introduction to Finite Markov Processes, Wiley Eastern.

- Medhi, J. (1996): Stochastic processes, New Age International (p) Ltd.
- Ross, S.M. (1983): Stochastic processes, John Wiley.
- Taylor, H.M. and Karlin, S. (1999): Stochastic Modelling, Academic press.

Web Resources:

https://www.youtube.com/watch?v=KUDhXlnr-gU&list=PLbMVogVj5nJSdK0QYFHb-dNHwMstca4OM
http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/305_03_00_Medhi_Stochastic-Processes.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Make use of probability and states space to understand the process with time	K3
CO2	Demonstrate the probability distribution of the states space with given transition probability matrix	K2
CO3	Classify and understand the various types of discrete and continuous stochastic process	K2
CO4	Simplify the numerical solution of transition probability matrixes for real time problem	K4
CO5	Pursue higher studies with the concept of Poisson process and Branching process and apply Markov property for estimating the future behavior of the process	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	2	2	2	2	
	CO2	3	3	1	1		1
	CO3	3	3	2	2	1	
	CO4	3	3	1	1		2
	CO5	3	3	2	2	1	1
	Total	15	14	8	8	4	4
	Average	3	2.8	1.6	1.6	0.8	0.8

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc Degree Programme in Statistics

Sixth Semester				
Course Title		**Computational Statistics - III**		
Course Code		**22UFSTC4**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External) 100**
CCP - XIV	**Core**	**4**	**3**	**40+60**

NOTE: Candidates are to answer any four out of six questions. All questions carry equal marks

Course Objectives:

- Classify the chronological data to analyze the pattern of data
- Drawing a sample from random number table by using different methods of sampling

1. Non – Parametric Test

- Sign Test
- Run Test
- Test For Randomness
- Mann – Whitney
- Wilcoxon U Test
- Median Test

2. Design of Experiments

- One – Way Classification
- Two – Way Classification
- Completely Randomized Design
- Randomized Block Design
- Latin Square Design

3. Statistical Quality Control

- $\bar{X}$ and R Chart
- $\bar{X}$ and S Chart
- p Chart
- np Chart
- c Chart
- Single Sampling Plan
- Double Sampling Plan

4. Sampling Techniques

- Selection of Simple Random Sample by Using Random Numbers Table
- Simple random sampling with replacement
- Simple random sampling without replacement
- Stratified Random Sampling- Proportional Allocation
- Stratified Random Sampling- Optimum Allocation

5. Time Series

- Estimating Trend by Method of Least Squares
- Estimating Trend by Moving Averages
- Seasonal Variations by the Method of Simple Averages
- Seasonal Variations by Ratio to Trend Method
- Seasonal Variations by Ratio to Moving Averages
- Seasonal Variations by Link Relative Method

6. Index Numbers

- Weighted Aggregate Index Number
    i. Laspeyre's Method
    ii. Paasche's Method
    iii. Dorbish and Bowley's Method
    iv. Fisher's Ideal Method
    v. Marshall – Edgeworth Method
    vi. Kelly's Method
    vii. Walsch's Method.
- Test of Consistency of Index Numbers
  i. Time Reversal Test
  ii. Factor Reversal Test
- Weighted Averages of Price Relatives
- Link Relative Methods of Price
- Conversion of Chain Base Index into Fixed Base Index
- Conversion of Fixed Base Index into Chain Base Index
- Cost of Living Index Number
  i. Aggregate Expenditure Method
  ii. Family Budget Method

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Categories proper test to Non- parametric test	K4
CO2	Construct simple random sample by using random number tables	K3
CO3	Analyse the real life problems of CRD, RBD and LSD	K4
CO4	Construct the ideal measure for Index numbers	K3
CO5	Identify the outliers in control chart and interpret the results	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**	**2**	**2**	
	CO2	**3**	**2**	**2**	**1**		**1**
	CO3	**3**	**2**	**2**	**1**	**2**	
	CO4	**3**	**2**	**3**	**2**		**1**
	CO5	**3**	**2**	**2**			**1**
	Total	**15**	**11**	**12**	**6**	**4**	**3**
	Average	**3**	**2.2**	**2.4**	**1.2**	**0.8**	**0.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Resource Management Techniques**		
Course Code		**22UFSTE3A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External) 100**
CEC - III	**Elective**	**5**	**6**	**25+75**

Course Objective:A conceptual and practical introduction to the basic concepts of Resource ManagementTechniquesandAchieve the satisfactory levels of customer service by keeping the inventory within reasonable bounds being explained.

UNIT -I: INVENTORY CONTROL (18 hours)

Inventory control – Costs associated with inventories, Factors affecting inventory control, Economic order Quantity – Deterministic Inventory problems with no shortages – EOQ problem with finite replenishment – Deterministic Inventory problem with shortages – EOQ problems with price breaks , one price break and more than one price break.

UNIT- II: QUEUEING THEORY (18 hours)

Queueing Theory – Introduction, Queueing system – Elements of queueing system – operating characteristics of queueing system – Probability distribution in queueing systems, Distribution of arrival, inter-arrival time and departures – Classification of queueing models – (M/M/1) : (∞ /FIFO) – Characteristic of Model I – (M/M/1): (N/FIFO) Model and its characteristics – (M/M/C) : (∞ /FIFO) and (M/M/C): (N/FIFO) – Concept and simple problems only

UNIT-III: REPLACEMENT PROBLEM (18 hours)

Replacement problem - Introduction – Replacement policy when value of Money does not change with time – Replacement policy when value of Money change with time - replacement of equipment that fails suddenly – Reliability and system failure rates – Bath – tub shaped failure rate – mean time between failure – Estimation of reliability , Reliability improvement.

UNIT- IV: DECISION MAKING (18 hours)

Decision Analysis – Introduction , Decision making problem – Decision making process – Decision making environment – Decision under uncertainty – Laplace criterion , Maximin or Minimax Criterion , Maximax or Minimin criterion, Hurwicz criterion and Savage criterion – Decision under risk – Expected monetary value , expected opportunity loss , Expected value of perfect information – Decision tree analysis

UNIT -V: SIMULATION (18 hours)

Simulation – Introduction – need of simulation – methodology – Simulation models – Event – type simulation – Generation of random numbers – Monte-Carlo simulation – simulation of inventory problems – simulation of Queueing problem – simple problems only.

Books for Study and Reference:

- Handy A. Taha (1996): Operations Research, 6 ed. Prentice Hall of India
- Kanti Swamp et al: Operations Research, suichand and Sons, New Delhi.
- Goel& Mittal (1982): Operations Research, PragatiPrakashan, Meerut.
- Gupta R.K.(1985): Operations Research, Krishna Prakashan, Mandir, Meerut.
- Schaum's outline series : Operations Research.
- Frederick S.Hillier& Gerald J.Lieberman: (1987) Operations Research, CBS publishers & Distributors, Delhi.
- Sharma J.K. (2001): Operations Research. Theory and applications, Macmillan India Ltd.
- Sharma J.K. (2002): Operations Research. Problems and solutions, Macmillan India Ltd.

Web Resources:

https://www.youtube.com/watch?v=tO5MmOBdkxk
https://alameen.ac.in/images/QUESTIONBANK/CSE/IIYEAR/MA6453PQTLecture-Notes.pdf
https://www.vssut.ac.in/lecture_notes/lecture1428910921.pdf
https://www.youtube.com/watch?v=60NPCETGFYI
https://cs.wmich.edu/alfuqaha/Spring10/cs6910/lectures/Chapter1.pdf
https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define the basics and classify the inventory models and identify the optimistic models with shortage cost and storage cost.	K1,K2
CO2	Understand the basic parameters of queueing models which will help to reduce the estimated waiting time of a customer and to improve customer behaviours in future.	K2
CO3	Demonstrate the replacement policy of a good and understand the pattern of mean failure rate.	K2
CO4	Classify the decision making circumstances and identify the optimum solution with respect to profit as well as loss.	K3,K4
CO5	Understand the real time unimaginable or non availability of data by using the concept of simulation which will help to reach a better solution for a practical situation without any loss.	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	2		1	2		
	CO2	2	2	3	3	1	2
	CO3	2	1	3	2	1	2
	CO4	3	2	3	2	1	1
	CO5	3	2	3	2		1
	Total	12	7	13	11	3	6
	Average	2.4	1.4	2.6	2.2	0.6	1.2

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Data Mining**		
Course Code		**22UFSTE3B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –III	**Elective**	**5**	**6**	**(25+75)**

Course Objectives:

- To learn about data mining Concepts and to study the different data mining techniques

UNIT – I :INTRODUCTION (18 hours)

Basic Data Mining Tasks – Data Mining Versus Knowledge Discovery in Data Bases – Data Mining Issues – Data Mining Matrices – Social Implications of Data Mining – Data Mining from Data Base Perspective.

UNIT – II :TECHNIQUES (18 hours)

Data Mining Techniques – a Statistical Perspective on data mining – Similarity Measures – Decision Trees – Neural Networks – Genetic Algorithms.

UNIT – III :CLASSIFICATION TECHNIQUE (18 hours)

Classification: Introduction – Statistical – Based Algorithms – Distance Based Algorithms – Decision.

UNIT – IV :CLUSTERING TECHNIQUES (18 hours)

Clustering Tree – Based Algorithms – Neural Network Based Algorithms – Rule Based Algorithms – Combining Techniques: Introduction – Similarity and Distance Measures – Outliers – Hierarchical Algorithms. Partitioned Algorithms.

UNIT – V :BASIC ALGORITHMS (18 hours)

Association Rules: Introduction - Large Item Sets – Basic Algorithms – Parallel & Distributed Algorithms – Comparing Approaches – Incremental Rules – Advanced Association Rules Techniques – Measuring the Quality of Rules.

TEXT BOOK:

Jiawei Han &MichelineKamber, “Data Mining Concepts & Techniques”, 2011, 3 rd Edition.

REFERENCE BOOK:

- Margaret H.Dunbam, “Data Mining Introductory and Advanced Topics”, Pearson Education 2003.
- Tan, T., Steinbach, M. and Kumar, V. (2006): Introduction to Data Mining, Pearson Education.

- Gupta, G.K. (2008): Introduction to Data Mining with case studies, Prentice – Hall of India Pvt. Ltd.
- Daniel T. Larose (2006):
- Data Mining: Methods and Models, John Wiley and Sons. Han, J. and Kamber, M. (2006):
- Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann Publishers. Paolo Gludici (2003):
- Applied Data Mining: Statistical Methods for Business and Industry, John Wiley and sons RajanChattamvelli (2009):
- Data Mining Methods, Narosa Publishing House, New Delhi.

WEB REFERENCES:

https://nptel.ac.in/courses/106105174

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Apply Data mining concepts in different fields and Examine the types of data to be mined	K3
CO2	Discover interesting patterns from large amounts of data to analyse and extract to solve problems	K3,K4
CO3	Select and apply proper data mining algorithms to build analytical applications.	K3
CO4	Evaluate supervised and unsupervised models and algorithms.	K4
CO5	Design and implement data mining application using realistic data sets and modern tools	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	2	1	2		
	CO2	3	3	2	3	1	2
	CO3	3	3	2	3		2
	CO4	3	3	2	3	1	2
	CO5	3	3	2	3		
	Total	15	14	9	14	2	6
	Average	3	2.8	1.8	2.8	0.4	1.2

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Python Programming for Statistics**		
Course Code		**22UFSTE3C**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
CEC –III	**Elective**	**5**	**6**	**(25+75)**

Course Objectives:

To acquire programming and object oriented skill in Python .
To acquire graphic oriented skill in python.
To learn features available in python for data analysis and develop database applications.

UNIT -I: DATA HANDLING (18 hours)

Python data types and variables-numbers, strings and lists-dictionaries-Tuples Data type conversions, simple programs using mathematical function-Generation of random numbers.

UNIT-II: CONTROL AND LOOPING STATEMENT (18 hours)

Statements and Syntax: Assignment, Expression and print- If tests-While and for loops- break, continue, pass and the loop else- Documenting python codes- Common coding - Simple programs using Statistical function.

UNIT -III:FILE HANDLING (18 hours)

Functions and File handling - Functions and its uses- Coding functions-Scope Rules-The global Statement-Scopes and nested functions-Passing arguments-Special Argument matching modes-Objects and Classes.

UNIT -IV:CLASSES AND INHERITANCE (18 hours)

Classes and OOP in Python:Classes: Class Statements-Methods-Inheritance. Operator-Overloading-Class coding Basics-Designing with Classes: Python and OOP, OOP and inheritance-OOP and Composition- OOP and delegation Multiple inheritance.

UNIT -V:DATA VISUALIZATION (18 hours)

Data Wrangling and Visualization in Python-Combining and merging datasets - Reshaping and Pivoting- Matplotlib package-plotting graph-Pivot table and Cross tabulation.

Books for References:

1. Mark Lutz (2010), Programming Python, O'Reilly,4th edition, 2010.
2. Wes Mc Kinney (2012), Python for Data Analysis, O'Reilly Media.
3. Martin C. Brown (2018), Python-The Complete Reference, McGraw Hill Education.

Web Resources:

https://www.youtube.com/watch?v=4SJ7bEILPJk&list=PLLy_2iUCG87CNafffzNZPVa9rW-QmOmEv
https://www.youtube.com/watch?v=Yg6xzi2ie5s&list=PLDsnL5pk7-N_9oy2RN4A65Z-PEnvtc7rf&index=4
https://mrcet.com/downloads/digital_notes/CSE/III%20Year/PYTHON%20PROGRAMMING%20NOTES.pdf
https://www.stat.berkeley.edu/~spector/python.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	To motivate the students to understand the fundamentals of Python programming.	K3
CO2	Exhibit the knowledge of Statistical Programming Skills based on real life datasets	K1
CO3	Develop the procedure for efficient Data Handling Techniques in Python	K3
CO4	Understand Python codes and packages for statistical analytical techniques.	K2
CO5	Analyse the real time data set by using Python	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**	**3**		
	CO2	**3**	**3**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**		**3**	**2**	**1**
	CO4	**3**	**3**	**2**	**3**	**2**	**1**
	CO5	**3**	**3**	**3**	**3**	**2**	**1**
	Total	**15**	**15**	**11**	**15**	**8**	**4**
	Average	**3**	**3**	**2.2**	**3**	**1.6**	**0.8**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Sixth Semester				
Course Title		**Data Analysis using MS Excel and SPSS**		
Course Code		**22UFSBE6**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
SBE - VI	**SBE**	**2**	**2**	**(40+60)**

Course Objective: To train the students in EXCEL and SPSS software.

UNIT-I : MS EXCEL INTRODUCTION (6 hours)

Introduction to MS Excel – MS Excel Options –Saving Excel File as PDF, CSV – Using Excel Shortcuts – Copy, Cut, Paste, Hide, Unhide, and Link the Data in Rows, Columns and Sheet – Using Paste Special Options – Formatting Cells, Rows, Columns and Sheets.

UNIT–II : FUNCTIONS& CHARTS (6 hours)

Functions: - Logical Functions – Date and Time Functions – Statistical Functions – Text Functions – Charts:- Simple Bar Chart – Multiple Bar Chart – Subdivided Bar Chart – Pie Chart.

UNIT –III : CALCULATION OF STATISTICAL MEASURES (6 hours)

Statistical measures – Mean, Variance, Percentiles, Quartiles – Pearson correlation – Spearman's Rank correlation.

UNIT-IV: SPSS –DATA HANDLING (6 hours)

Data handling: open SPSS data file – save – import from other data source – data entry – 115abeling for dummy numbers – recode in to same variable – recode in to different variable – transpose of data – insert variables and cases.

UNIT – V: ANALYSIS USING SPSS (6 hours)

Diagrammatic representation: Simple Bar chart – Multiple bar chart – Sub-divided Bar chart– Percentage chart– Pie chart- Data analysis– descriptive – correlation, parametric tests – non-parametric tests.

Books for Study:

1. Microsoft Excel 2016 Step by Step by Curtis Frye
2. Microsoft Excel Functions & Formulas by Bernd Held
3. Clifford E.Lunneborg (2000). Data analysis by resampling: concepts and applications. Dusbury Thomson learning. Australia.
4. Everitt, B.S and Dunn, G (2001). Applied multivariate data analysis. Arnold London.

Books for Reference:

1. Excel Functions and Formulas Paperback by Bernd Held
2. Microsoft Excel 2010 Data Analysis and Business Modeling Paperback by Winston

3. Jeremy J. Foster (2001). Data analysis using SPSS for windows. New edition. Versions 8-10. Sage publications. London.
4. Michael S. Louis – Beck (1995). Data analysis an introduction, Series: quantitative applications in the social sciences. Sage. Publications. London.

Web Resources:

https://www.gacbe.ac.in/pdf/ematerial/18BCS5EL-U5.pdf
https://nios.ac.in/media/documents/vocational/basiccomp/l12.pdf
https://www.uvm.edu/~statdhtx/fundamentals9/SPSSManual/SPSSLongerManual/SPSSChapter1.pdf
https://www.ibm.com/docs/en/SSLVMB_28.0.0/pdf/IBM_SPSS_Statistics_Brief_Guide.pdf
https://www.youtube.com/watch?v=rwbho0CgEAE
https://www.youtube.com/watch?v=ZpwZS3XnEZA

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Understand the basics of data entry and analyse the simple data which will help to pursue data science in their higher studies	K2,K4
CO2	To classify the data set to understand the pattern of the data.	K2
CO3	Analyse the real life examples data by Excel	K4
CO4	Interpret the analysis of statistical data by using EXCEL and SPSS	K2
CO5	Make use of EXCEL AND SPSS knowledge to solve the problems in research methodology	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (©	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**3**	**3**	**2**		
	CO2	**3**	**3**	**2**	**2**	**1**	**2**
	CO3	**3**	**3**	**2**	**2**	**1**	**2**
	CO4	**3**	**3**	**3**	**2**	**1**	**2**
	CO5	**3**	**3**	**3**	**2**	**3**	**3**
	Total	**15**	**15**	**13**	**10**	**6**	**9**
	Average	**3**	**3**	**2.6**	**2**	**1.2**	**1.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

Ms. Excel

➢ Spreadsheet basics

➢ Creating, editing, saving and printing spreadsheets

➢Working with functions & formulas

➢ Graphically representing data : Charts & Graphs

➢ Speeding data entry : Using Data Forms

➢ Analyzing data : Data Menu, Subtotal, Filtering Data

➢ Formatting worksheets

➢ Securing & Protecting spreadsheets

- Diagrams: Bar: Simple, Multiple and subdivided, Pie diagram
- Calculation of statistical measures: Mean , variance, Percentiles, quartiles, Pearson Correlation and Spearmans rank correlation.

SPSS

➢ Type of Scale of Measurements, Choosing appropriate scale and measurement to the data, preparing codebook.

➢getting to Know SPSS: Starting SPSS, Working with data file, SPSS windows, Menus, Dialogue boxes.

➢preparing the Data file: Creating data file and entering data, Defining the variables, Entering data, modifying data file, import file, Screening and cleaning data, Manipulation of data. SPSS - Preliminary Analysis

Descriptive statistics: Categorical variables, continuous variables, checking normality, outliers checking.

➢ Statistical techniques: Explore relationship among variables Correlation: Pearson product moment correlation, Spearman rank correlation, Simple linear regression.

- Parametric and non Parametric test.

NOTE:
Semester Examination for 60 Marks.

1. (a) or (b) Questions from Excel
2. (a) or (b) Questions from SPSS (Diagrams or Graphical representation)
3. (a) or (b) Questions from SPSS (Application of Statistical Tools)

- Three Questions will be given and they have to answer all the Questions
- One from MS –EXCEL - To find average and represent in charts
- Two Questions from SPSS (Basic and applying Proper Statistical Tools)
- Students has to enter the problem (data) in EXCEL & SPSS
- Frame the Null and Alternative Hypothesis
- Choose the correct Statistical Tool and apply
- Display the output
- Interpret the result

B.Sc., Degree Programme in Statistics

First Semester				
Course Title		**Statistics for Beginners**		
Course Code		**22UASTN1A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-I	**NME**	**2**	**2**	**(25+75)**

Course Objective: Toorient the students to learn Basic Statistics for other department students in all discipline (BA/B.com/B.sc/BBA)

UNIT – I: INTRODUCTION (6 hours)

Introduction of Statistics – Definition – Scope of Statistics – limitations of statistics.

UNIT –II: COLLECTION & TABULATION (6 hours)

Collection of Data: Data collection – Primary data – Secondary data – sources of data – Classification – Tabulation of data.

UNIT –III: DIAGRAMMATIC & GRAPHICAL PRESENTATION (6 hours)

Presentation of Data: Diagrammatic presentation of data – construction of simple bar – sub divided – multiple bars – pie diagram – pictograms – cartograms.
Graphical presentation of Data – Histogram, frequency polygon – frequency curve – ogives

UNIT –IV:MEASURES OF AVERAGE (6 hours)

Measures of Central tendency – Arithmetic Mean – Median –Mode – Geometric Mean – Harmonic Mean

UNIT –V: THEORY OF ATTRIBUTES (6 hours)

Theory of attributes – consistency of of data – independence of attributes and Association of attributes – Yule's coefficient of association – coefficient of colligation.

Books for Study:

1. Hogg, R.V. and Craig, A.T. (1998): Introduction to Mathematical Statistics, 4th ed. Academic Press.
2. Hoel, P.G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.
3. Goon, AM., Gupta M.K and .Dasgupta B (1991): Fundamentals of Statistics, Vol.1, World Press, Calcutta.

4. Bhat B.R, Srivenkataramana T, and Madhava K.S,(1996) Statistics: A Beginner's text Vol. I, New Age International (P) Ltd.
5. Gupta,S.P.:Statisticalmethods,Sultan Chand & Sons PvtLtd.New Delhi.

Books for Reference:

1. G.U.Yule and M.G. Kendall (1956): An introduction to the theory of Statistics, Charles Griffin.
2. M.R. Spiegel (1961): Theory and problems of statistics, Schaum's outline series. Snedecor .G.W. and Cochran W.G. (1967): Statistical methods, Iowa State University Press.
3. Anderson, T.W. and Sclove SL. (1978): An introduction to statistical analysis of data, Houghton Miffin/co.
   Croxton FE, and Cowden D.J. (1973) Applied General Statistics, Printice Hall of India.

Web Resources:

https://www.youtube.com/watch?v=B_kWOlxxQYo
https://www.youtube.com/watch?v=69oJW0HkOOk
http://arif.works/wp-content/uploads/2020/09/Course-notes-descriptive-statistics.pdf
http://subasish.github.io/pages/stat_courses/des_stat.pdf
http://web.mit.edu/~17.871/www/2015/02descriptive_stats_2015.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define the basics and need of Statistics	K1
CO2	Construct diagrammatic and graphical representation to demonstrate the real life problems	K3
CO3	Describe the structure of the given sample data set by using statistical measures	K2
CO4	Make use of different formula to measure the averages	K3
CO5	Categorize the concept of the association of attributes and obtain the qualitative measures between immeasurable variables.	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO 1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**	**2**	**2**		
	CO2	**2**	**2**	**2**	**1**	**1**	**2**
	CO3	**3**	**2**	**2**	**2**	**2**	**3**
	CO4	**3**	**3**	**2**	**1**	**2**	**3**
	CO5	**3**	**3**	**2**	**2**	**2**	**3**
	Total	**14**	**12**	**10**	**8**	**7**	**11**
	Average	**2.8**	**2.4**	**2**	**1.6**	**1.4**	**2.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statisitcs

First Semester				
Course Title		**Mathematical Statistics - I**		
Course Code		**22UASTN1B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-I	**NME**	**2**	**2**	**(25+75)**

Course Objective: To introduce Discrete distributions and apply their concept in real life problems

UNIT- I: BINOMIAL DISTRIBUTION (6 hours)

Binomial distribution – Definition, physical conditions for Binomial distribution – Mean and Variance – simple problems

UNIT -II:POISSON DISTRIBUTION (6 hours)

Poisson distribution – Definition – Application of Poisson distribution – Mean and variance – problems based on Poisson distribution.

UNIT-III:GEOMETRIC DISTRIBUTION (6 hours)

Geometric distribution – Definition - concept of Lack of memory – Mean and Variance.

UNIT - IV: DISTRIBUTION FITTING (6 hours)

Fitting of Binomial and Poisson distribution.

UNIT -V: LIMITING CASES (6 hours)

Poisson distribution is a limiting case of the Binomial distribution.

Book for Study:

Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Book for Reference :

- Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics, Pearson Education Asia, India.
- Mood, AM. Graybill, F.A. and Boes, D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.
- Hogg R.V. and Craig, A.T. (1972): Introduction to mathematical statistics, 3rd edition, Academic Press, USA.
- Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical theory, Vol.I, 6th revised ed. World Press limited, Calcutta.

Web Resources:

https://www.youtube.com/watch?v=HRQHVuQkKGE

https://www.youtube.com/watch?v=VWEoAjVRnmQ

https://www3.nd.edu/~rwilliam/stats1/x13.pdf

https://www.stats.ox.ac.uk/~filippi/Teaching/psychology_humanscience_2015/lecture5.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Label and classify the basic assumptions of several importance of discrete distributions	K1 K2
CO2	List out the importance of various distributions to real life problems	K1
CO3	Study the probability pattern of big data for further analysis	K4
CO4	Ability to identify and label the distribution for classification techniques	K3, k1
C05	Match the real time data into theoretical distributionby fitting of distribution	K4
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**	**1**	**2**		
	CO2	**3**	**3**	**2**	**2**	**2**	**2**
	CO3	**3**	**3**	**2**	**2**	**2**	**1**
	CO4	**3**	**3**	**2**	**2**	**1**	**1**
	CO5	**3**	**3**	**2**	**2**	**2**	**2**
	Total	**15**	**14**	**9**	**10**	**7**	**6**
	Average	**3**	**2.8**	**1.8**	**2**	**1.4**	**1.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Second Semester				
Course Title		**Statistics in Real life**		
Course Code		**22UBSTN2A**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-II	**NME**	**2**	**2**	**(25+75)**

Course Objective: To orient the students to learn Basic Statistics for other department students in all disciplines (BA/B.com/BBA/B.sc)

Unit -I :OFFICIAL STATISTICS (6 hours)

Official Statistics: Present official statistical systems in India –Ministry of Statistics and Programme implementation -NSSO, CSO and their functions

Unit -II: VITAL STATISTICS (6 hours)

Registration of vital events – National Income Statistics – Agricultural Statistics – Industrial Statistics in India – Trade Statistics in India – Labour Statistics in India – Financial Statistics in India.

Unit -III: TIME SERIES (6 hours)

Time Series – Definition – Components of time series – Measurement of Trend – Graphical method, Semi average method, 3 and 5 yearly Moving average method- simple problems only.

UNIT -IV:INDEX NUMBERS (6 hours)

Index numbers: Index numbers and their definitions - construction and uses of fixed and chain based index numbers-simple and weighted index numbers - Laspeyre's, Paasche's, Fisher's, and Marshall-Edgeworth index numbers – optimum tests for index numbers-Cost of living index number– simple problems only.

Unit -V : SQC (6 hours)

Statistical quality control – definition of quality - need for quality control in industry – controlcharts – Mean chart and Range chart – simple problems

Books for study and reference

- Statistical Methods - S P Gupta
- Fundamentals of Applied Statistics - Gupta Kapoor
- Demography -
- Quality control – Montgomery

Web Resources:

https://ncert.nic.in/textbook/pdf/lesy102.pdf
https://www.youtube.com/watch?v=YtLmLPI-7sE
https://www.youtube.com/watch?v=ldo4b-d2EYM
https://www.youtube.com/watch?v=0odTT2CZdN0&list=PLcOVZjNptNPKIcEaxHqoqT811YYm7CAsi
http://ie.sharif.edu/~qc/Introduction%20to%20statistical%20qulity%20control,%206th%20edition.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Demonstrate the application of statistics in various sectors	K2
CO2	Acquire knowledge about the function of NSSO, CSO	K3
CO3	Analyse the economic crisis by constructing various Index numbers	K4
CO4	Interpret the predicted values by summarizing time series values	K2
CO5	Outline the need of SQC in industry.	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating **K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**				**1**
	CO2	**3**	**2**	**1**	**1**	**1**	
	CO3	**3**	**2**	**1**	**2**	**1**	**1**
	CO4	**3**	**2**	**1**	**1**		
	CO5	**3**	**2**	**1**	**1**	**1**	**1**
	Total	**15**	**10**	**4**	**5**	**3**	**3**
	Average	**3**	**2**	**0.8**	**1**	**0.6**	**0.6**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Sc., Degree Programme in Statistics

Second Semester				
Course Title		**Mathematical Statistics-II**		
Course Code		**22UBSTN2B**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
NME-II	**NME**	**2**	**2**	**(25+75)**

Course Objective: To orient the students to learn continuous distributions and their applications by testing the statistical hypothesis.

UNIT-I :NORMAL DISTRIBUTION (6 hours)

Normal distribution – Definition – Chief Characteristic of the normal distribution and normal curve – Area property – Importance of normal distribution – Application of Central limit theorem.

UNIT -II:UNIFORM DISTRIBUTION (6 hours)

Rectangular (Uniform) distribution – Definition – Moments of rectangular distribution.

UNIT -III:SAMPLING DISTRIBUTION (6 hours)

Introduction: Population – sample – parameter – statistic – sampling error – non sampling error. Exact Sampling distribution – chi-square , t and F distribution – Definition and their Applications

UNIT -IV:TESTING OF HYPOTHESIS (6 hours)

Testing of hypothesis – Null and alternative hypothesis – Critical region – Type I and Type II error – level of significance – one-tailed and two-tailed tests – Procedure for testing of hypothesis. (Concepts only)

UNIT -V:LARGE AND SMALL SAMPLE TEST (6 hours)

Large Sample test – Test of significance for single Mean – Test of significance for Difference of means – Small Sample test - Test of significance for single Mean and difference of means (t -test) - Goodness of fit and Independence of attributes. (Problems only)

Book for Study:

- Gupta, S. C and Kapoor, V. K (2002), Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi.

Book for Reference:

- Hogg, R. V and Craig, A. T (2002), Introduction to Mathematical Statistics, Pearson Education Asia, India.
- Mood, AM. Graybill, F.A. and Boes, D.C. (1974) : Introduction to the theory of Statistics, McGraw Hill.

- Hogg R.V. and Craig, A.T. (1972): Introduction to mathematical statistics, 3rd edition, Academic Press, USA.
- Goon, A.M. Gupta, M.K., and Das Gupta, B. (1980): An outline of statistical theory, Vol.I, 6th revised ed. World Press limited, Calcutta.

Web Resources:

https://www3.nd.edu/~rwilliam/stats1/x21.pdf
https://www.cse.iitk.ac.in/users/nsrivast/HCC/lec07-09.pdf
http://math.ucdenver.edu/~ssantori/MATH2830SP13/Math2830-Chapter-08.pdf
https://www.youtube.com/watch?v=lQ1ec1nQvKM
http://shiacollege.org/uploads/econtent/T-distribution.pdf
http://shiacollege.org/uploads/econtent/F-Distribution.pdf
http://shiacollege.org/uploads/econtent/Chi%20Square%20Distribution.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course Outcome	K LEVEL
CO1	Understand the concept of Normality.	**K2**
CO2	Demonstrate the concept of parameter, statistic and sampling distributions	**K2**
CO3	Define the sampling distribution of t,F and chisquare	**K1**
CO4	Framing the hypothesis for solving the problems with the critical values.	**K3**
C05	Outline the procedure for hypothesis testing in Research methodology	**K2**
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**	**1**	**2**	**1**	
	CO2	**3**	**2**	**1**	**2**		
	CO3	**3**	**2**	**2**	**2**	**1**	
	CO4	**3**	**3**	**3**	**2**	**1**	**2**
	CO5	**3**	**3**	**3**	**2**	**1**	**1**
	Total	**15**	**12**	**10**	**10**	**4**	**3**
	Average	**3**	**2.4**	**2**	**2**	**0.8**	**0.6**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

COURSES OFFERED FOR OTHER DEPARTMENTS

B.B.A., Degree Programme

Third Semester				
Course Title		**Quantitative Methods**		
Course Code		**22UC**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
	Allied	**5**	**6**	**(25+75)**

Course Objective: To promote the skill of applying statistical techniques in business
To enable the students to apply the statistical tools in analysis and interpretation of data

UNIT – I: COLLECTION OF STATISTICAL DATA (18 hours)
Nature and scope of statistical methods – Functions and Limitations of statistics –applications - – Collection of data – primary and secondary data – sources – methods of collection of primary and secondary data-Preparation of Questionnaire and schedule Observational studies and sample surveys.

UNIT – II: DIAGRAMMATIC AND GRAPHICAL REPRESENTATION (18 hours) Diagrammatic representation of data:–significance of diagrams and graphs -Types of diagram - one and two dimensional – Bars –cartograms and pictographs -Graphical representation of data – Frequency curve – frequency polygon – Histogram and Ogive curve.

UNIT – III: MEASURES OF AVERAGE (18 hours)
Measures of central tendency: Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits.

UNIT – IV: MEASURES OF VARIATION AND SKEWNESS (18 hours)
Measures of Dispersion – Absolute and Relative measures – Range, Quartile deviation, Mean deviation, Standard deviation and its Coefficients – Merits and Demerits.Measure of Skewness and Kurtosis.

UNIT – V: ASSOCIATION OF ATTRIBUTES (18 hours) Fundamental sets of frequencies – Consistency of Data – Conditions for consistency – Contingency table – Association of attributes.Chi-square test for independence of attributes – Test for Goodness for fit.

Note: The proportion of theory and problems is 30:70

Books for study and reference:

- Statistical methods – S. P. Gupta, Sultan Chand & sons

- Comprehensive Statistical Methods – P.N. Arora, SumeetArora and S. Arora, S. Chand
- Business Statistics -P.R. Vittal

Web Resources:

https://www.youtube.com/watch?v=B_kWOlxxQYo
https://www.youtube.com/watch?v=69oJW0HkOOk
http://arif.works/wp-content/uploads/2020/09/Course-notes-descriptive-statistics.pdf
http://subasish.github.io/pages/stat_courses/des_stat.pdf
http://web.mit.edu/~17.871/www/2015/02descriptive_stats_2015.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define the basic and need of statistics	K1
CO2	Make use of the collected data and present in the form of diagrams and graphs	K3
CO3	Analyse and interpret the inferences from the mathematical formula	K4
CO4	Categories the concept of association of attributes and obtain the qualitative measures between two attributes	K4
CO5	Identify the shape of the distribution using skewness and kurtosis	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**			**2**		
	CO2	**3**	**1**	**2**	**2**	**2**	**2**
	CO3	**3**	**3**	**2**	**2**	**2**	**2**

	CO4	**3**	**3**	**2**	**2**	**2**	**2**
	CO5	**3**	**2**	**2**	**2**	**2**	**2**
	Total	**15**	**9**	**8**	**10**	**8**	**8**
	Average	**3**	**1.8**	**1.6**	**2**	**1.6**	**1.6**

Level of Correlation between PSO's and CO's
(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.B.A, Degree Programme

Fourth Semester				
Course Title		**Business Statistics**		
Course Code		**22UD**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
	Allied	**5**	**6**	**(25+75)**

Course Objective: To promote the skill of applying statistical techniques in business
To enable the students to apply the statistical tools in analysis and interpretation of data

UNIT – I: CORRELATION (18 hours)

Correlation Analysis – Definition significance of study of correlation– Types –Methods of studying correlation - Scatter diagram – Karl Pearson's Correlation Coefficient – Spearman's Rank Correlation Coefficient – Its properties – problem.

UNIT – II: REGRESSION ANALYSIS (18 hours)

Regression Analysis – Definition –Uses of regression analysis – difference between correlation and regression – Regression equations – Regression lines – properties – Related simple problem.

UNIT – III: TIME SERIES ANALYSIS (18 hours)

Time Series – Definition – Components of time series – Measurement of Trend – Graphical method, Semi average method, Moving average method and method of Least squares – Measurement of Seasonal Variations – simple average method – Ratio – to – moving average method.

UNIT – IV: INDEX NUMBERS (18 hours)

Index Numbers – Definition – uses of Index numbers - problems in the construction of Index numbers -Methods – Unweighted and Weighted index numbers – Test of adequacy of Index Number formulae — Chain base method –Cost of living Index Number- Uses of Index Numbers – Simple problems.

UNIT – V: SAMPLING METHODS (18 hours)

Concept of Sampling – Methods of Sampling – Random Sampling – Stratified Sampling – Systematic Sampling – Sampling Error – Non sampling Error.

Note: The proportion of theory and problems is 20:80

Books for study and reference:

- Statistical methods – S. P. Gupta, Sultan Chand & sons

- Comprehensive Statistical Methods – P.N. Arora, SumeetArora and S. Arora, S. Chand
- Business Statistics -P.R. Vittal
- Practical Statistics – R.S.N Pillai and Bagavathi, S. Chand
- Statistics - R.S.N Pillai and Bagavathi, S. Chand

Web Resources:

https://www.youtube.com/watch?v=B_kWOlxxQYo
https://www.youtube.com/watch?v=69oJW0HkOOk
http://arif.works/wp-content/uploads/2020/09/Course-notes-descriptive-statistics.pdf
http://subasish.github.io/pages/stat_courses/des_stat.pdf
http://web.mit.edu/~17.871/www/2015/02descriptive_stats_2015.pdf
https://www.youtube.com/watch?v=YtLmLPI-7sE
https://www.youtube.com/watch?v=ldo4b-d2EYM

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Examine the correlation between variables and to predict for the future based on the past data	K4
CO2	Interpret the predicted values by summarizing time series values	K2
CO3	Analyse the economic crisis by constructing various Index numbers	K4
CO4	Construct the different types of index numbers	K3
CO5	Idea of conducting the sample survey and selecting appropriate sampling techniques	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**			**2**	**1**
	CO2	**3**	**3**	**2**		**2**	**2**
	CO3	**3**	**3**	**2**	**2**	**2**	**2**
	CO4	**3**	**3**	**2**		**1**	**2**
	CO5	**3**	**3**	**2**	**3**	**2**	**2**
	Total	**15**	**14**	**8**	**5**	**9**	**9**
	Average	**3**	**2.8**	**1.6**	**1**	**1.8**	**1.8**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)**EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Com., Degree Programme

Third Semester				
Course Title		**Business Statistics**		
Course Code		**22U**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
	Allied	**5**	**6**	**(25+75)**

Course Objective: To develop an understanding of a variety of statistical and quantitative techniques applicable to a wide range of business situations

UNIT – I : STATISTICS INTRODUCTION (18 hours)

Statistics – Introduction – Definition – Scope – Limitations – Collection of data Classification – Tabulation of data – Diagrammatic and Graphical representation of statistical data.

UNIT – II: MEASURES OF AVERAGE (18 hours)

Measures of central tendency – Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits.

UNIT – III: MEASURES OF VARIATION AND SKEWNESS (18 hours)

Measures of Dispersion – Absolute and Relative measures – Range, Quartile deviation, Mean deviation, Standard deviation and its Coefficients – Merits and Demerits – Measures of Skewness and Kurtosis.

UNIT – IV: CORRELATION AND REGRESSION ANALYSIS (18 hours)

Correlation Analysis – Definition significance of study of correlation– Types –Methods of studying correlation - Scatter diagram – Karl Pearson's Correlation Coefficient – Spearman's Rank Correlation Coefficient – Its properties –Regression Analysis – Definition –Uses of regression analysis – difference between correlation and regression – Regression equations – Regression lines – properties – Related simple problem.

UNIT – V: TIME SERIES & INDEX NUMBERS (18 hours)

Time Series – Definition – Components of Time Series – Measurement of Trend – Measurement of Seasonal variation. Index Numbers – Definition – problems in the construction of Index numbers- simple and weighted Index numbers- Methods – Test for Index Numbers – Chain base method – Cost of living Index Number – Uses – Simple problem.

Note: The proportion of theory and problems is 20:80

Books for study and reference:

- Statistical methods – S. P. Gupta, Sultan Chand & sons
- Comprehensive Statistical Methods – P.N. Arora, SumeetArora and S. Arora, S. Chand

- Business Statistics -P.R. Vittal
- Practical Statistics – R.S.N Pillai and Bagavathi, S. Chand
- Statistics - R.S.N Pillai and Bagavathi, S. Chand

Web Resources:

https://www.youtube.com/watch?v=B_kWOlxxQYo
https://www.youtube.com/watch?v=69oJW0HkOOk
http://arif.works/wp-content/uploads/2020/09/Course-notes-descriptive-statistics.pdf
http://subasish.github.io/pages/stat_courses/des_stat.pdf
http://web.mit.edu/~17.871/www/2015/02descriptive_stats_2015.pdf
https://www.youtube.com/watch?v=YtLmLPI-7sE
https://www.youtube.com/watch?v=ldo4b-d2EYM

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Define the basics and need of Statistics	K1
CO2	Construct diagrammatic and graphical representation to demonstrate the real life problems	K3
CO3	Summarize the structure of the given sample data sets by using statistical measures	K2
CO4	Examine the Correlation between variables and predict the future based on the past and present available data	K4
CO5	Interpret the future values by summarizing past time series values. Analyse the economic crisis by constructing various Index Numbers.	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	2				
	CO2	3	2	2	2	2	2
	CO3	3	2	2	1	2	2
	CO4	3	2	2	2	2	2
	CO5	3	2	2	1	2	2
	Total	15	10	8	6	8	8
	Average	3	2	1.6	1.2	1.6	1.6

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)**EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

B.Com Degree Programme

FourthSemester				
Course Title		**Operations Research**		
Course Code		**22U**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
	Allied	**5**	**6**	**(25+75)**

Course Objective: To help understand the conceptual aspects of Operations research.
To impart knowledge on Linear programming problem, transportation and assignment problem.

UNIT – I : OR INTRODUCTION & APPLICATIONS (18 hours)
Introduction to Operations Research – Meaning –scientific methods in OR. – Modeling in OR – classification of models – methodology of OR – application of operations research and its Limitations

UNIT – II: LPP (18 hours)
Linear Programming Problem – Mathematical Formulation – Graphical and Algebraic Method (Maximization and Minimization) – Simplex method only – simple problems.

UNIT – III: TRANSPORTATION PROBLEM (18 hours)
Transportation Problem – Formulation – Balanced and Unbalanced – Obtaining IBFS using North West Corner, Least Cost Method, Vogel's Approximation method – Optimum solution (MODI method) – simple problem.

UNIT – IV: ASSIGNMENT PROBLEM & GAME THEORY (18 hours)
Assignment problem – Formulation – Hungarian method of Assignment (Maximum and Minimum) – Travelling salesman Problem – Game Theory – Two person Zero sum games – Maximin&Minimax Principle – Games without saddle point – Mixed strategy – Graphical solution of 2 x n and m x 2 games – Dominance property.

UNIT – V: NETWORK ANALYSIS (18 hours)
Network Scheduling – Introduction, Network: Basic Concepts, Logical Sequencing, Rules of Network Construction, Critical Path Method –Total float, Free float and Independent float. Probability Considerations in PERT – Three time estimates. Distinction between PERT and CPM, Applications of Network Techniques.

Note: The proportion of theory and problems is 20:80

Books for study and reference:

- Operations Research – KantiSwarup, P.K. Gupta and Manmohan, Sultan chand
- Operations Research – J.K. Sharma, Sultan
- Introduction to Operations Research – P.R. Vittal

Web Resources:

https://web.itu.edu.tr/topcuil/ya/OR.pdf
https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX
https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	Course outcome	K LEVEL
CO1	Identify and classify the different models in OR	K2, K3
CO2	Utilize the OR models to solve the problems	K3
CO3	Develop the mathematical models for real time problems	K3
CO4	Finding the optimum cost by assigning the jobs and transporting the goods	K1
CO5	Disseminate the project and construct the network models.	K3
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**				
	CO2	**3**	**2**		**1**	**1**	
	CO3	**3**	**3**	**2**	**2**	**2**	**2**
	CO4	**3**	**3**	**2**	**2**	**2**	**2**
	CO5	**3**	**3**	**3**	**2**	**2**	**2**
	Total	**15**	**13**	**7**	**7**	**7**	**6**
	Average	**3**	**2.6**	**1.4**	**1.4**	**1.4**	**1.2**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

UG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.com Degree Programme

First Semester				
Course Title		**Operations Research**		
Course Code		**22PCO**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
	Core	**5**	**6**	**(25+75)**

Course Objectives: To understand the conceptual aspects of Operations research and impart knowledge on Linear Programming problem, Transportation and Assignment models.

UNIT -1: **OR & LPP INTRODUCTION** **(18 hours)**

Introduction to Operations Research – Meaning – definition – origin and history – characteristic feature – need – scope and limitation – Models of O.R and Phases of O.R – Linear Programming Problem(LPP) – Meaning – assumptions – applications – Formulation LPP – advantages – Limitations.

UNIT – II: METHODS OF SOLVING LPP **(18 hours)**

Obtaining optimal solution for LPP – Graphical method – Simplex method for Maximization function – Minimization function (simple problems only) – Duality in LPP meaning – construction dual LPP

UNIT – III: TRANSPORTATION & ASSIGNMENT PROBLEM **(18 hours)**

Transportation Problem –meaning -Balanced and Unbalanced problems - Initial Basic Feasible Solution – North West Corner Rule – Least Cost method – Vogel's Approximation method – Solution by optimality by MODI method – Assignment Problem – Models – Hungarian method.

UNIT – IV: GAME THEORY, NETWORK &SEQUENCING PROBLEM **(18 hours)**

Game Theory – meaning – types of games – basic assumptions – finding value of game for pure strategy – saddle point – payoff matrix –mixed strategy- graphical method – value of game – Network analysis – network diagram and critical path method CPM – PERT (No crashing) – Sequencing Problem – meaning – assumption – 2 machine problem only

UNIT – V : QUEUEING THEORY AND SQC **(18 hours)**

Queueing theory – Meaning – objectives – limitations – Elements of Queueing system – Queueing models – M/M/1: ∞/FIFO and M/M/I : N/FIFO. Statistical Quality Control (SQC) – Meaning of quality – Quality control – benefits – uses of SQC – Control charts- X and R chart – control limits.

Note: The proportion of theory and problems is 30:70

Books for study and reference:

- Operations Research – J.K. Sharma, Sultan
- Operations Research – Goel& Mittal
- Operations Research, Theory and application – J.K. Sharma
- ANAND SHARMA,(2014), 'Operations Research', Himalaya Publishing House, Mumbai
- AGARWAL N P AND SONIA AGARWAL, (2009), 'Operations Research and Quantitative Techniques', R B S A Publishers, Mumbai
- GURUSAMY S,(2016), 'Operations Research', Vijay Nicole Imprints, Chennai
- GUPTA P K & GUPTA S P, (2014), 'Quantitative Techniques & Operations Research', Sultan Chand and Sons, New Delhi
- KANTI SWARUP, P.K.GUPTA& MAN MOHAN, (2010), 'Operations Research', Jain Book Agency, New Delhi
- KAPOOR V K, (2011), 'Operations Research Techniques for Management', Sultan
    - Chand and Sons, New Delhi
- SHRIDHARA K BHAT, (2011), 'Operations Research', Himalaya Publishing House, Mumbai
- Montgomery, D.C (1983) Introduction to Statistical quality control, John Wiley & Sons.

Web Resources:

https://web.itu.edu.tr/topcuil/ya/OR.pdf
https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX
https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf
http://ie.sharif.edu/~qc/Introduction%20to%20statistical%20qulity%20control,%206th%20edition.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	Identify the models in OR	K3
CO2	Maximize and minimize the function of linear models	K6
CO3	Disseminate the project and construct the network model	K3
CO4	Formulate the models of Assignment and Transportation and prioritize the order of jobs in sequencing	K5, K6
CO5	Define the basic concept of game theory saddle point and fair game. Outline the need of SQC in industry	K1,K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**
	CO1	**3**	**2**				
	CO2	**3**	**2**	**2**	**2**	**1**	**1**
	CO3	**3**	**2**	**2**	**3**	**2**	**1**
	CO4	**3**	**2**	**2**	**2**	**2**	**1**
	CO5	**3**	**3**				**2**
	Total	**15**	**11**	**6**	**7**	**5**	**5**
	Average	**3**	**2.2**	**1.2**	**1.4**	**1**	**1**

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low
2 – Medium
3 – High
0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN
PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three question from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**

M.com Degree Programme

Second Semester				
Course Title		**Quantitative Technique for Business decisions**		
Course Code		**22PCO**		
Course No	**Course Category Core / Elective**	**No. of Credits**	**No. of Hrs / Week**	**Total Marks (Internal +External)**
		5	**6**	**(25+75)**

Course Objective: To develop an understanding of a variety of statistical and quantitative techniques applicable to a wide range of business situations.

UNIT – I: QUANTITATIVE TECHNIQUE INTRODUCTION (18 hours)

Meaning – scope and limitations of quantitative techniques – uses of quantitative techniques in business decisions.

UNIT – II: PROBABILITY & DISTRIBUTION (18 hours)

Concepts of Probability – definition of Probability – sample space – addition theorem of probability – multiplication theorem- conditional probability-Baye's theorem. Theoretical distributions – Binomial – Poisson – Normal distribution – fitting and testing the Goodness of fit.

UNIT – III: LARGE SAMPLE TEST (18 hours)

Testing of Statistical hypothesis – Null – Alternative hypothesis- type I and type II error Test of Significance – Large Sample test – Test for single Mean – Test for difference of means

UNIT – IV: SMALL SAMPLE TEST (18 hours)

Significance tests in Small samples – Testing the significance of the mean of a random sample – Testing difference between means of two samples – F- test – chi square test – independence of Attributes. Analysis of Variance: assumptions of ANOVA (one way and two wayclassifications, problems only).

UNIT – V: DECISION THEORY & INTERPOLATION (18 hours)

Decision Theory – Meaning – Definitions – Uncertainty – pay offs – Expected opportunity loss (EOL) – Maximin principle – Minimax principle –Bayes principle – Decision tree analysis – steps in construction of Decision tree analysis.

Interpolation – Methods of Interpolation – Binomial expansion method – Newtons' method – Extrapolation. (Problems only)

Note: The proportion of theory and problems is 40:60

Books for study and reference:

- Fundamentals of Mathematical Statistics – S.C. Gupta and V.K. Kapoor, sultan chand
- Statistical Methods – S.P. Gupta (1995), Statistical Methods, Sultan Chand & Sons, New Delhi
- Gurusamy S, (2018), Operations Research, Vijay Nicole Imprints Pvt. Ltd, Chennai.
- Joseph D and Anbarasu, (2011), Business Statistics, Vijay Nicole Imprints Pvt. Ltd.,
- Chennai.
- Kothari C R (1998), Quantitative Techniques, Vikas Publishing House, New Delhi.
- Hooda, R.P (2010), Statistics for Business and Economics, Macmillan, New Delhi.
- Hein, L.W (2011), Quantitative Approach to Managerial Decisions, Prentice Hall, Delhi
- Levin, Richard I. and David S Rubin (2010), Statistics for Management, Prentice Hall,

Web Resources:

http://isl.stanford.edu/~abbas/ee178/lect01-2.pdf
http://users.stat.umn.edu/~helwig/notes/ProbabilityTheory_slides.pdf
https://www.youtube.com/watch?v=6x1pL9Yov1k
https://www.youtube.com/watch?v=ggImvELUfxI
https://www.youtube.com/watch?v=lQ1ec1nQvKM
http://shiacollege.org/uploads/econtent/T-distribution.pdf
http://shiacollege.org/uploads/econtent/F-Distribution.pdf
http://shiacollege.org/uploads/econtent/Chi%20Square%20Distribution.pdf

Methodology of Teaching:

- Class lectures
- Group discussion
- Seminars and Assignments
- Power point presentation

COURSE OUTCOMES (CO):

Upon completion of this course, the students will be able to:

CO	COURSE OUTCOME	K LEVEL
CO1	List the applications of quantitative techniques in business	K1
CO2	Enumerate and classify the basic assumptions of several important discrete and continuous probability distribution	K4
CO3	Framing the hypothesis for solving the problems with the critical values.	K3
CO4	Apply appropriate statistical tools for testing small and large samples	K3
CO5	Compare the various operators used for interpolation and extrapolation	K2
K1 – Remembering ,**K2**– Understanding , **K3** –Applying ,**K4** –Analysing , **K5**–Evaluating ,**K6**–Creating		

PROGRAMME SPECIFICOUTCOMES (PSO) –COURSE OUTCOME (CO) MAPPING

COURSE OUTCOMES (CO)	PROGRAMME SPECIFIC OUTCOMES (PSO)						
		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
	CO1	3	2				
	CO2	3	1	2	2	2	
	CO3	3	3	2	2	1	3
	CO4	3	3	2	2	2	3
	CO5	3	3	2	2	2	3
	Total	15	12	8	8	7	9
	Average	3	2.4	1.6	1.6	1.4	1.8

Level of Correlation between PSO's and CO's

(Suggested by UGC as per Six Sigma Tool – Cause and Effect Matrix)

Assign the value

1 – Low

2 – Medium

3 – High

0– No Correlation

BLOOM'S TAXANOMY BASED QUESTION PAPER PATTERN

PG Degree Pattern

Knowledge Level	Section	Marks	Description	Total Marks
K1, K2, K3, K4	A (Answer all the questions)	10 X 2	Short Answer (Two questions from each unit)	20
K1, K2, K3, K4	B **(INTERNAL CHOICE)** EITHER (a) OR (b)	5 X 5	Question (a) OR (b) from the same Unit and same K Level	25
K2, K3, K4, K5	C (Answer any three questions from five questions)	3 X 10	One questions from each unit (No unit missing)	30
Grand Total				**75**