

**GOVERNMENT ARTS COLLEGE
(AUTONOMOUS)
COIMBATORE 641 018**

DEPARTMENT OF STATISTICS



**B. Sc STATISTICS
Syllabus
(with effect from 2023 – 24)**

GOVERNMENT ARTS COLLEGE, COIMBATORE 641 018**B. Sc. STATISTICS (CBCS PATTERN)**(For the students admitted from the academic year **2023-2024** and onwards)**Scheme of Examination**

Part	Sub Code	Title of the Paper	Hrs (wk)	Internal (CA) Marks	External Marks	Total Marks	Ext- Min.	Total Pass Mark	Credits
Semester - 1									
I	23TAM11L	Part-I :Language: Tamil I	6	25	75	100	30	40	3
II	23ENG12L	Part-II: English I	6	25	75	100	30	40	3
III	23BST13C	Core I : Descriptive Statistics	5	25	75	100	30	40	4
III		Core Practical – I: Statistics Practical – I (Using MS Excel)	3	-	-	-	-	-	-
III	23BST14A	Allied – 1: Mathematics for Statistics - I	8	25	75	100	30	40	5
IV	23ENV1GE	Value Education – Environmental Studies	2	25	75	100	30	40	2
Semester – II									
I	23TAM21L	Part-I: Language:Tamil II	6	25	75	100	30	40	3
II	23ENG22L	Part-II: English II	4	25	75	100	30	40	2
III	23BST23C	Core II: Probability and Random variables	5	25	75	100	30	40	4
III	23BST24P	Core Practical – I: Statistics Practical – I (Using MS Excel)	3	40	60	100	24	40	4
III	23BST25A	Allied – 2: Mathematics for Statistics - II	8	25	75	100	30	40	4
IV	23VAL2GE	Value Education – Gandhian Thoughts	2	25	75	100	30	40	2
IV	23NMN2AL	Naan Mudhalvan Scheme- Skill Course : Overview of English Language Communication	2	25	75	100	30	40	2

Part	Sub Code	Title of the Paper	Hrs (wk)	Internal (CA) Marks	External Marks	Total Marks	Ext- Min.	Total Pass Mark	Credits
Semester – III									
*I	23TAM31L	*Part–I: Language: Tamil III	6	25	75	100	30	40	3
II	23ENG32L	*Part–II: English III	6	25	75	100	30	40	3
III	23BST33C	Core III: Probability Distributions	6	25	75	100	30	40	4
III	23BST34A	Allied – 3: Programming in ‘C’	5	25	75	100	30	40	4
III		Core Practical – II: Statistics Practical – II (Using C Language)	2	-	-	-	-	-	-
IV	23BST35S	Skill Based Subject–I: Indian Official Statistics	3	25	75	100	30	40	2
IV	23NMN3AL	Naan Mudhalvan Scheme- Skill Course : Aptitude Skills for Employability	2	25	75	100	30	40	2
Semester – IV									
I*	23TAM41L	*Part–I: Language: Tamil IV	6	25	75	100	30	40	3
II	23ENG42L	*Part–II: English IV	6	25	75	100	30	40	3
III	23BST43C	Core IV: Basic Sampling Theory	5	25	75	100	30	40	4
III	23BST44P	Core Practical – II: Statistics Practical – II (Using C Language)	3	40	60	100	24	40	3
III	23BST45A	Allied – 4: Numerical Analysis	5	25	75	100	30	40	4
IV	23BST46S	Skill Based Subject–II: Elements of Actuarial Statistics	3	25	75	100	30	40	3
IV	23NMN4AL	Naan Mudhalvan Scheme- Skill Course : Employability Skills	2	25	75	100	30	40	2
V	23EXA4GE	@Extension Activities: NCC/NSS/SPORTS/YRC	-	-	-	-	-	-	1

Part	Sub Code	Title of the Paper	Hrs (wk)	Internal	External	Total Mar	Ext-	Total Pass	Credits
Semester – V									
III	23BST51C	Core V : Statistical Estimation Theory	5	25	75	100	30	40	4
III	23BST52C	Core VI: Statistical Quality Control	5	25	75	100	30	40	4

III	23BST53C	Core VII: Elements of Econometrics	4	25	75	100	30	40	3
III	23BST54C	Core VIII: AOS: Elements of Operations Research	5	25	75	100	30	40	3
III		Core Practical – III: Statistics Practical – III (Using Scientific Calculator)	2	-	-	-	-	-	-
IV	23BST55S	Skill Based Subject – III: Educational and Psychological Statistics	4	25	75	100	30	40	3
IV	23BST5EL	Non-Major Elective Paper – I:	3	25	75	100	30	40	2
IV	23NMN5AL	Naan Mudhalvan Scheme- Skill Course : Computational Intelligence for Employability	2	25	75	100	30	40	2
Semester – VI									
III	23BST61C	Core IX: Testing Statistical Hypothesis	6	25	75	100	30	40	4
III	23BST62C	Core X: Design of Experiments	6	25	75	100	30	40	4
III	23BST63C	Core XI:AOS: Applied Statistics	5	25	75	100	30	40	3
III	23BST64P	Core Practical – III: Statistics Practical – III (Using Scientific Calculator)	3	40	60	100	24	40	3
III	23BST65P	Core Practical – IV: Statistics Practical – IV (Using SPSS)	2	40	60	100	24	40	4
III	23BST66V	Project & Viva – Voce	-	25	75	100	30	40	15
IV	23BST67S	Skill Based Subject–IV: Demographic methods	3	25	75	100	30	40	3
IV	23BST6EL	Non-Major Elective Paper – II:	3	25	75	100	30	40	2
IV	23NMN6AL	Naan Mudhalvan Scheme- Skill Course : Advanced Data Analytics using Python	2	25	75	100	30	40	2
		Total/Credits	180			4100			140

*Courses offered with four semester Language Papers

@ No External Examinations. Only Continuous Internal Assessment (CIA)

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	I	23BST13C	CORE PAPER I – DESCRIPTIVE STATISTICS	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Design the basics of data collection and organization of data			
2	Apply the theory and applications of statistics			
3	Present the data through diagrams and graphs			
4	Explain the statistical concepts of Measures of central tendency, Dispersion, Skewness and Kurtosis			
5	Calculate and interpret the various Measures of central tendency, Measures of dispersion and Measures of Skewness			
6	Analyze and interpret the relationship between variables using correlation			
7	Estimate the values using regression analysis			
Unit - I				
Statistics – Definition – Origin - Scope and Limitations – Collection of data - Primary and Secondary data – Classification and Tabulation of Statistical Data - Formulation of Frequency Distributions - Diagrammatic Representation - One Dimensional and Two Dimensional Diagrams – Box plots - Graphical Representation – Histogram - Frequency Polygon - Frequency Curve and Ogives.				
Unit - II				
Measures of Central Tendency - Characteristics of a Good Average - Arithmetic Mean, Median, Mode - Geometric Mean and Harmonic Mean - Weighted Arithmetic Mean – Merits and Demerits - Trimmed mean.				
Unit – III				
Absolute and Relative Measures of Dispersion – Range - Quartile Deviation - Mean Deviation - Standard Deviation and Co-efficient of Variation - Merits and Demerits . Measures of Skewness - Karl-Pearson’s Co-efficient of Skewness - Bowley’s Co-efficient of Skewness. Kurtosis (concept only)				
Unit – IV				
Correlation - Types of Correlation - Uses - Properties - Scatter Diagram – Karl Pearson’s co-efficient of Correlation - Spearman’s Rank Correlation - Concurrent Deviation Method of Correlation – Properties of Correlation coefficient.				

Unit - V	
Regression Analysis - Regression Equations – Properties of Regression Co-efficients - Simple problems – comparison of correlation and regression.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor (2002). Fundamentals of Mathematical Statistics, 11 th thoroughly Revised Edition, Reprint 2013, Sultan Chand & Sons Publishers, New Delhi.
2	S.P. Gupta (2012). Statistical Methods, 42 nd Revised Edition, Sultan Chand & Sons Publishers, New Delhi.
FURTHER READING:	
1	B.L. Agarwal (2009). Programmed Statistics, 2 nd Edition, New Age International Publishers, New Delhi.
2	Goon, A.M., Gupta, M. K., Dasgupta, B. (2016). Fundamentals of Statistics, Vol. I, World Press, Kolkata, India
3	R.S.N. Pillai and V. Bagavathi (1984). Statistics – Theory and Practice, Reprint 1999, S. Chand & Sons Company Ltd, New Delhi.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.investopedia.com/terms/d/descriptive_statistics.asp
2	https://youtu.be/mk8tOD0t8M0
3	https://youtu.be/MXaJ7sa7q-8

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge		✓	✓	✓	✓	✓	✓
	2	Communication Skills		✓		✓	✓	✓	✓
	3	Critical Thinking	✓			✓	✓	✓	✓
	4	Research related Skills			✓		✓	✓	✓
	5	Analytical Reasoning		✓			✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work			✓	✓	✓		
	8	Moral and Ethical Awareness	✓			✓	✓		
	9	Multi Cultural Competence	✓			✓	✓		

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	II	23BST23C	CORE PAPER II: PROBABILITY AND RANDOM VARIABLES	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the concept of probability, basic terminologies and the application of addition and multiplication theorems.			
2	Analyze the basics of conditional probability and the related theorems			
3	Summarize the concept of random variables and its related terminologies. Evaluate various measures of central tendency			
4	Explain mathematical expectation and its properties related to variance, covariance and linear combination of random variables.			
5	Calculate moment generating function and explain its limitations along with properties. Discuss the cumulants, characteristic functions and its properties.			
6	Demonstrate the concept of convergence in probability, bivariate distributions, marginal and conditional distributions.			
7	Analyze the independence of random variables, deriving moments, marginal and conditional expectations			
Unit - I				
Probability - Basic terminology - Sample space - Classification of events - Mathematical, Statistical and Axiomatic definition of probability - Theorems on Probability -Addition and Multiplication theorems for two events - Conditional Probability - Baye's theorem - Boole's inequality - Simple problems.				
Unit - II				
Random variables - Distribution function - Properties (without proof) - Discrete and Continuous Random Variables - Probability Mass function - Probability density function - Measures of central tendency for continuous random variable - Mean, Median, Mode, Dispersion and moments - simple problems.				
Unit – III				
Mathematical Expectation - Expected value of function of a random variable - Properties of Expectations - Properties of variance - covariance - Linear combination of Random Variables - simple problems.				
Unit – IV				
Moment Generating Function and Cumulants - Limitations - Properties of MGF - Uniqueness theorem (statement only) - Cumulants – Properties (without proof) .				

Characteristics Function - Properties (without proof) - T Chebychev's inequality - Convergence in probability - Weak law of large number - Concept of Central limit theorem - De Moivre's Theorem (Statement only).	
Unit - V	
Bivariate Distributions - Concept of Bivariate Distributions - Marginal and Conditional Distributions - Independence of Random Variables - Moments of Bivariate probability distributions - Marginal and Conditional expectations - Conditional variance.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	R.V. Hogg and A.H. Craig (2012). Introduction to Mathematical Statistics, Seventh Edition, Pearson Education.
2	S.C. Gupta and V.K. Kapoor (2002). Fundamentals of Mathematical Statistics, 11 th thoroughly Revised Edition, Reprint 2013, Sultan Chand & Sons Publishers, New Delhi.
FURTHER READING:	
1	J.N. Kapoor and H.C. Saxena (2011). Mathematical Statistics, Sultan Chand & Sons, New Delhi.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102111/
2	https://nptel.ac.in/courses/111/104/111104146/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓		
	2	Communication Skills	✓	✓	✓				✓
	3	Critical Thinking	✓	✓	✓				
	4	Research related Skills		✓	✓	✓		✓	
	5	Analytical Reasoning			✓	✓	✓		
	6	Problem Solving	✓	✓	✓	✓	✓		
	7	Team Work	✓	✓	✓				✓
	8	Moral and Ethical Awareness	✓	✓	✓				
	9	Multicultural Competence		✓	✓	✓		✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	II	23BST24P	CORE PRACTICAL – I: STATISTICS PRACTICAL – I (Using MS Excel)	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the theory through practical oriented training			
2	Perform the basic operations of Excel software			
3	Apply the software for various applications			
4	Compute statistical measures using software			
5	Perform statistical data analysis			
6	Compute probability, conditional probability and probabilities using Baye's theorem			
7	Compute Expectation, mean and variance			
1. Formation of Frequency Distribution.				
2. Formation of Diagrams - Bar Diagrams, Pie Diagram				
3. Formation of Graphs - Frequency Polygon, Frequency Curve and Ogive Curves.				
4. Calculation of Measures of Central Tendency - Mean, Median, Mode, Geometric Mean, and Harmonic Mean				
5. Calculation of Quartiles and Percentiles				
6. Calculation of Measures of Dispersion- Range, Quartiles Deviation, Mean Deviation, Standard Deviation and Variance.				
7. Calculation of Coefficient of Skewness and Kurtosis.				
8. Correlation - Scatter Diagram - Calculation of Correlation Coefficients				
9. Regression - Finding Regression Coefficients and Formation of Regression Lines.				
10. Calculation Probability				
11. Calculation of Conditional probability				
12. Solve problems under Bayes' theorem				
13. Expectation - mean and variance				
PEDAGOGY STRATEGIES				
<ul style="list-style-type: none"> • Lecturing and Hands-on training • Lab Experiments • Questioning • Class Test • Quiz & Drill Practice • Providing feedback 				

REFERENCES:	
1	S.P. Gupta (2012). Statistical Methods, 42 nd Revised Edition, Sultan Chand & Sons Publishers, New Delhi.
2	R.V. Hogg and A.H. Craig (2012). Introduction to Mathematical Statistics, Seventh Edition, Pearson Education.
FURTHER READING:	
1	Brian W. Sloboda (2020) - EXCEL for Statistical Analysis, University of Phoenix, Arizona, USA.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.udemy.com/basic-excel/promo
2	https://www.linkedin.com/learning/excel
3	https://www.udemy.com/course/statistics-using-excel

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓		
	2	Communication Skills	✓	✓	✓				✓
	3	Critical Thinking	✓	✓	✓		✓		✓
	4	Research related Skills		✓	✓	✓		✓	
	5	Analytical Reasoning			✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓		
	7	Team Work	✓	✓	✓				✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	III	23BST33C	CORE PAPER III – PROBABILITY DISTRIBUTIONS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the concept of Bernoulli, Binomial, Hypergeometric distribution and discuss its properties, uses and moments. Deduce the cumulants and characteristic function			
2	Estimate the Poisson distribution, Negative Binomial and its related constants			
3	Identify the limiting cases of the distributions. Examine the lack of memory of Geometric distribution			
4	Define and discuss Normal distribution - mean, median, mode, M.G.F, Cumulants, Mean deviation, Characteristic function			
5	Write the Rectangular distribution and its moments			
6	Outline the Exponential, Beta and Gamma distribution and Analyze the property of lack of memory			
7	Summarize the concept of sampling distributions such as t, F and Chi-square. Determine the density functions and analyzing their relationships			
Unit - I				
Discrete Distributions - Concept of theoretical probability distributions - Discrete distributions - Bernoulli, Binomial - Properties and uses - Moments - Recurrence relation for moments - Mode - MGF - Additive property - Characteristic function - Cumulants - Fitting of Binomial distribution.				
Unit - II				
Discrete Distributions - Poisson distribution - Properties - Moments - Mode - Recurrence relation for moments - MGF - Characteristic function - Cumulants - Additive property- Fitting of Poisson distribution. Hypergeometric distribution - Mean and variance - Factorial moments -Approximation to Binomial distribution. Negative Binomial Distribution - Deductions - MGF - Cumulants - Poisson as limiting case of the Negative binomial distribution - Geometric distribution - Lack of Memory - Moments - MGF.				
Unit – III				
Continuous Distributions - Rectangular distribution - Moments - MGF - Characteristic Function - Normal distribution - Chief Characteristics - Mode - Median - MGF - Cumulants - Moments -Linear combination of independent Normal variate - Area property - Simple problems.				
Unit – IV				
Continuous Distributions - Exponential Distribution - MGF- Moments - Lack of memory. Gamma distribution - MGF - Cumulants - Additive property. Beta distribution (first kind and second kind) - Moments.				

Unit - V	
Sampling Distributions - Population – Sample - Concept of sampling distribution - Chi-square - Derivation of density - Additive property - Definition – Student’s t - Derivation of density – Definition of F variate – Derivation of density – Relationship between t, F and Chi-square Distributions.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K.Kapoor (2012). Fundamentals Of Mathematical Statistics, 11 th edition, Sultan Chand & Sons, New Delhi.
2	R.V. Hogg and A.H. Craig (2012). Introduction to Mathematical Statistics, Fifth Edition, Pearson Education .
FURTHER READING:	
1	J.N. Kapoor and H.C. Saxena (2011). Mathematical Statistics, Sultan Chand & Sons, New Delhi,.
2	V.K. Rohatgi and A.K.M.E Saleh. An Introduction to Probability and Statistics, Third Edition, John Wiley & Sons, NewYork.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayamprabha.gov.in/index.php/Syllabus/detail/10774
2	https://nptel.ac.in/courses/111/105/111105041/
3	https://nptel.ac.in/courses/111/104/111104146/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓		✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓		✓		✓
	3	Critical Thinking	✓	✓		✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓		✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓		✓	✓
	6	Problem Solving	✓	✓		✓	✓	✓	✓
	7	Team Work	✓		✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	III	23BST34A	ALLIED PAPER III - PROGRAMMING IN 'C'	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the basic concepts and Structure of C Language			
2	Discuss the concept of Looping			
3	Apply decision making statements			
4	Describe the concept of arrays and its applications in Statistics			
5	Point out the Parameters, functions and Pointers in Data Analytics			
6	Describe Cyber Crime and Cyber Threat.			
7	Develop computing skills for Statistics and Data Analytics			
Unit - I				
Introduction To C - Overview of C - Importance of C-Structure Of C Program-Programming Style – Process of Executing a C Program- Constants - Variables - Data Types - Character Set - C Tokens - Keywords – Identifiers - Declaration of Variables - Assigning Values to Variables -Symbolic Constants.				
Unit - II				
Operators and Expression - Arithmetic Operator-Relational Operator - Logical Operators-Assignment Operators - Conditional Operators-Increment and Decrement Operators - Library Function - Managing Input and Output Statements: Single Character Input- getchar() Function- putchar() function- scanf() function - Output functions - printf() function - gets() and puts() function.				
Unit – III				
Decision Making and Branching - Decision Making with if Statement – if – else Statement - Nesting if-else Statement – Switch Statement - Break - Continue Statement - Looping and Branching Using While Statement - Do-While Statement - For Loop Statement - Syntax and Simple Examples.				
Unit – IV				
Arrays - One Dimensional Arrays -Declaration - Initialization - Two Dimensional Arrays - Syntax - Initialization (Concepts only) Simple Programs - Mean – Median - Standard Deviation – Correlation.				
Unit - V				
User Defined Functions - Need – Multi-Function Program - Elements Of User Defined Functions - Definition Of Functions - Function Calls - Return Types – Declaration - Category Of Functions - Function Program To Sort An Array Of Integers.				

Cyber Crime – Definition – Characteristics of Cyber Crime – Tools of Cyber Crime – Identity Theft – International convention on Cyber Crime – Cyber Security (Theory Only)	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	E. Balagurusamy (2009). Programming in ANSI C, Tata McGraw-Hill, New Delhi.
2	Clay Wilson (2020). https://ndupress.ndu.edu/ - CHAPTER 18 - Cyber Crime
FURTHER READING:	
1	Herbert Scheldt (2012). The C Complete Reference.
2	https://ndupress.ndu.edu/ -
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105171/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking	✓	✓	✓	✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 Onwards	III	23BST35S	Skill Based Subject – I: INDIAN OFFICIAL STATISTICS	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to				
1	Describe the Statistical System in India			
2	Apply the fundamentals of measurement in official statistics			
3	Apply appropriate methods for presenting and preparing commentaries on official statistics			
4	Evaluate the methods for data collection, analysis and interpretation of health, social and economic problems			
5	Recognize the limitations that arise from measurement and processes of statistical production			
6	Execute the tasks in agricultural and economic statistics			
7	Evaluate the Official Index Numbers			
UNIT-I				
Statistical System in India - Central and State Government Organizations - Functions of Central Statistical Organization (CSO) - National Sample Survey Organization (NSSO) - Organization of large scale sample surveys - General and special data dissemination systems.				
UNIT –II				
Official Statistics – Meaning - Present official statistical system in India- methods of collection – limitations - reliability Principal publications containing data on the topics such as population – agriculture - industry – trade – prices – labour – employment - transport and communications - Banking and finance.				
UNIT –III				
National Income – Measures of national income - Income expenditure and production approaches - Applications in various sectors in India - Measurement of income inequality - Gini's coefficient - Lorenz curves - Application of Pareto - Lognormal as income distribution.				
UNIT – IV				
Agricultural and Social Statistics - System of Collection of Agricultural Statistics - Crop forecasting and estimation – Productivity - fragmentation of holdings - Support prices - Buffer stocks - Impact of irrigation projects. Statistics related to industries - foreign trade - Balance of payment - Inflation - Social statistics.				
UNIT – V				
Official Index Numbers - Price Index Numbers- Construction – Uses – Limitations - Tests for index numbers - Chain base Index Number - Consumer Price Index - Index of Industrial Production – Construction of index numbers - uses.				

PEDAGOGY STRATERGIES:	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing Feedback 	
REFERENCES:	
1	Allen R. G. D. (1975). Index Numbers in Theory and Practice, Macmillan.
2	C. S. O. (1990). Basic Statistics Relating to the Indian Economy.
3	C.S.O. (1995). Statistical System in India.
4	C. S. O. (1999). Guide to Official Statistics.
5	Mukhopadhyay, P. (2011). Applied Statistics, Second Edition, Books & Allied Ltd, India.
FURTHER READING:	
1	Bhaduri, A. (1990). Macroeconomics: The Dynamics of Commodity Production, Macmillan India Limited, New Delhi.
2	Branson, W. H. (1992). Macroeconomic Theory and Policy, Third Edition, Harper Collins Publishers India (P) Ltd., New Delhi.
3	Goon A. M., Gupta M. K., and Dasgupta. B. (2001). Fundamentals of Statistics, Vol. 2, World Press, India.
4	Panse, V. G. (1964). Estimation of Crop Yields (FAO), Food and Agriculture Organization of the United Nations.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
<ul style="list-style-type: none"> • https://www.classcentral.com/course/swayam-macro-economics-19942 • https://www.classcentral.com/course/swayam-economics-of-health-and-health-care-14023 	

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning		✓	✓	✓		✓	✓
	3	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	4	Scientific Reasoning			✓	✓		✓	✓
	5	Information/Digital Literacy		✓	✓	✓		✓	✓
	6	Problem Solving		✓	✓	✓	✓	✓	✓
	7	Cooperation/ Team Work			✓	✓		✓	✓
	8	Moral and Ethical Awareness			✓		✓	✓	
	9	Self-Directed Learning			✓		✓	✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	IV	23BST43C	CORE PAPER IV – BASIC SAMPLING THEORY	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the method of designing, organizing and executing a sample survey.			
2	Summarize the various types of Simple random sampling and its practical usage.			
3	Explain Stratified random sampling and its applications.			
4	Describe the method of selecting a Systematic sample and its efficiency.			
5	Summarize the Cluster sampling in detail.			
6	Explain the significance of Two stage sampling method and its uses.			
7	Discuss the significance of the Sample survey and its applications in real life situations.			
Unit - I				
Sample Survey - Concept of Population and Sample – Census and Sample surveys – Merits and Limitations of Sampling technique – Design, Organization and Execution of Sample Survey – Principal Steps in Sample Surveys – Principles of Sample survey - Preparation of Questionnaire and Schedules – Pilot Survey – Sampling and Non-Sampling Errors				
Unit - II				
Simple Random Sampling - Selection of Simple Random Sample – Merits and Drawbacks of Simple Random Sampling – Simple Random Sampling With and Without Replacement – Unbiased Estimate of Mean and Variance – Simple Random Sampling of Attributes – Estimation of mean and variance - Determination of sample size.				
Unit – III				
Stratified Random Sampling - Concept and Advantages of Stratification – Principal advantages of Stratified Random Sampling - Unbiased Estimate of the Mean and Variance – Proportional and Optimum Allocation – Neyman’s Allocation - Comparison of Stratified and Simple Random Sampling.				
Unit – IV				
Systematic Random Sampling - Concept, Merits and Demerits of Systematic Sampling - Estimation of the Mean and Variance – Comparison of Simple, Stratified and Systematic Sampling – Population with Linear Trend - Circular Systematic sampling.				
Unit - V				
Cluster Sampling - Introduction – Equal Cluster Sampling – Estimation of mean and its variance – Relative efficiency of Cluster sampling.				

Two-stage Sampling - Introduction – Two-stage sampling with equal First-stage units with respect to Simple Random Sampling – Estimation of the Mean and its Variance.

PEDAGOGY STRATEGIES

- Lecturing
- Assignment
- Classroom Discussion
- Questioning
- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

1	Daroga Singh, F.S. Chaudhary (2018) – Theory and Analysis of Sample Survey Designs, New Age International (P) Limited, Publishers, New Delhi.
2	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi.

FURTHER READING:

1	William. G. Cochran (2011). Sampling Techniques, Wiley India (P) Limited, New Delhi.
2	Des Raj (1978). Sampling Theory, Tata-McGraw Hill, New Delhi.
3	Sukhatme, P.V., and Sukhatme, B.V. (1970). Sampling Theory of Surveys with Applications, 1970, Asia Publishing House, New Delhi.

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/111/104/111104073/
2	https://nptel.ac.in/content/storage2/courses/111104073/Module14/Lecture42.pdf
3	https://www.mooc-list.com/tags/sampling-methods

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓		✓		
	3	Critical Thinking	✓		✓		✓	✓	
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning				✓	✓	✓	✓
	6	Problem Solving			✓	✓	✓	✓	
	7	Team Work	✓	✓	✓	✓		✓	
	8	Moral and Ethical Awareness	✓	✓			✓	✓	
	9	Multicultural Competence					✓	✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	IV	23BST44P	CORE PRACTICAL -II – STATISTICS PRACTICAL –II (Using ‘C’ Language)	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the theory through practical oriented training			
2	Perform the basic operations of C Language			
3	Apply the C Language for Data Analytics			
4	Access the data through Arrays			
5	Compute Model fitting by developing programs			
6	Perform Computations for Index numbers			
7	Develop computation skills for Statistics and Data Analytics			
LIST OF EXPERIMENTS				
1. C Program to find factorial of n numbers.				
2. C program to find Binomial Coefficient nC_x .				
3. C program to Arrange Data in Ascending and Descending order Using Bubble Sort.				
4. C program to find the Value of Mean and Standard Deviation for raw data.				
5. C Program to find the Coefficient of Variations for two groups.				
6. C Program to determine Median and Mode for raw data.				
7. C Program to find Skewness and Kurtosis.				
8. C program to Calculate Correlation Coefficient.				
9. C program to determine the regression equations.				
10. C program to Calculate Cumulative Probabilities of Binomial Distribution.				
11. C program to Calculate Cumulative Probabilities of Poisson Distribution.				
12. C program to solve the simultaneous equations by Gauss Jacobi Methods.				
13. C program to find the roots of equation by Newton Raphson Method.				
14. C program to fit a Linear Trend by the Method of Least Squares.				
15. C program to find the sum of the series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \dots + \frac{1}{n}$.				
16. C program for Fitting Exponential Curve $Y = ab^x$				
17. C program for Fitting Exponential Curve $y = ax^b$				
18. C Program to determine the roots of the quadratic equation of the form $ax^2 + bx + c = 0$.				

19. C Program to Interpolate using Trapezoidal rule.	
20. C Program to Interpolate using Simpson's 1/3 rd rule.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing and Hands-on training • Lab Experiments • Questioning • Class Test • Quiz & Drill Practice Providing feedback	
REFERENCES:	
1	E. Balagurusamy (2009). Programming in ANSI C, Tata McGraw-Hill, New Delhi.
2	Clay Wilson (2020). https://ndupress.ndu.edu/ - CHAPTER 18 - Cyber Crime
FURTHER READING:	
1	Herbert Scheldt (2012). The C Complete Reference.
2	https://ndupress.ndu.edu/ -
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105171/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking	✓	✓	✓	✓	✓	✓	✓
	4	Research related Skills							
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	IV	23BST45A	ALLIED PAPER IV – NUMERICAL ANALYSIS	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Analyze the data and predict the future values using curve fitting.			
2	Summarize the finite differences and explain the operators and its relationships			
3	Interpolate the missing values using Newton's Forward and Backward difference formula.			
4	Interpolate the central difference using Gauss Forward, Backward, Stirling's and Bessel's formula.			
5	Apply interpolation for unequal intervals by Newton's divided difference formula, Lagrange's and Inverse interpolation formula			
6	Compute the numerical differentiation using Newton's Forward and Newton's Backward			
7	Compute the Derivative using Stirling's Formula - using Trapezoidal, Simpson's 1/3 rd and 3/8 th rule computing integration.			
Unit - I				
Curve Fitting - Principle of least squares - fitting the curves of the form $Y = a + bx$, $Y = a + bx + cx^2$ and curves transformable to the above form. Fitting an exponential curve $Y = ax^b$, $Y = ab^x$				
Unit - II				
Interpolation with Equal Intervals - Finite Differences - Operators – Forward and Backward Difference Operators – Operator E and their basic Properties (without proof) - Interpolation with Equal Intervals - Newton's Forward and Backward Difference Formulae – Simple Problems – Equidistant Terms with One or More Missing Values .				
Unit – III				
Central Difference Interpolation - Central Difference Interpolation Formula – Gauss Forward Interpolation Formula – Gauss Backward Interpolation Formula – Stirling's Formula – Bessel's formula – Simple problems				
Unit – IV				
Interpolation with Unequal intervals – Divided Difference and their properties (without proof) – Newton Divided Difference Formula – Lagrange's Formula – simple problems – Inverse Interpolation using Lagrange's formula.				
Unit - V				
Numerical Differentiation - Newton's Forward and Newton's Backward difference formula to compute the derivative – Derivative using Stirling's formula (Upto Second order only). Numerical Integration - Trapezoidal Rule, Simpson's 1/3 rd and 3/8 th rules, Weddle's Rule				

PEDAGOGY STRATEGIES

- Lecturing
- Assignment
- Classroom Discussion
- Questioning
- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

1	P. Kandasamy, K.Thilagavathy and K.Gunavathi (2016)- Numerical Methods, S.Chand Company Ltd, New Delhi.
2	S.S. Sastry (2012). Introductory Methods of Numerical Analysis, PHI Learning Pvt Ltd

FURTHER READING:

1	G. Shanker Rao. Numerical Analysis, New Age International (P) Ltd, Publishers, New Delhi
2	V. Rajaraman (2018). Computer Oriented Numerical Methods, PHI Learning Pvt. Ltd.
3	M. Shanthakumar (1987). Computer based Numerical analysis, Khanna Publishers, New Delhi.

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/127/106/127106019/
2	https://nptel.ac.in/courses/111/106/111106101/
3	https://nptel.ac.in/courses/111/107/111107062/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	
	3	Critical Thinking	✓	✓	✓	✓	✓	✓	✓
	4	Research related Skills							
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work							
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
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2023-2024 Onwards	IV	23BST46S	SKILL BASED ELECTIVE PAPER II - ELEMENTS OF ACTUARIAL STATISTICS	3
Course Level Outcomes:				
On the successful completion of the course, student will be able to:				
1	Describe and analyze the impact of Finance events on Simple Interest, Compound interest			
2	Explain the Present value concept			
3	Calculate Annuities and identify its types. Explain Financial interest, social and financial issues of Actuarial Statistics			
4	Demonstrate the procedures of developing and implementing of Redemption of loan – Sinking fund – Lender’s sinking fund in Actuarial Statistics			
5	Describe the principle of Life assurance and premium relate to types of endowments			
6	Explain the procedures in Financial Sectors			
7	Compute the interests involved in Actuarial Statistics			
Unit:1				
Mathematic Finance - Simple Interest - Compound interest - nominal and effective rate of interest - Definition – Simple problem				
Unit:2				
Present Value - accumulated value of a single payment with fixed rate or varying rate of interest during certain period – Varying payments during certain period with fixed or varying rate of interest – Simple problems.				
Unit:3				
Annuities – types – Present and accumulated value of an Immediate Annuity and with different period value of an Annuity due and with different periods – Simple problems.				
Unit:4				
Redemption of loan – Sinking fund – Lender’s sinking fund – Simple problems- Probabilities survival and death $p_x, q_x, {}_n p_x, {}_m q_x$ and ${}_{m n} q_x$ – Simple problems.				
Unit:5				
Principle of Life assurance – Premium and its types (single, annual, half yearly, quarterly) – Four basic types of assurance – Temporary, Whole life, Endowment and Pure Endowment.				
<ul style="list-style-type: none"> • PEDAGOGY STRATERGIES: • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing Feedback 				
REFERENCES:				

1	Mathematical Basis of Life Assurance (2015). Published by Insurance Institute of India, Bombay.
2	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
FURTHER READINGS:	
1	PA. Navaneetham (2014) - Business Mathematics and Statistics, Jai Publishers, Trichy.
2	CT- 5 Indian institute of Actuarial Statistics.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.edx.org/course/introduction-to-actuarial-science
2	https://www.iiap.res.in/astrostat/School08/PennStateSchool08_LecNotes.pdf
3	https://www.annuityfyi.com/types-of-annuities/
4	http://www.math.utk.edu/~kbonec/123/2.3-2.4-problems-sol.pdf
5	https://www.ifs.org.mo/Document/Insurance%20Manual/English/Life%20Ins.%20Examination.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning	✓	✓	✓	✓			✓
	3	Research related Skills							
	4	Scientific Reasoning							
	5	Information/Digital Literacy	✓	✓		✓		✓	✓
	6	Problem Solving	✓	✓	✓		✓		✓
	7	Cooperation/ Team Work	✓	✓		✓		✓	
	8	Moral and Ethical Awareness	✓	✓		✓		✓	
	9	Self-Directed Learning	✓	✓	✓	✓	✓	✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
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2023-2024 onwards	V	23BST51C	CORE PAPER V – STATISTICAL ESTIMATION THEORY	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Point out the basic concepts of Population, Sample and explain the Characteristics of estimators			
2	Analyze the concept of unbiasedness and consistency with examples			
3	Compute the efficiency of estimators and describe its essential concepts			
4	Identify the minimum variance estimators with its examples			
5	Discuss the sufficiency with its related theorems			
6	Identify the methods of estimations			
7	Identify the possible intervals of the estimators with examples			
Unit - I				
Statistical Inference - Basic Concepts - Population, Sample, Statistic, Parameter, Parameter Space Point estimation - Meaning – Characteristics of estimators – Unbiasedness – Simple problems - Consistency – Invariance Property of consistent estimator – Sufficient condition for consistency - Simple problems.				
Unit - II				
Efficiency - Efficient Estimators - Simple problems - Most Efficient Estimator - Simple problems - Minimum Variance Unbiased Estimators - Uniqueness of MVUE - Theorems on MVUE.				
Unit – III				
Sufficiency – Neymann Factorization theorem – Cramer-Rao Inequality – Assumptions -Conditions for equality - Minimum Variance Bound Estimator – Simple problems based on Normal, Exponential and Cauchy distributions - Rao-Blackwell Theorem.				
Unit – IV				
Methods of Estimation - Method of Maximum Likelihood - Properties of MLE (Without Proof)- Simple theorems - Methods of Minimum variance -Method of moments - Simple Examples.				
Unit - V				
Interval Estimation - Confidence interval and Confidence limits - Simple problems based on Normal distribution and Uniform distribution - Confidence intervals for Large samples - Simple problems based on Poisson distribution and Exponential distributions.				
PEDAGOGY STRATEGIES				
<ul style="list-style-type: none"> • Lecturing • Assignment 				

<ul style="list-style-type: none"> • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi.
2	A.M. Goon, M.K. Gupta, B. Dasgupta - An Outline of Statistical Theory Vol. II, World Press.
FURTHER READING:	
1	C.W. Snedecor, and W.G.Cochran (1991) - Statistical Methods, Eight reprint, Wiley International.
2	P.G. Hoel (2012). Introduction to Mathematical Statistics, Wiley International.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayamprabha.gov.in/index.php/Syllabus/detail/1077
2	https://nptel.ac.in/courses/111/105/111105041/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

	Course Level Outcomes (CLO)
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			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓		✓		✓	
	3	Critical Thinking	✓	✓		✓		✓	
	4	Research related Skills							
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓			✓	
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
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2023-2024 onwards	V	23BST52C	CORE PAPER VI – STATISTICAL QUALITY CONTROL	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	List out the basis of control charts and Construct control charts for attributes and variables			
2	Interpret the results from the control charts			
3	Explain the basic concepts of acceptance sampling plans			
4	Describe the role of Acceptance Sampling in modern quality control systems			
5	Discuss the advantages and disadvantages of Acceptance Sampling			
6	Point out the major types of Acceptance sampling procedures and explain the uses of Single, Double and Sequential sampling plans			
7	Determine the Operating Characteristic (OC), AOQ, ATI and ASN curves for Single, Double and Sequential sampling plans for Attribute			
8	Discuss the effects of sampling plan parameters on sampling plan performance			
Unit - I				
Quality – meaning - concepts – Quality of design – Quality of conformance – Quality of performance Statistical Quality Control – Meaning – Basic concepts of SQC – Uses – Causes of variation – Process Control – Basis of Control Charts – Uses of control charts - 3 sigma control limits.				
Unit - II				
Control Charts - Criteria for deducting lack of control - Control Charts for Variables – \bar{x} and R Charts - Control Chart for attributes - p and np charts - Control Charts for number of defects - c Charts (for fixed and varying sample size) – Comparison of attribute and variable control charts.				
Unit – III				
Product Control - Acceptance Sampling – Meaning – Applications in Industry - Producer’s Risk and Consumer’s Risk - Definitions of AQL, IQL, LQL - Measures of performance - Concept of OC Function - Type A and Type B OC curves – OC Functions Based on Hyper-geometric, Binomial and Poisson distributions - Attribute Sampling Plans – Designing a Sampling Plan.				
Unit – IV				
Single Sampling Plans - Designing a Sampling Plan - Determination of the parameters in Single Sampling Plans - OC, AOQ, ASN and ATI functions of SSP. Double Sampling Plans for attributes - Operating Procedures - Conditions of Applications - OC, AOQ, ASN and ATI functions – Advantages – Disadvantages.				
Unit - V				

Sequential Sampling Plan for Attributes – Wald’s Sequential Probability Ratio Test – Operating Procedure - OC Curve – ASN Function – Five Points on OC Curve –Five Points on ASN.	
INDUSTRIAL VISIT	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor- Fundamentals of Applied Statistics, 4 th Edition 2015, Sultan Chand & Sons, New Delhi.
2	M. Mahajan - Statistical Quality Control, 2009, Dhanpat Rai & Co (P) Ltd, Delhi, 2009.
FURTHER READING:	
1	E.L.Grant and R.S. LeavenWorth. Statistical Quality Control, McGraw Hill.
2	Duncan, A. J. (2003). Quality Control and Industrial Statistics, Irwin-Illinois, US.
3	Montgomery, D. C. (2009). Introduction to Statistical Quality Control, Sixth Edition, Wiley India, New Delhi
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://bmepedia.weebly.com/uploads/2/6/6/8/26683759/unit_4_quality_control.pdf
2	https://nptel.ac.in/courses/116/102/116102019/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	
	3	Critical Thinking	✓	✓	✓		✓	✓	
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓					✓
	6	Problem Solving	✓	✓					✓
	7	Team Work	✓			✓	✓	✓	✓
	8	Moral and Ethical Awareness	✓			✓	✓	✓	✓
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	V	23BST53C	CORE PAPER VII – ELEMENTS OF ECONOMETRICS	4
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the need and assumptions of Econometric models			
2	Discuss the Linear regression model and the significance of Least square estimation			
3	Analyze the Multiple regression model and the practical applications of the model in real life situations			
4	Summarize the methods of detecting Multicollinearity and remove it from the model			
5	Explain Auto correlation and to analyze the problems related to Auto correlated variables			
6	Describe the techniques of fitting and computing the Econometric models			
7	Illustrate the uses of Econometric models in predicting the future values			
Unit - I				
Econometrics – Nature, Definition and Scope of Econometrics – Relationship between economic theory, Mathematics and Statistics – Model building in Econometrics – Goals of Econometrics – Limitations and Divisions of Econometrics.				
Unit - II				
Simple Linear Regression Model – Error Term in Econometric Models – Reasons for introducing error term in the econometric model - Statistical Assumptions in Linear Model - Least Square Estimation- Gauss-Markov theorem - Properties of Least Square Estimation - Testing of Parameters of the Model - Estimation of Error Variance - Simple Problems.				
Unit – III				
Multiple Regression Model – Model with two explanatory variables – Derivation of normal equations - Measure of goodness of fit –Adjusted co-efficient of multiple determinations – Testing of significance of individual regression co-efficients.				
Unit – IV				
Multicollinearity – Consequences of perfect and imperfect Multicollinearity - Detection of Multicollinearity – Auxiliary regressions - Variance Inflation Factor and its relation – Solution to the problem of Multicollinearity.				
Unit - V				
Autocorrelation - Pure and Impure serial correlation – Autocorrelation by omitted variable and incorrect functional form – Visual inspection – Positive and Negative Autocorrelation – Consequences and sources of Autocorrelation - Durbin-Watson Test.				

PEDAGOGY STRATEGIES

- Lecturing
- Assignment
- Classroom Discussion
- Questioning
- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

1	K. Dhanasekaran (2011). Econometrics, 2 nd Edition, Vrinda Publications (P) Ltd, Delhi -110 091
2	A. Koutsoyiannis (2004). Theory of Econometrics, 2 nd Edition, Palgrave Publishers Limited, Replica Press Private Limited, India.

FURTHER READING:

1	S.P. Singh, Anil. K Parshar and H.P. Singh (1999). Econometrics and Mathematical Economics, 7th Edition, S.Chand & Company Ltd, New Delhi – 110 055.
2	Johnston. J. (1997). Econometric Methods, McGraw-Hill International Editions.
3	Dawn C. Porter, Sangeetha Gunasekar, and Damodar N. Gujarati (2004). Basic Econometrics, 5 th Edition, McGraw-Hill Inc.,

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.youtube.com/watch?v=6I1WPKkNgoQ
2	https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ECO/1.pdf
3	https://sites.google.com/site/econometricsacademy/masters-econometrics/simple-regression-model

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking	✓	✓				✓	✓
	4	Research related Skills	✓		✓	✓		✓	✓
	5	Analytical Reasoning	✓	✓			✓		✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work			✓		✓	✓	✓
	8	Moral and Ethical Awareness	✓	✓			✓	✓	✓
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	V	23BST54C	CORE PAPER VIII – AOS – ELEMENTS OF OPERATIONS RESEARCH	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Point out the Definition, Scope, Uses and Limitations of Operations Research and solve Linear Programming Problem by Graphical and Simplex methods			
2	Find the Optimum Solution in Transportation problem by using NWC, LCM, VAM and MODI method			
3	Solve the Assignment problems by Hungarian method			
4	Solve problems on Inventory Control in Purchasing and Manufacturing Models with No Shortages			
5	Explain the Replacement problems arises in different situations			
6	Solve the Sequencing problems in industries			
7	Explain the theory of Games and solve it			
Unit - I				
Operations Research - Definition – Scope – Uses – Linear Programming Problem – Formulation of LPP – Solution by Graphical Method - Canonical and Standard Form of LPP – Maximization and Minimization Problems – Simplex Method.				
Unit - II				
Transportation Problem – Definition - Balanced and Unbalanced Transportation Problem – Initial Basic Feasible Solution – North West Corner Rule, Least Cost Method and Vogel's Approximation Method – Optimum solution by MODI method				
Unit – III				
Assignment Problem – Definition - Balanced and Unbalanced Assignment Problem – Maximization and Minimization Problems – Hungarian Method – Difference between Transportation and Assignment problems. Inventory Control – Introduction –Types of Inventory – Reasons for maintaining inventory – Costs associated with Inventories - Factors affecting Inventory control – Purchasing and Manufacturing models with no Shortages.				
Unit – IV				
Replacement Problems – Introduction – Replacement of items that deteriorates gradually - Replacement policy when Value of Money does not Change with Time. Sequencing Problem – Introduction – Basic terms - Problems with n-jobs through Two Machines – Problems with n- jobs on Three Machines.				

Unit - V	
Game Theory – Introduction – Two-Person Zero-Sum Games – Concept of Pure and Mixed Strategies – Games With and Without Saddle Points – Solving 2 x 2 Games – Graphic Solution of $m \times 2$ and $2 \times n$ Games.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	Kanti Swarup, P.K. Gupta and Manmohan (2009). Operations Research, Fourteenth Thoroughly Revised Edition, Sultan Chand & Sons, New Delhi.
2	Prof. V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan (2000). Resource Management Techniques, A.R. Publications, Tamil Nadu, New Revised Edition.
FURTHER READING:	
1	Hamdy A. Taha. (2017). Operations Research - An Introduction, 10th Edition, Prentice Hall of India.
2	J.K. Sharma (2007). Operations Research - Theory & Applications, Macmillan India Ltd, Third Edition.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/107/111107128/
2	https://nptel.ac.in/courses/112/106/112106134/
3	https://onlinecourses.swayam2.ac.in/cec20_ma10/preview

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	3	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	4	Scientific Reasoning	✓	✓	✓	✓	✓	✓	✓
	5	Information/Digital Literacy					✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Cooperation/ Team Work							
	8	Moral and Ethical Awareness	✓	✓	✓				
	9	Self-Directed Learning							

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	V	23BST55S	SKILL BASED SUBJECT III - EDUCATIONAL AND PSYCHOLOGICAL STATISTICS	4
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Discuss the various concepts of Correlation (Biserial, Point biserial, Tetrachoric r, Phi coefficient and contingency coefficient) with the corresponding computations			
2	Compute Z-score, Standard score, Normalized and T-scores for ungrouped and grouped data			
3	Explain scaling of rankings and scaling of ratings with examples			
4	Explain the basics of reliability and different methods of determining test reliability			
5	Identify the effect of test length and effect of different ranges on testing reliability of a test			
6	Explain the basics, types, estimation of validity and also the effect on validity by lengthening a test			
7	Discuss the concepts Mental Age and Intelligent Quotient (IQ) with simple calculation			
Unit - I				
Correlation - Biserial correlation - Standard deviation of Biserial Correlation – Point Biserial correlation – Comparison of Biserial and Point Biserial correlation – Tetrachoric r – Calculation. The Phi (Φ) co-efficient – Significance of Phi (Φ) – Comparison of Phi and Tetrachoric r. The contingency coefficient (c) - Simple Problems - Curvilinear or Non-Linear relationship.				
Unit - II				
Partial and Multiple Correlation - Correlation ratio - Intra-class correlation - Partial and Multiple correlation - Definition- Formula for three variables - Simple problems - Properties of multiple correlation co-efficient – Limitations to the use of partial and multiple correlation.				
Unit – III				
Scaling of Scores on a Test - Scaling procedures - Introduction - Scaling individual test item in terms of difficulty – Scaling of scores on a test - Z or σ scores -Standard scores - Normalized scores - T-scores for ungrouped and grouped data - Percentile score - Scaling of rankings in terms of Normal Probability curve - scaling of ratings in terms of Normal Probability curve.				

Unit – IV	
Reliability - Reliability of test scores - Definition of Reliability - Index of Reliability - Methods for determining test reliability - Test-Retest Method - Alternate or Parallel Forms Method - Split Half method - Effect of test length on the reliability of the test - Effect of different ranges on the reliability of the test.	
Unit - V	
Validity - Validity of test scores - Estimation of Validity - Types of Validity - Validity and Test Length - Comparison between Reliability and Validity.	
Intelligence Tests - Mental Age - Intelligence Quotient.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Classroom Discussion • Assignment • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	Gupta, S.C. and Kapoor, V.K. (2019). Fundamentals of Applied Statistics, Sultan Chand and Sons, 4th thoroughly revised edition, New Delhi.
2	Henry. E. Garrett (2014). Statistics in Psychology and Education, Surjeet Publications, Fourth Indian Reprint.
FURTHER READING:	
1	Gupta, S.C. and Kapoor, V.K (2017). Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 11 th Revised Edition.
2	Guilford, J.P. (1986). Fundamental Statistics in Psychology and Education, Mc Graw Hill
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/noc/courses/noc21/SEM1/noc21-hs49/
2	https://labs.la.utexas.edu/gilden/files/2016/05/Statistics-Text.pdf
3	https://www.youtube.com/watch?v=W9yiUIBIRjg
4	https://www.youtube.com/watch?v=jjgzph9118vk

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning	✓	✓			✓	✓	✓
	3	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	4	Scientific Reasoning	✓	✓	✓	✓	✓	✓	✓
	5	Information/Digital Literacy							
	6	Problem Solving	✓	✓			✓	✓	✓
	7	Cooperation/ Team Work	✓	✓			✓	✓	✓
	8	Moral and Ethical Awareness	✓		✓	✓			✓
	9	Self-Directed Learning	✓	✓		✓	✓	✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	V	23BST5EL	NON MAJOR ELECTIVE - I BASIC STATISTICS – I	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the basic concepts in Statistics and develop the skills in collection and presentation of data			
2	Calculate various Measures of Statistics			
3	Compute various problems through Statistical Methods			
4	Apply the concept of Spread and Dispersion Measures			
5	Differentiate the concept of Symmetry and Skewness			
6	Outline the concept of Peakedness and Kurtosis			
7	Explain the application of Statistics in Various fields			
Unit – I				
Basic Statistics – Introduction – Definition - Functions of Statistics – Scope - Uses - Limitations of Statistics – Collection of data – Primary and Secondary data – Methods of collecting Primary data – Classification of data - Tabulation of data - Formation of Frequency Distribution.				
Unit - II				
Diagrams and Graphs – Bar diagrams – Multiple Bar diagram – Box Plot - Pie diagram – Graphs of frequency distribution – Histogram - Frequency polygon - Frequency curve - Ogive curves - Merits - Demerits.				
Unit – III				
Measures of Central Tendency - Requisites of a good average – Raw Data – Frequency Data – Continuous Data - Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits.				
Unit – IV				
Measures of Dispersion - Absolute and Relative Measures – Range, Quartile Deviation, Mean Deviation, Median Deviation, Standard Deviation and Co-efficient of Variation – Simple problems.				
Unit - V				
Skewness - Definition - Characteristics of Skewness - Measures of Skewness – Types - Karl-Pearson’s Co-efficient of Skewness - Bowley’s Co-efficient of Skewness - Simple Problems. Kurtosis – Types of Kurtosis – Characteristics of Kurtosis (Concept only)				
PEDAGOGY STRATEGIES				

- Lecturing
- Assignment
- Classroom Discussion
- Questioning
- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

- | | |
|---|---|
| 1 | Navanitham, P.A. (2008). Business Mathematics and Statistics, Jai Publishers, Trichy. |
| 2 | Pillai, R.S.N and V. Bagavathi (1999). Statistics – Theory and Practice, S.Chand & Sons Company Ltd, New Delhi. |

FURTHER READING:

- | | |
|---|---|
| 1 | S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi. |
| 2 | Vittal P.R. - Business Statistics, Margham Publications, Chennai. |

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

- | | |
|---|---|
| 1 | https://nptel.ac.in/courses/110/107/110107114/ |
|---|---|

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning		✓	✓	✓	✓	✓	
	3	Self-directed Learning	✓	✓	✓	✓	✓	✓	
	4	Reflective Thinking	✓	✓	✓	✓	✓	✓	✓
	5	Information/Digital Literacy		✓	✓		✓	✓	
	6	Problem Solving	✓	✓	✓	✓	✓	✓	
	7	Cooperation/Team Work	✓	✓	✓	✓	✓	✓	
	8	Moral and Ethical Awareness			✓	✓	✓	✓	
	9	Lifelong learning	✓	✓	✓	✓	✓	✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 Onwards	VI	23BST61C	CORE PAPER IX - TESTING STATISTICAL HYPOTHESIS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1	Discuss testing of statistical hypothesis			
2	Explain the procedures for Likelihood Ratio Test and tests based on normal Population			
3	Discuss the test of significance for Large and small sample tests			
4	Explain the procedures of F-test and Chi-Square Test			
5	Describe Non-Parametric Tests on one Sample and Two Sample Problems			
6	Apply Mann-Whitney 'U' Test, Kolmogorov's Smirnov One Sample Test and Kruskal Wallis Test			
7	Apply testing of hypothesis to different distributions			
UNIT - I				
Testing of Hypothesis - Statistical Hypothesis - Simple and Composite Hypothesis, Null and Alternative Hypothesis - Two Types of Errors - Critical Region - Level of significance and Power of a Test - Most Powerful Test - Uniformly Most Powerful Tests - Neyman-Pearson Lemma.				
UNIT - II				
Tests Based on NP lemma - Likelihood Ratio test – Definition - Test for Single Mean, Two Means, Single Variance and Two Variance for normal population.				
UNIT - III				
Tests of Significance - Large Sample Tests - Mean, difference of two Means, Single proportion, difference of Two proportions. Small Sample Tests - t-test for single Mean, difference of two Means, Paired t-test – Test of Correlation Co-efficient				
UNIT - IV				
F-test for variances - Contingency Tables - Yate's correction – Chi-Square Test - Test for Goodness of Fit and Independence of Attributes.				
UNIT - V				
Non-Parametric Tests – Introduction - Advantages and Disadvantages - Sign test, Run test, Median test and Mann-Whitney 'U' test (One Sample and Two Sample Problems) - Kolmogorov's Smirnov One Sample Test - Kruskal Wallis Test.				

PEDAGOGY STRATEGIES:	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing Feedback 	
REFERENCES:	
1	S.C. Gupta, and V.K. Kapoor (2012). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11 th Revised Edition.
2	Hogg R.V and Craig A.G. Introduction to Mathematical Statistics
FURTHER READING:	
1	Snedecor, G.W and Cochran W. G . Statistical Methods (Oxford and IBH)
2	Lehmann, E.L. (1986). Testing Statistical Hypothesis (2 nd Edition), Springer New York.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://math.ucdenver.edu/~ssantori/MATH2830SP13/Math2830-Chapter-08
2	https://www.cse.iitk.ac.in/users/nsrivast/HCC/lec07-09.pdf
3	http://www2.univet.hu/users/jfodor/biomath/Biomath12

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓			
	3	Critical Thinking	✓	✓	✓	✓			
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓				✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	VI	23BST62C	CORE PAPER X – DESIGN OF EXPERIMENTS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the theoretical aspects of Linear models, Analysis of Variance and Design of Experiments			
2	Discuss the fundamental principles of experimentation			
3	Analyze and interpret one-way and two – way ANOVA			
4	Outline the type of Design of experiments with its advantages and disadvantages			
5	Analyze and interpret Completely Randomized Design, Randomized Block Design and Latin Square Design			
6	Discuss the basics of Factorial experiments with its design			
7	Analyze and apply Factorial experiments			
8	Explain the need of concept of confounding			
Unit - I				
ANOVA - Definition – Assumptions – Importance – Linear Models – Fixed Effect Model – Random Effect Model – One-way ANOVA for Fixed Effect Model – Least Square Estimates of Parameters and the Variances - Sum of squares – Two-way ANOVA for Fixed Effect Model - Least Square Estimates of Parameters and the Variances – Sum of squares.				
Unit - II				
Design of Experiments - Fundamentals – Terminology in design of Experimental design – Experimental Error –Principles of Experimental Design – Size and Shape of the Plots. Completely Randomized Design (CRD) - Concept - Layout - Statistical Analysis - Advantages and Disadvantages.				
Unit – III				
Randomized Block Design (RBD) – Application of RBD - Layout – Statistical Analysis of RBD for observation per experimental unit– Advantages and Disadvantages – Efficiency of RBD over CRD – Estimation of one Missing value and its ANOVA in RBD – Estimation of Two missing values in RBD				
Unit – IV				
Latin Square Design (LSD) – Layout of LSD – Standard Latin Square - Statistical Analysis of LSD for one observation per experimental unit.– Advantages and Disadvantages – Least Square Estimates – Estimation of one Missing Value in LSD - Efficiency of LSD over CRD and RBD.				

Unit - V	
Factorial Experiments – Advantages and Limitations – 2^2 Factorial Design – Statistical Analysis of 2^2 Design – Yates method of Computing Factorial Totals – 2^3 Factorial Design - Statistical Analysis of 2^3 Design – Confounding - Partial and Complete Confounding .	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi.
2	R. Pannerselvam (2012). Design and Analysis of Experiments, Prentice Hall of India, New Delhi.
FURTHER READING:	
1	Montgomery. Design and Analysis of Experiments, Wiley India Pvt. Ltd, 5 th Edition,
2	Das M.N. and Giri N.C. (2011). Design and Analysis of Experiments, New Age International Private Ltd., New Delhi
3	Cochran W.G. and Cox G.M. (1992). Experimental Designs, Second Edition, John Wiley & Sons, New York.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/110/105/110105087/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking				✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning				✓	✓	✓	✓
	6	Problem Solving				✓	✓	✓	✓
	7	Team Work							
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	VI	23BST63C	CORE PAPER XI – AOS – APPLIED STATISTICS	5
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Discuss the concept of Time series and its components			
2	Analyze and interpret the Trend values			
3	Forecast the values using trend analysis			
4	Differentiate the concepts of ARMA and ARIMA models			
5	Explain the concept and uses of Index Numbers			
6	Analyze and interpret the Weighted index numbers			
7	Discuss the various measurements and scaling techniques			
UNIT - I				
Time Series - Definition- Components of Time Series - Uses - Measurement of Trend: Graphical Method - Semi-Average Method - Method of Moving Averages - Merits and Demerits - Method of Least Squares in fitting a linear trend.				
UNIT - II				
Seasonal Variation – Measurement of Seasonal Variations - Method of Simple Averages, Ratio-to-Trend Method, Ratio-to-Moving Average Method and Link Relative Method – Cyclical Variations and Random Variations (Concepts only) - Concept of ARMA and ARIMA models.				
UNIT – III				
Index numbers - Meaning - Definition - Uses and Types – Price Index numbers – Un-weighted Index Numbers – Simple aggregative method – Simple average of Price relative method - Weighted Index Numbers – Weighted Aggregative Price Index - Laspeyre’s Price Index, Paasche’s Price Index, Dorbish & Bowley’s Price Index, Marshall Edgeworth Price Index and Fisher’s Index Number - Weighted Average of Price Relatives Method.				
UNIT – IV				
Criteria of a Good Index Number : Unit Test, Time Reversal Test, Factor Reversal Test and Circular Test – Construction of Fixed Base and Chain Base Index Numbers - Cost of Living Index Numbers – Uses – Construction - Aggregate Expenditure and Family Budget Methods				
UNIT – V				
Measurement and Scaling techniques - Categorical variables - Data types - Metric, Interval and Ratio data. Non-Metric data – Nominal and Ordinal data. Scales of measurement - Comparative scale, Paired comparison scale, Rank order scale, Constant sum scale, Non-comparative scale - Continuous rating scale, Itemized rating scale - Likert scale and Guttman scale				

PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi.
2	S.P.Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
3	S.K. Mangal (2009). Statistics in Psychology and Education, Second Edition, PHI Learning Private Limited, New Delhi.
FURTHER READING:	
1	Croxton and Cowden - Applied General Statistics, Prentice - Hall of India (Private) Ltd, New Delhi.
2	B.L. Agarwal – Programmed Statistics, New Age International, Chennai
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.slideshare.net/ujjmishra1/measurement-and-scaling-techniques
2	https://www.stat.berkeley.edu/~bartlett/courses/153-fall2010/lectures/1.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓			
	3	Critical Thinking	✓	✓	✓	✓	✓		
	4	Research related Skills	✓	✓	✓	✓			
	5	Analytical Reasoning	✓	✓	✓	✓			
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓			✓	✓	
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
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2023-2024 onwards	VI	23BST64P	CORE PRACTICAL III – STATISTICS PRACTICAL – III (Using Scientific Calculator)	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Estimate the parameters using method of moments and MLE. Analyze the data using appropriate Large and small sample test. Ensuring the Goodness of fit and Independence of attributes using Chi – Square Test. Verify the data using Non – Parametric Tests.			
2	Ensure the Goodness of fit and Independence of attributes using Chi – Square Test. Verify the data using Non – Parametric Tests			
3	Analyze the data using CRD, RBD and LSD. Estimate the missing values in RBD and LSD.			
4	Frame the control charts using p, np, c, \bar{x} and R charts. Verify the process is under control practically Draw the OC, ASN, ATI, AOQ curves and analyze the data using Single sampling plan and measuring the performances			
5.	Frame the LPP and solving them. Identify the transportation cost using various methods and analyze the optimal solution. Determine the optimal assignment using Hungarian method.			
6	Identify the duration to replace the parts. Identify the optimal strategies in Game theory.			
7	Measure the trend and identify the seasonal variations. Calculate the index number using various methods.			
Statistical Inference				
<ol style="list-style-type: none"> 1. Estimation of Parameters of Distribution by the Method of Moments 2. Estimation of Parameters by the Method of Maximum Likelihood 3. Testing of hypothesis- Large Sample Tests- Test for Mean – Difference of Mean. Proportion - Difference of proportion. Small sample tests - Test for mean - Difference of mean – Paired t-test -Test for variance ratio 4. Chi – Square Test - Test for Goodness of Fit and Independence of Attributes. 5. Non – Parametric Tests – Sign test - Run Test - Median Test - Mann-Whitney ‘U’ Test - Kolmogorov’s Smirnov One Sample Test - Kruskal Wallis Test 				
Design of Experiments				
<ol style="list-style-type: none"> 6. Analysis of CRD 7. Analysis of RBD 8. Analysis of LSD Layouts 9. Missing Plot Techniques in RBD 10. Missing Plot Techniques in LSD 				
Statistical Quality Control				
11. Control Charts for Attributes - p, np and c charts				

12. Control Charts for Variables - \bar{X} and R charts	
13. Single Sampling Plan for attributes - OC, ASN, ATI and AOQ Curves.	
Operations Research	
14. Linear Programming Problem –Formation of LPP- Graphical Method – Simplex Method	
15. Transportation Problem – North West Corner Rule – Least Cost Method – VAM Method	
16. Optimal Solution by MODI Method	
17. Assignment Problem – Hungarian Algorithm	
18. Replacement Problems	
19. Sequencing problems - Problems with n jobs on three machines	
20. Game theory - Games without saddle point - Solving 2x2 games - Graphic Solution of 2 x n and m x 2 Games.	
Time Series	
21. Measurement of Trend - Graphical Method - Semi-Average Method - Method of Moving Averages	
22. Measurement of Seasonal Variations - Method of Simple Averages, Ratio-to-Trend Method, Ratio-to-Moving Average Method and Link Relative Method	
23. Index numbers - Un-weighted Index Numbers – Simple aggregative method – Simple average of Price relative method	
24. Weighted Index Numbers - – Laspeyre’s Price Index – Paasche’s Price Index – Dorbish & Bowley’s Price Index – Marshall Edgeworth Price Index - Fisher’s Index Number.	
25. Time Reversal Test and Factor Reversal Test	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing and Hands-on training • Lab Experiments • Questioning • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta, and V.K. Kapoor (2012). Fundamentals of Mathematical Statistics, 11 th Revised Edition, Sultan Chand & Sons, New Delhi.
2	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, 4 th Edition, Sultan Chand & Sons, New Delhi.
3	P.K. Kanti Swarup, Gupta and Manmohan (1980). Operations Research, Sultan Chand & Sons, New Delhi.
4	S.P.Gupta (2012). Statistical Methods, 42 nd revised Edition, Sultan Chand & Sons, New Delhi.
5	M. Mahajan (2009) - Statistical Quality Control , Dhanpat Rai & Co (P) Ltd, New Delhi.

6	A.M. Goon, M.K.Gupta and B. Dasgupta (1989). An Outline of Statistical Theory-Vol.II, World Press, Calcutta.
FURTHER READING:	
1	P.A. Navanitham (2008) - Business Mathematics and Statistics, Jai Publishers, Trichy.
2	Prof. V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan (2000). Resource Management Techniques, New Revised Edition, A.R. Publications, Tamil Nadu.
3	P. K. Gupta and Manmohan - Problems in Operations Research, Sultan Chand & Sons, New Delhi.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/102/111102111/
2	https://nptel.ac.in/courses/111/104/111104032/
3	https://nptel.ac.in/courses/111/105/111105043/
4	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=34
5	https://nptel.ac.in/courses/110/105/110105087/
6	https://nptel.ac.in/courses/112/106/112106134/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	
	3	Critical Thinking							
	4	Research related Skills							
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work			✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
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2023-2024 onwards	VI	23BST65P	CORE PRACTICAL IV – STATISTICS PRACTICAL – IV (Using SPSS)	2
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Design a questionnaire and collect the data			
2	Demonstrate the method of creating and formatting a data file in SPSS.			
3	Handle and transform the data in SPSS			
4	Draw various diagrams for the created data set using SPSS.			
5	Analyze the Univariate and Bivariate data set			
6	Analyze Parametric and Non parametric statistical tests			
7	Analyze a big data set and solve the complicated problems using various statistical concepts			
1. Creating, Editing and Managing Data Files				
2. Diagrammatic Representation – Simple, Multiple, Sub-divided and Percentage bar diagrams				
3. Pie diagram, Scatter diagram, Box plots, Histogram and Frequency table				
4. Descriptive Statistics – Mean, Median, Mode and S.D				
5. Skewness and Kurtosis				
6. Correlation – Karl Pearson’s and Spearman’s Rank correlation				
7. Regression – Simple Regression analysis				
8. Testing of Hypothesis – Parametric tests – One sample ‘t’ test – Two sample ‘t’ test – Paired ‘t’ Test				
9. Non- Parametric tests – One sample K-S test - Mann-Whitney U test – Wilcoxon Signed Rank test – Kruskal Wallis test				
10. Chi-square test – Test for independence of attributes – Test for goodness of fit				
11. Analysis of Variance – One way ANOVA – Two way ANOVA				
PEDAGOGY STRATEGIES				
<ul style="list-style-type: none"> • Lecturing and Hands-on training • Lab Experiments • Questioning • Class Test • Quiz & Drill Practice • Providing feedback 				
REFERENCES:				
1	Jeremy J. Foster (2001). Data analysis using SPSS for windows - New edition, Versions 8-10 Sage publications, London			
2	Darren George and Paul Mallery. SPSS for Windows Step by Step, Eighth Edition – Dorling Kindersely (India) Pvt. Limited (Pearson Education), New Delhi.			

FURTHER READING:	
1	Clifford E. Lunneborg (2000) - Data analysis by resampling: concepts and applications - Dusbury Thompson learning, Australia.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/110/107/110107113/
2	https://nptel.ac.in/courses/110/105/110105060/
3	https://nptel.ac.in/courses/111/104/111104098/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking	✓	✓	✓	✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
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2023-2024 onwards	VI	23BST67S	SKILL BASED SUBJECT IV - DEMOGRAPHIC METHODS	3
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the basics of demography and the sources of demographic data			
2	Discuss the uses and applications of demography in various fields			
3	Explain the concept fertility and calculate its measures CBR, GFR, TFR, ASFR, GRR and NRR			
4	Summarize the concept mortality and calculate its measures CDR, ASDR, SDR and IMR.			
5	Calculate and construct the life table and discuss its uses and functions			
6	Discuss about migration and its types in real life situations			
7	Describe various types, importance and methods for estimation of population projection.			
Unit - I				
Demography - Definition - Importance of Demographic data – Sources of Demographic data - Population Census – Uses - Registration method - Vital Registration - Population Register - Records - Sample surveys - International publications - Demography in Sociology, Economics and Health planning.				
Unit - II				
Fertility measurements - Rates and Ratios – Fertility – Factors affecting Fertility – Fertility Measures - Crude Birth Rate (CBR), General, Specific and Total Fertility Rates – Growth Rates - Gross Reproduction Rate (GRR) - Net Reproduction Rate (NRR) - Simple Problems.				
Unit – III				
Mortality Measurements - Mortality – Mortality Measures - Crude Death Rate (CDR), Age, Sex and Cause Specific Death Rates - Standardized Death Rate - Infant Mortality Rate - Simple Problems.				
Unit – IV				
Life Table – Assumptions - Description of various columns of a Life table –Relationship between life table functions - Construction of a Life table - Uses of a Life table - Simple Problems. Migration - Definition – Types of Migration - Effects of Migration.				
Unit - V				
Population Projection – Types - Methods of population projection – Importance - limitations – Population estimates and projection – Mathematical Method – Arithmetic Method and Geometric Method - Growth Component Method – Logistic curve – Basic ideas of Stationary and Stable population.				
PEDAGOGY STRATEGIES				
<ul style="list-style-type: none"> • Lecturing • Classroom Discussion 				

	<ul style="list-style-type: none"> • Questioning • Seminar • Assignment • Class Test • Quiz & Drill Practice • Providing feedback
REFERENCES:	
1	Jhingan M.L, Bhatt B.K and Desai J.N. (2003). Demography, Vrinda Publications (P) Ltd, Delhi, 2nd Revised Edition.
2	Gupta S.C. and Kapoor V.K. (2019). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi, 4th thoroughly revised edition.
FURTHER READING:	
1	Mishra D.E (2001). An Introduction to the Study of Population, South India publishers, Madras.
2	Goon, A.M, Gupta, M.K and Das Gupta (2009). Fundamentals of Statistics, Vol II (World Press).
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/109/104/109104045/
2	https://swayam.gov.in/nd1_noc19_hs39/preview
3	https://nptel.ac.in/courses/109/104/109104150/
4	http://www.ru.ac.bd/wp-content/uploads/sites/25/2019/03/402_10_00_Lundquist_Demography.pdf
5	https://www.youtube.com/watch?v=51eqdcSg0Pw

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	3	Research related Skills					✓	✓	✓
	4	Scientific Reasoning					✓	✓	✓
	5	Information/Digital Literacy	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving			✓	✓	✓	✓	✓
	7	Cooperation/ Team Work	✓	✓	✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness	✓	✓			✓	✓	✓
	9	Self-Directed Learning	✓	✓				✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	VI	23BST6EL	NON MAJOR ELECTIVE II - BASIC STATISTICS – II	3

COURSE LEVEL OUTCOMES:	
On the successful completion of the course, students will be able to:	
1	Explain the study of relationship between two variables
2	Convert qualitative data into ranks and calculate the rank correlation.
3	Discuss the applications of Time Series and its Components
4	Compute Index numbers
5	Discuss the concept of cost of living index
6	Apply index numbers in real life situations
7	Demonstrate the applications of Time Series in Forecasting
Unit - I	
Correlation – Meaning – Scatter diagram – Karl Pearson’s Correlation Coefficient – Merits and Demerits - Rank Correlation – Spearman’s Rank Correlation Coefficient – Merits and Demerits – Concurrent Deviation Method – Simple Problems.	
Unit - II	
Regression – Meaning - Uses – Applications - Regression Equation Y on X – Regression Equation X on Y – Properties – Determination of Correlation using Regression Coefficients – Forecasting - Simple Problems.	
Unit – III	
Time Series – Uses – Components of Time Series – Measurement of Trend –Graphical method- Semi Average Method - Moving Average Method - Method of Least Squares – Simple Problems.	
Unit – IV	
Index Numbers – Uses – Characteristics – Price Index Numbers - Construction of Weighted Index Numbers – Laspeyre’s, Paasches and Fisher’s Index Numbers – Cost of Living Index - Simple Problems.	
Unit - V	
Sampling Techniques – Census Survey – Merits and Demerits - Sample Survey – Merits and Demerits – Principles of Sampling – Methods of Sampling – Simple Random Sampling – Non-Random Sampling Methods – Snow Ball Sampling – Quota Sampling - Merits and Demerits – Sampling Error (Concepts Only).	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning 	

- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

1	Navanitham, P.A. (2008). Business Mathematics and Statistics, Jai Publishers, Trichy.
2	S.C. Gupta and V.K. Kapoor (2015). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

FURTHER READING:

1	Pillai, R.S.N and V. Bagavathi (1999). Statistics – Theory and Practice, S.Chand & Sons Company Ltd, New Delhi.
2	Vittal P.R. Business Statistics, Margham Publications, Chennai.

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/110/107/110107114/
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COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

	Course Level Outcomes (CLO)
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		1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓
	2	Analytical Reasoning	✓	✓	✓	✓	✓	✓
	3	Self-directed Learning	✓	✓			✓	✓
	4	Reflective Thinking	✓	✓		✓		✓
	5	Information/Digital Literacy	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓
	7	Cooperation/Team Work	✓	✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness		✓	✓	✓		
	9	Lifelong learning			✓	✓	✓	✓

ALLIED PAPERS

(Offered to other Departments)

GOVERNMENT ARTS COLLEGE, COIMBATORE 641 018

B. Sc. STATISTICS (OBE PATTERN)

(For the students admitted from the academic year **2023-2024** and onwards)

Scheme of Examination for Allied Papers offered to Other Departments

Part	Sub Code	Title of the Paper	Hrs (wk)	Internal (CA) Marks	External Marks	Total Marks	Ext- Min.	Total Pass Mark	Credits
Semester – 1									
III	23BGE14A	Statistics – I	8	25	75	100	30	40	
III	23BCS16A	Statistics and Numerical Methods	6	25	75	100	30	40	
III	23BCA15A	Business Mathematics	6	25	75	100	30	40	
III	23BBA15A	Statistics for Management – I	6	25	75	100	30	40	
Semester – II									
III	23BGE24A	Statistics – II	8	25	75	100	30	40	
III	23BIT25A	Computer Oriented Numerical and Statistics Methods	6	25	75	100	30	40	
III	23BBA25A	Statistics for Management – II	6	25	75	100	30	40	
Semester – III									
III	23BPS34A	Statistics – I	6	25	75	100	30	40	
III	23BCA36A	Statistics for Business	4	25	75	100	30	40	
Semester – IV									
III	23BPS44A	Statistics – II	6	25	75	100	30	40	
III	23BCO45A /23BIB46A	Business Statistics	4	25	75	100	30	40	

Year	Sem.	Subject Code	Title of the Paper	Hours / Week
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2023-24 onwards	I	23BGE14A	I B.Sc., GEOGRAPHY – Allied – I: STATISTICS – I	8
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1.	Discuss the scope and necessity of Statistics			
2.	Tabulate and represent the data in diagrams and graphs			
3.	Identify the nature of data			
4.	Choose the suitable measure according to the nature of the observed data			
5.	Apply the formula and calculate statistical measures for the observed data in their field			
6.	Check the relevance of the measures calculated			
7.	Interpret the results of the statistical measures used			
Unit – I				
Statistics - Definition, Scope and Limitations – Types and Sources of Data – Methods of Collecting Primary Data – Tools for Data Collection - Sources of Secondary Data – Classification and Tabulation of Data.				
Unit – II				
Frequency Distribution - Formation of Frequency Distribution - Presentation of Data. Diagrams: Bar Diagrams and Pie Diagram. Graphs – Histogram - Frequency Polygon - Frequency Curve and Ogives – Finding Median and Mode graphically.				
Unit – III				
Measures of Central Tendency – Meaning - Objectives - Mean, Median, Mode, Geometric Mean and Harmonic Mean – Merits and Demerits – Properties of a Good Measure – The Best Measure among Measures of Central Tendency.				
Unit – IV				
Measures of Dispersion – Meaning - Objectives - Range, Quartile Deviation, Mean Deviation, Standard Deviation and Co-efficient of Variation. The Best Measure among Measures of Dispersion. Skewness and Kurtosis - Definition – Concept of Symmetry and Skewness - Measures of Skewness – Karl Pearson’s Co-efficient of Skewness and Bowley’s Co-efficient of Skewness - Measures of Kurtosis.				
Unit – V				
Probability - Concept – Basic Concepts – Types of Events – Mathematical and Statistical Definitions of Probability – Conditional Probability – Addition and Multiplication Theorems (Without Proof) – Problems based on these theorems.				
PEDAGOGY STRATEGIES				
<ul style="list-style-type: none"> Lecturing 				

<ul style="list-style-type: none"> • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback
References:
1. S.P.Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
2. Gupta, S C. and Kapoor V. K. (2018) - Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
Further Reading:
1. P. R. Vittal - Business Statistics, Margham Publications, Chennai.
2. P.A. Navneetham (2008). Business Mathematics & Statistics, Jai Publishers, Trichy.
3. Goon A.M., Gupta M.K., and Das Gupta B. (2013). Fundamentals of Statistics, Vol.1, World Press Private Ltd, Calcutta.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1. https://nptel.ac.in/courses/111/105/111105041/
2. https://nptel.ac.in/courses/111/106/111106112/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓			✓	✓	✓	
	2	Communication Skills		✓	✓	✓	✓	✓	
	3	Critical Thinking	✓	✓	✓	✓	✓		✓
	4	Research related Skills			✓	✓		✓	✓
	5	Analytical Reasoning		✓		✓	✓		✓
	6	Problem Solving							
	7	Team Work							
	8	Moral and Ethical Awareness	✓		✓			✓	
	9	Multicultural Competence	✓		✓			✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	I	23BCS16A	I BSc., (CS) - Allied I: STATISTICS & NUMERICAL METHODS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Calculate and apply measures of central tendency and measures of dispersion – grouped data cases.			
2	Calculate and apply measures of central tendency and measures of dispersion –ungrouped data cases.			
3	Compute and interpret the results of Skewness and Correlation Analysis.			
4	Demonstrates and understands Linear Regression and Curve fitting.			
5	Apply numerical methods to solve system of simultaneous equations and analyze and evaluate the accuracy of common numerical methods.			
6	Solve Numerical Differentiation and Central difference problems using Newton Forward Difference and Backward Difference.			
7	Solve Numerical Integration problems using Newton Forward Difference and Backward Difference, Trapezoidal Rule, Simpson Rule $1/3^{\text{rd}}$, $3/8^{\text{th}}$ and Weddle's rules.			
Unit - I				
Measures of Central Tendency – Mean - Median and Mode - Relationship among Mean, Median and Mode – Uses - Merits and Demerits				
Measures of Dispersion - Range - Quartile Deviation - Mean Deviation - Standard Deviation and Coefficient of Variation.				
Unit - II				
Skewness and Kurtosis - Definition - Bowley's and Karl Pearson's Coefficient of Skewness. Concept of Kurtosis.				
Correlation - Definition - Scatter Diagram - Types of Correlation - Karl Pearson Correlation Coefficient – Spearman's Rank Correlation Coefficient.				
Unit – III				
Regression Analysis -Definition - Regression Equations for Two Variables - Regression Coefficients - Properties - Curve Fitting - Linear - Simple Problems.				
Unit – IV				
Numerical Methods - System of Simultaneous Equations - Gauss Elimination- Gauss Seidal Methods – Interpolation - Newton's Forward and Backward Interpolation Formula - Lagrange's Interpolation - Central difference interpolation formulae - Gauss forward and backward formula - (No Derivations) Simple Problems Only.				

Unit - V	
Numerical Differentiation - Newton Forward Difference - Newton Backward Difference. Numerical Integration - Trapezoidal Rule - Simpson's $1/3^{\text{rd}}$ Rule - Simpson's $3/8^{\text{th}}$ Rule and Weddle's Rule (No Derivations) Simple Problems Only.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	S.C. Gupta and V.K. Kapoor (2012). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11 th revised Edition.
2	P. Kandasamy, K. Thilagavathy and K. Gunavathi. Numerical Methods, S. Chand & Company Ltd, New Delhi.
FURTHER READING:	
1	S.P. Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
2	R.S.N. Pillai and V. Bagavathi (1999). Statistics – Theory and Practice, S. Chand & Sons Company Ltd, New Delhi.
3	E. Balagurusamy - Numerical Methods, Tata MC grew hill Pvt ltd.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/111/105/111105041/
2	https://nptel.ac.in/courses/111/106/111106112/
3	https://www.classcentral.com/course/intro-to-numerical-analysis-13684

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge							
	2	Communication Skills							
	3	Critical Thinking							
	4	Research related Skills							
	5	Analytical Reasoning							
	6	Problem Solving							
	7	Team Work							
	8	Moral and Ethical Awareness							
	9	Multicultural Competence							

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	I	23BCA15A	I BCom (CA) -Allied I: BUSINESS MATHEMATICS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Explain the concepts and uses of series.			
2	Discuss the nature of business problems			
3	Apply the knowledge of mathematics (algebra, matrices, calculus) in solving business problems.			
4	Solve the business problems using Basic Mathematics			
5	Analyze and take decisions in day to day business transactions			
6	Solve the Transportation problem			
7	Discuss Assignment problem and solve it			
Unit - I				
Mathematics of Finance - Arithmetic and Geometric Series - Simple interest - Compound interest - Annuity - Concept of present value and amount of sum types of annuities - Present value and amount of an annuity including the cases of continuous compounding - Problems relating to sinking fund.				
Unit - II				
Matrices - Definition of a matrix - types of matrices- Properties of determinants - Calculations of values of determinants up to third order – Adjoint of a matrix – Elementary row and column operations - Inverse of a Matrix (up to 3 x 3) - Solution of a system of linear equations having unique solution and involving not more than three variables - Rank of a Matrix (up to 3 x 3).				
Unit – III				
Numerical Differentiation - Variables - Constants and Functions - Differentiation - Meaning of Derivative – First and Second Order Derivatives - Maxima and Minima; cases of one variable involving second or higher order derivatives - Marginal Revenue and Marginal Cost - Simple Problems.				
Unit – IV				
Numerical Integration - Integration as anti-derivative process - Standard forms - Meaning - Basic Integral Formulas - Methods of Integration - By substitution - By parts - By use of partial functions – Simple Problems.				
Unit - V				

Transportation and Assignment Problems - Transportation Problem - Introduction - Balanced and Unbalanced Problems – Initial Basic Feasible Solution – North-West Corner Rule, Least Cost Method and Vogel’s Approximation Method (VAM) - Assignment Problem – Hungarian Method - Simple Problems.

PEDAGOGY STRATEGIES

- Lecturing
- Assignment
- Classroom Discussion
- Questioning
- Seminar
- Class Test
- Quiz & Drill Practice
- Providing feedback

REFERENCES:

1	Vittal P.R. (2012). Business Mathematics and Statistics: Margham Publications, Chennai.
2	Eugene Don and Joel J. Lerner, (2009). Basic Business Mathematics: McGraw-Hill Education, New Delhi.

FURTHER READING:

1	Navneetham P.A. (2008). Business Mathematics & Statistics: Jai Publishers, Trichy.
2	Kanti Swarup, Gupta P.K and Manmohan (1980). Operations Research: Sultan Chand & Sons, New Delhi.

RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.notesformba.com/subject/business-mathematics
2	https://www.mheducation.com/highered/explore/business-math.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills		✓			✓	✓	✓
	3	Critical Thinking	✓	✓		✓		✓	✓
	4	Research related Skills							
	5	Analytical Reasoning		✓		✓			
	6	Problem Solving					✓	✓	✓
	7	Team Work							
	8	Moral and Ethical Awareness						✓	✓
	9	Multicultural Competence						✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours / Week
2023-24 onwards	I	23BBA15A	I BBA – Allied I: STATISTICS FOR MANAGEMENT- I	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1.	Discuss the scope and necessity of Statistics			
2.	Tabulate and represent the data in Diagrams and Graphs			
3.	Identify the nature of data			
4.	Choose the suitable measure according to the nature of the observed data			
5.	Apply the formula and calculate statistical measures for the observed data in their field			
6.	Check the relevance of the measures calculated			
7.	Interpret the results of the statistical measures used			
Unit – I				
Statistics – Definition - Scope and Limitations – Types and Sources of Data – Methods of Collecting Primary Data – Tools for Data Collection - Sources of Secondary Data – Classification and Tabulation of Data. Graphs - Histogram - Frequency Curve and Ogives – Finding Median and Mode graphically. Measures of Central Tendency - Mean, Median, Mode.				
Unit – II				
Measures of Dispersion - Meaning - Objectives - Range, Quartile Deviation, Mean Deviation, Standard Deviation and Co-efficient of Variation. The Best Measure among Measures of Dispersion. Skewness - Definition – Concept of Symmetry and Skewness - Measures of Skewness – Karl Pearson’s Co-efficient of Skewness and Bowley’s Co-efficient of Skewness.				
Unit – III				
Correlation - Definition - Types and Methods of measuring of Correlation - Scatter Diagram - Karl Pearson’s Method - Spearman’s Rank Method. Regression - Definition and Types – Simple Regression only – Construction of Regression Equations – Difference between Correlation and Regression.				
Unit – IV				
Index Numbers - Definition - types and uses - Weighted and Un-weighted Methods of constructing Price index Numbers – Time Reversal and Factor Reversal Tests. Cost of Living Index Number – Uses - Construction by Family Budget Method – Aggregate Expenditure Method.				
Unit – V				
Time Series - Concept and Components - Estimation of Trend – Method of Moving Averages - Method of Least squares (Linear only). Estimation of Seasonal Variation – Method of Simple Averages – Ratio-to-Moving Averages Method.				

PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
References:	
1.	S.P. Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
2.	Gupta S.C. and Kapoor V.K. (2018). Fundamentals of Mathematical Statistics, Eleventh Edition, Sultan Chand & Sons, New Delhi.
Further Reading:	
1.	P. R. Vittal - Business Statistics, Margham Publications, Chennai.
2.	P.A. Navneetham (2008) - Business Mathematics & Statistics, Jai Publishers, Trichy.
3.	Goon A.M., Gupta, M.K. and Das Gupta B. (2013). Fundamentals of Statistics, Vol.1, World Press Private Ltd, Calcutta.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1.	https://nptel.ac.in/courses/111/105/111105041/
2.	https://nptel.ac.in/courses/111/106/111106112

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓			✓	✓	✓	
	2	Communication Skills		✓	✓	✓	✓	✓	
	3	Critical Thinking	✓	✓	✓	✓	✓		✓
	4	Research related Skills			✓	✓		✓	✓
	5	Analytical Reasoning		✓		✓	✓		✓
	6	Problem Solving							
	7	Team Work							
	8	Moral and Ethical Awareness	✓		✓			✓	
	9	Multicultural Competence	✓		✓			✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	II	23BGE24A	II B.Sc., GEOGRAPHY – Allied II: STATISTICS – II	8
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Evaluate the correlation and constructing regression equations by various methods			
2	Explain the applications of random and non-random sampling methods			
3	Analyze and test the means, proportions using large sample procedure			
4	Identify and apply small sample test problems for testing means and variances			
5	Evaluate the various applications of Chi square test with relevant examples			
6	Demonstrate layout and application of one-way and two-way classifications			
7	Identify and apply CRD and RBD with appropriate real-life problems			
Unit - I				
Correlation – Meaning - Scatter Diagram - Karl Pearson’s Co-efficient of Correlation - Spearman’s Rank Correlation – Coefficient of Concurrent Deviation - Simple Problems. Regression – Meaning - Construction of regression equations - Difference between Correlation and Regression – Properties of Regression coefficients - Simple Problems.				
Unit - II				
Sampling Methods – Advantages and Limitations – Sampling and Non-Sampling Errors – Random Sampling Methods - Simple Random Sampling - Systematic Sampling - Stratified Sampling – Non-Random Sampling Methods (No Derivations, Only Concepts).				
Unit – III				
Testing of Hypothesis - Sampling Distribution – Standard Error – Tests of Significance – Null and Alternative Hypotheses – Type I and Type II Errors. Large Sample Tests – Test for Single Mean, Difference of Means, Single Proportion and Difference of Proportions – Simple Problems.				
Unit – IV				
Small Sample Tests - Student’s ‘t’ test – Test for Single Mean - Difference of Means (independent and paired samples) – Chi-Square Test – Test for Independence of Attributes and Goodness of Fit – F- test for Equality of Two Variances.				
Unit - V				
ANOVA, CRD AND RBD – Assumptions – Layout and analysis of One way and Two way Classifications (No Derivations) – Layout and analysis of Completely Randomized Design (CRD) - Randomized Block Design (RBD) - Simple Problems.				

PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Classroom Discussion • Questioning • Seminar • Assignment • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	Gupta, S.C. and Kapoor, V.K. (2017). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11 th revised Edition.
2	Pannerselvam R (2012). Design and Analysis of Experiments – Prentice Hall of India.
FURTHER READING:	
1	Gupta, S.P. (2014). Statistical Methods, Sultan Chand & Sons, New Delhi, 44 th Thoroughly Revised Edition.
2	Gupta S.C. and Kapoor V.K. (2019). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi 4th Thoroughly Revised Edition.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/110/105/110105087/
2	https://nptel.ac.in/courses/102/106/102106051/
3	https://nptel.ac.in/courses/102/101/102101056/
4	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-mg23/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓		✓	✓	✓	✓	✓
	3	Critical Thinking	✓	✓	✓	✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓		✓	✓	✓	✓	✓
	6	Problem Solving	✓		✓	✓	✓	✓	✓
	7	Team Work	✓		✓	✓	✓	✓	
	8	Moral and Ethical Awareness	✓		✓	✓	✓	✓	✓
	9	Multicultural Competence	✓		✓	✓	✓	✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	II	23BIT25A	I BSc., (IT) - Allied II: COMPUTER ORIENTED NUMERICAL & STATISTICAL METHODS	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Apply numerical methods to solve system of simultaneous equations and analyze and evaluate the accuracy of common numerical methods			
2	Solve Numerical Differentiation and Central difference problems using Newton Forward Difference and Backward Difference			
3	Solve Numerical Integration and differentiation problems using Newton Forward Difference and Backward Difference, Trapezoidal Rule, Simpson Rule $1/3^{\text{rd}}$, $3/8^{\text{th}}$ rules and Weddle's rule			
4	Calculate and apply measures of central tendency and measures of dispersion – grouped data cases			
5	Calculate and apply measures of central tendency and measures of dispersion –ungrouped data cases			
6	Compute and interpret the results of Skewness and Correlation Analysis			
7	Demonstrates and understands Linear Regression and Curve fitting			
Unit - I				
Numerical Methods - System of Simultaneous Equations - Gauss Elimination- Gauss Seidal Methods – Interpolation - Newton's Forward and Backward Interpolation Formula - Lagrange's Interpolation - Central difference interpolation formulae: Gauss forward and backward formula - (No Derivations) Simple Problems Only.				
Unit - II				
Numerical Differentiation - Newton Forward Difference - Newton Backward Difference - Numerical Integration - Trapezoidal Rule - Simpson's $1/3^{\text{rd}}$ Rule - Simpson's $3/8^{\text{th}}$ Rule and Weddle's Rule (No Derivations) - Simple Problems Only.				
Unit – III				
Measures of Central Tendency – Mean -Median and Mode - Relationship among Mean, Median and Mode – Uses - Merits and Demerits Measures of Dispersion - Range - Quartile Deviation - Mean Deviation - Standard Deviation and Coefficient of Variation.				
Unit – IV				

Skewness and Kurtosis - Meaning - Bowley's and Karl Pearson's Coefficient of Skewness - Concept of Kurtosis.	
Correlation - Definition - Scatter Diagram - Types of Correlation - Karl Pearson Correlation Coefficient – Spearman's Rank Correlation Coefficient.	
Unit - V	
Regression Analysis - Definition - Regression Equations for Two Variables - Regression Coefficients - Properties - Curve Fitting - Linear - Simple Problems.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	P. Kandasamy, K. Thilagavathy and K. Gunavathi - Numerical Methods, S. Chand & Company Ltd, New Delhi.
2	S.C. Gupta and V.K. Kapoor (2012). Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi, 11 th revised Edition.
FURTHER READING:	
1	E. Balagurusamy - Numerical Methods, Tata MC Grawhill Pvt ltd.
2	S.P. Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
3	R.S.N. Pillai and V. Bagavathi (1999). Statistics – Theory and Practice, S. Chand & Sons Company Ltd, New Delhi.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.classcentral.com/course/intro-to-numerical-analysis-13684
2	https://nptel.ac.in/courses/111/105/111105041/
3	https://nptel.ac.in/courses/111/106/111106112/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓			✓		✓	✓
	3	Critical Thinking	✓			✓		✓	
	4	Research related Skills				✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work	✓	✓	✓			✓	✓
	8	Moral and Ethical Awareness		✓	✓	✓	✓	✓	
	9	Multicultural Competence				✓	✓	✓	

Year	Sem.	Subject Code	Title of the Paper	Hours / Week
2023-24 onwards	II	23BBA25A	I BBA – Allied II: STATISTICS FOR MANAGEMENT- II	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1.	Explain the scope and necessity of Operations Research			
2.	Identify the nature of data observed			
3.	Discuss the various techniques available in OR			
4.	Choose the suitable Technique according to the nature of the observed data			
5.	Apply the formula and arrive the relevant results related to the observed data in their field			
6.	Validate the relevance of the technique applied			
7.	Interpret the results arrived using the OR techniques			
Unit – I				
Operations Research – Introduction – Meaning – Scope. Linear Programming Problem – Definition – Assumptions – General Form – Advantages and Limitations of LPP – Mathematical Formulation – Graphical Method.				
Unit – II				
Transportation Problem – Definition – Balanced and Unbalanced Problems – Initial Basic Feasible Solution (IBFS) – Methods of Finding IBFS – North-West Corner Rule – Least Cost Method and Vogel’s Approximation Method (VAM). Assignment Problem – Definition – Hungarian Method of Solving – Simple Problems.				
Unit – III				
Game Theory – Concept and Definition of a Game – Pure and Mixed Strategies – Saddle Point – Value of a Game – Algebraic Method – Dominance Rule. Queuing Theory – Concept – Uses – Queuing System – Characteristics of a Queuing System – (M/M/1):(∞/FIFO) Model – Simple Problems.				
Unit – IV				
Network Analysis – Basic Concepts – Rules of Network Construction – Types of Floats – Earliest Start Time – Earliest Finish Time – Latest Start Time – Latest Finish Time – Duration of Critical Path – Critical Path Method – PERT Method – Probability Considerations.				
Unit – V				
Replacement Problem – Definition – Concept and Types of Replacement – Replacement of items that Deteriorates Gradually – Replacement of items that Fails Suddenly – Simple Problems.				

PEDAGOGY STRATEGIES	
	<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback
References:	
1.	Kanti Swarup, Gupta P.K. and Man Mohan. (2017). Operations Research, Nineteenth Edition, Sultan Chand & Sons, New Delhi.
2.	V. Sundaresan, K.S. Ganapathy Subramanian and K. Ganesan (2000). Resource Management Techniques, A.R. Publications, Tamil Nadu.
Further Reading:	
1.	J.K. Sharma (2007). Operations Research -Theory & Applications, Macmillan India Ltd, Third Edition.
2.	Sharma S. D. (2017). Operations Research: Theory, Methods and Applications, Kedar Nath, Ram Nath and Co, Meerut.
3.	Taha H. A. (1982). Operations Research: An Introduction, Third Edition, McMillan Publishing Co., Inc., London.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1.	https://nptel.ac.in/courses/111/107/111107128/
2.	https://nptel.ac.in/courses/112/106/112106134/
3.	https://onlinecourses.swayam2.ac.in/cec20_ma10/preview

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	
	2	Communication Skills	✓	✓	✓	✓	✓	✓	
	3	Critical Thinking			✓	✓	✓	✓	
	4	Research related Skills	✓	✓				✓	✓
	5	Analytical Reasoning			✓	✓	✓	✓	✓
	6	Problem Solving			✓	✓	✓	✓	✓
	7	Team Work	✓	✓		✓	✓	✓	✓
	8	Moral and Ethical Awareness	✓	✓				✓	✓
	9	Multicultural Competence	✓	✓				✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 Onwards	III	23BPS34A	II B.Sc., Psychology –Allied III: STATISTICS – I	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1	Discuss the importance of Statistics and Scope in Psychology			
2	Draw Diagrams, Graphs and compute averages for the collected data			
3	Calculate the Measures of Dispersion and Skewness			
4	Explain the concept of Correlation and its practical applications			
5	Describe the theorems in probability, compute and solve the problems in probability			
6	Analyze the nature of data and interpret the measures			
7	Describe the concepts of probability and find solutions in real life situations			
UNIT - I				
Statistics - Definition - Scope – limitations - uses - Importance of Statistics in Psychology - Collection of Data - Primary and Secondary - Classification and Tabulation - Formation of Frequency Distribution.				
UNIT - II				
Diagrammatic and Graphical Representation - Simple, Multiple, Sub-Divided, Percentage Bar Diagrams and Pie Diagram - Histogram, Frequency Polygon, Frequency Curve and Ogives. Measures of Central Tendency - Mean, Median, Mode, Geometric Mean and Harmonic Mean.				
UNIT - III				
Measures of Dispersion – Range, Quartile Deviation, Mean Deviation (about Mean), Standard Deviation and Co-efficient of Variation – Concept of Skewness – Karl Pearson’s and Bowley’s Coefficient of Skewness – Simple Problems				
UNIT - IV				
Correlation – Definition, Types of correlation, Scatter Diagram –Measures of Correlations Karl-Pearson’s Coefficient of Correlation – Spearman’s Rank Correlation. Regression Analysis - Definition – Properties of Regression Coefficients – Simple Problems.				
UNIT - V				
Probability - Concept of Probability – Basic Definitions – Mathematical and Statistical Approach – Addition and Multiplication Theorems of Probability (Without Proof) – Simple Problems.				
<ul style="list-style-type: none"> ● PEDAGOGY STRATERGIES: ● Lecturing ● Assignment ● Classroom Discussion ● Questioning 				

<ul style="list-style-type: none"> • Seminar • Class Test • Quiz & Drill Practice • Providing Feedback 	
REFERENCES:	
1	R.S.N. Pillai and V. Bagavathi (1999). Statistics – Sultan Chand & Sons Company Ltd, New Delhi.
2	S.P. Gupta (2012). Statistical Methods, Sultan Chand & Sons, New Delhi, 42 nd revised Edition.
3	J.P. Verma and Mohammed Ghufuran. Statistics for Psychology, Tata Mcgraw Hill Education (P) Ltd. New Delhi.
FURTHER READING:	
1	Henry E. Garrett (2007). Statistics in Psychology and Education, Paragon International Publishers, Twelfth Indian Reprint.
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://cs.ioc.ee/ITKStat/files/1_intro .
2	https://labs.la.utexas.edu/gilden/files/2016/05/Statistics
3	https://numeros.files.wordpress.com/2012/04/research-methods-and-statistics-in-psychology

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking				✓	✓	✓	✓
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work			✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness			✓	✓	✓	✓	
	9	Multicultural Competence			✓	✓	✓	✓	

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023-2024 onwards	III	23BCA36A	II BCom (CA) - Allied III : STATISTICS FOR BUSINESS	4
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Deal with numerical and quantitative issues in business			
2	Enable the use of statistical, graphical and algebraic techniques wherever relevant			
3	Produce numerical descriptive statistics for different types of data			
4	Use simple correlation and simple regression models to analyse the underlying relationships between the variables			
5	Apply index number rules and construct index number relating to Weighted and Un-weighted Methods answer questions within a business context			
6	Demonstrate knowledge of the importance of the tests of index number and its applications			
7	Conduct and interpret a variety time series method to aid decision making in a business context			
Unit - I				
Introduction to Statistics: Meaning and Definition - Primary and Secondary Data - Sources of Data – Methods of Collecting Data - Classification and Tabulation of Data – Diagrammatic Representation - Bar Diagrams – Pie Diagram – Graphical Representation - Histogram – Frequency Curve and Ogives.				
Unit - II				
Measures of Central Tendency: Meaning – Definition – Arithmetic Mean – Median - Mode – Simple Problems..				
Measures of Dispersion: Meaning - Definition – Absolute and relative measures - Range - Quartile Deviation- Mean Deviation- Standard Deviation – Co-efficient of variation - Simple Problems.				
Unit – III				
Correlation and Regression: Meaning – Definition – Scatter diagram - Karl Pearson’s Co-efficient of Correlation - Spearman’s Rank Correlation – Meaning and uses of Regression – Regression Equations – Simple Problems.				
Unit – IV				
Index Numbers: Concept – Definition – Methods of construction of Index number– Weighted and Un-weighted Methods –Time Reversal and Factor Reversal Tests - Cost of Living Index Number - Construction of Cost of Living Index using Family Budget Method – Aggregate Expenditure Method.				

Unit - V	
Time Series Analysis: Time Series – Concept and Components – Estimation of Trend: Methods of Moving Averages - Method of Least squares (Linear only). Measurement of Seasonal Variation: Method of Simple Averages.	
<p>PEDAGOGY STRATEGIES</p> <ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	Gupta S.P. (2012). Statistical Methods, Sultan Chand & Sons, New Delhi.
2	Goon A.M., Gupta M.K., and Das Gupta B. (2013). Fundamentals of Statistics, Vol.1, World Press Private Ltd, Calcutta.
FURTHER READING:	
1	Vittal P.R. (2012). Business Mathematics and Statistics, Margham Publications, Chennai.
2	Navneetham P.A, (2008). Business Mathematics & Statistics, Jai Publishers, Trichy.
3	Aczel A.D. et al., (2012). Complete Business Statistics, Tata McGraw Hill Education Private Limited, New Delhi.
RELATED ONLINE CONTENTS	
1	https://nptel.ac.in/courses/111/105/111105041/
2	https://nptel.ac.in/courses/111/106/111106112/
3	www.edx.org › learn › statistics

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓		✓		✓	✓
	3	Critical Thinking			✓	✓	✓		✓
	4	Research related Skills			✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓	✓	✓	✓	✓	✓	✓
	6	Problem Solving	✓	✓	✓	✓	✓	✓	✓
	7	Team Work		✓	✓		✓		✓
	8	Moral and Ethical Awareness			✓	✓	✓		✓
	9	Multicultural Competence			✓	✓	✓		✓

Year	Sem.	Subject Code	Title of the Paper	Hours/Week
2023 – 2024 Onwards	IV	23BPS44A	II B.Sc., Psychology – Allied IV : STATISTICS – II	6
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, student will be able to:				
1	Discuss the importance of Discrete and Continuous distributions			
2	Explain the methods of sampling with its Advantages and Disadvantages			
3	Apply the Small sample tests, Chi-Square test and Association of Attributes in Psychological testing problems			
4	Explain the types of Measurement and scaling techniques			
5	Describe Non-Parametric tests based on one sample and two sample tests			
6	Compute the parameters of Discrete and Continuous distributions			
7	Analyze the different types of data in Statistical Inference			
UNIT - I				
Probability Distribution – Binomial, Poisson and Normal Distributions – Definitions, Properties and Applications (without Proof) – Simple Problems.				
UNIT - II				
Sampling Methods – Advantages and Disadvantages – Simple Random Sampling – Stratified Random Sampling – Systematic Sampling – (Concept Only) – Sampling Distribution – Standard Error. Tests of Significance – Types of Errors - LOS – Large Sample Tests for Single Mean and Two Means. Tests for single proportion and difference of two proportions.				
UNIT - III				
Small Sample Tests – Test for Single Mean and Two Means – Paired ‘t’ Test. Chi-Square Test - Independence of Attributes- Goodness of fit – Contingency Tables – Theory of Association of Attributes – Yule’s Coefficient of Association				
UNIT - IV				
Measurement and Scaling techniques- Categorical Variables - Data Types - Metric, Interval and Ratio data. Non-Metric data- Nominal, ordinal data. Scales of measurement -Comparative scale, paired Comparison scale, rank order scale, constant sum scale, Non-comparative scale- continuous rating scale, Itemized rating scale - Likert scale, Guttman scale				
UNIT - V				
Non – Parametric Tests – Introduction, Definition, advantages and disadvantages. Run test, Sign test, Median test, Mann-Whitney U test (one sample only) Kolmogorov - Smirnov test (two samples).				

PEDAGOGY STRATERGIES:	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing Feedback 	
REFERENCES:	
1	R.S.N. Pillai and V. Bagavathi (1999). Statistics – Theory and Practice, S. Chand & Sons Company Ltd, New Delhi.
2	S.C. Gupta and V.K. Kapoor(2012). Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi, 11 th revised Edition.
3	J.P Verma and Mohammed Ghufuran. Statistics for Psychology, Tata Mcgraw Hill Education (P)Ltd. New Delhi.
FURTHER READING:	
1	Henry E. Garrett (2007). Statistics in Psychology and Education, Paragon International Publishers, Twelfth Indian Reprint.
2	Hogg, R.V and Craig, A.G. Introduction to Mathematical Statistics
RELATED ONLINE CONTENTS [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.google.com/search?q=probability+distribution+ppt&rlz
2	https://math.ucdenver.edu/~ssantori/MATH2830SP13/Math2830-Chapter-08
3	https://www.cse.iitk.ac.in/users/nsrivast/HCC/lec07-09.pdf
4	http://www2.univet.hu/users/jfodor/biomath/Biomath12

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓	✓	✓	✓
	3	Critical Thinking	✓		✓	✓	✓		
	4	Research related Skills	✓	✓	✓	✓	✓	✓	✓
	5	Analytical Reasoning	✓		✓	✓		✓	✓
	6	Problem Solving	✓		✓	✓	✓	✓	✓
	7	Team Work	✓		✓	✓	✓		
	8	Moral and Ethical Awareness					✓	✓	✓
	9	Multicultural Competence				✓	✓	✓	✓

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2023-2024 onwards	IV	23BCO45A/ 23BIB46A	II BCOM & II BCOM (IB) - Allied IV: BUSINESS STATISTICS	4
COURSE LEVEL OUTCOMES:				
On the successful completion of the course, students will be able to:				
1	Differentiate numerical and quantitative issues in business			
2	Use the statistical, graphical and algebraic techniques wherever relevant			
3	Create numerical descriptive statistics for different types of data			
4	Use simple correlation and regression to analyse the relationships between the variables			
5	Apply index number rules and construct index number relating to Weighted and Un-weighted methods			
6	Demonstrate the importance and applications of the tests of index numbers			
7	Conduct and interpret the variety of time series methods in decision making problems			
Unit - I				
Introduction to Statistics: Meaning and Definition - Primary and Secondary Data - Sources of Data – Methods of Collecting Data - Classification and Tabulation of Data – Diagrammatic Representation - Bar Diagrams – Pie Diagram – Graphical Representation - Histogram – Frequency Curve and Ogives.				
Unit - II				
Measures of Central Tendency: Meaning – Definition – Arithmetic Mean – Median - Mode – Simple Problems..				
Measures of Dispersion: Meaning - Definition – Absolute and relative measures - Range - Quartile Deviation- Mean Deviation- Standard Deviation – Co-efficient of variation - Simple Problems.				
Unit – III				
Correlation and Regression: Meaning – Definition – Scatter diagram - Karl Pearson’s Co-efficient of Correlation - Spearman’s Rank Correlation – Meaning and uses of Regression – Regression Equations – Simple Problems.				
Unit – IV				
Index Numbers: Concept – Definition – Methods of construction of Index number– Weighted and Un-weighted Methods –Time Reversal and Factor Reversal Tests - Cost of Living Index Number - Construction of Cost of Living Index using Family Budget Method – Aggregate Expenditure Method.				

Unit - V	
Time Series Analysis: Time Series – Concept and Components – Estimation of Trend: Methods of Moving Averages - Method of Least squares (Linear only). Measurement of Seasonal Variation: Method of Simple Averages.	
PEDAGOGY STRATEGIES	
<ul style="list-style-type: none"> • Lecturing • Assignment • Classroom Discussion • Questioning • Seminar • Class Test • Quiz & Drill Practice • Providing feedback 	
REFERENCES:	
1	Gupta, S. P. (2012). Statistical Methods, Sultan Chand & Sons, New Delhi.
2	Goon, A.M, Gupta M.K. and Das Gupta B. (2013). Fundamentals of Statistics, Vol.1, World Press Private Ltd, Calcutta.
FURTHER READING:	
1	Vittal P.R. (2012). Business Mathematics and Statistics, Margham Publications, Chennai.
2	Navaneetham P.A. (2008). Business Mathematics & Statistics, Jai Publishers, Trichy.
3	Aczel A.D, et al., (2012). Complete Business Statistics, Tata McGraw Hill Education Private Limited, New Delhi.
RELATED ONLINE CONTENTS	
1	https://nptel.ac.in/courses/111/105/111105041/
2	https://nptel.ac.in/courses/111/106/111106112/
3	www.edx.org › learn › statistics

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)						
			1	2	3	4	5	6	7
Program Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓	✓	✓
	2	Communication Skills	✓	✓	✓	✓			✓
	3	Critical Thinking			✓	✓	✓		
	4	Research related Skills			✓	✓	✓	✓	✓
	5	Analytical Reasoning			✓	✓	✓	✓	✓
	6	Problem Solving			✓	✓	✓	✓	✓
	7	Team Work			✓	✓	✓	✓	✓
	8	Moral and Ethical Awareness					✓	✓	✓
	9	Multicultural Competence			✓	✓	✓		