P.G. AND RESEARCH DEPARTMENT OF STATISTICS

PERIYAR E.V.R. COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI – 620 023.

SYLLABI

B.Sc. STATISTICS

MCBCS

(From 2015 onwards)

Question Paper Pattern

(For Part I, II, III and IV)

For all Language, Core and Allied courses .

Section - A (10 x 2 = 20 Marks)
Answer ALL the questions

Two questions are compulsory from each unit of the syllabus.

Section - B (5 x 5 = 25 Marks)
Answer ALL the questions

Five questions in either or pattern with internal choice covering all the five units of the syllabus

Section - C (3 x 10 = 30 Marks)
Answer any THREE questions

Three out of Five questions covering all the five units of the syllabus

Part - IV - NME, SBE, Environmental Science and Value Education

Part - V - Gender Equality.

Five out of Eight questions covering all the five units of the syllabus.

(5 x 15 : 75 marks)

MCBCS – COURSE STRUCTURE B.Sc. STATISTICS (2015 – 2016)

Sl. No.	COURSE TITLE			Hrs.	Credits	Internal Exam	External Exam
I - SEMESTER							
1	P - I	TAMIL - I		6	3	25	75
2	P - II	ENGLISH - I		6	3	25	75
3	P - III	CORE - I	DESCRIPTIVE STATISTICS	6	5	25	75
		CORE - P II	PRACTICAL-I (Non-Sitting)	2	-	-	-
4		ALLIED - I	MATHEMATICS - I	4	4	25	75
		ALLIED - P II	MATHEMATICS – II (Non-Sitting)	2	-	-	-
5	P - II	VE	VALUE EDUCATION	2	2	25	75
6		SBE - I	STATISTICAL SURVEY	2	4	25	75
			TOTAL	**30**	**21**	**150**	**450**
II - SEMESTER							
7	P - I	TAMIL - II		6	3	25	75
8	P - II	ENGLISH - II		6	3	25	75
9	P - III	CORE - III	THEORY OF PROBABILITY	6	4	25	75
10		CORE - P II	PRACTICAL	4	4	25	75
11		ALLIED - P II	MATHEMATICS - II	2	3	25	75
12		ALLIED III	MATHEMATICS - III	4	4	25	75
13	P - IV	ES	ENVIRONMENTAL SCIENCE	2	2	25	75
			TOTAL	**30**	**23**	**175**	**525**
III - SEMESTER							
14	P - I	TAMIL III		6	3	25	75
15	P - II	ENGLISH III		6	3	25	75
16	P - III	CORE IV	THEORETICAL DISCRETE DISTRIBUTIONS	4	4	25	75
		CORE - P V	COMPUTER LAB FOR DATA ANALYSIS USING MS-OFFICE (Non-Sitting)	2	-	-	-
17		ALLIED IV	PROGRAMMING IN C	4	3	25	75
		ALLIED - P V	COMPUTER LAB FOR C (Non-Sitting)	2	-	-	-
18		ME - I	NUMERICAL ANALYSIS	4	5	25	75
19	P - IV	SBE - II	BIO-STATISTICS	2	4	25	75
			TOTAL	**30**	**22**	**150**	**450**

IV - SEMESTER							
20	P - I	TAMIL - IV		6	3	25	75
21	P - II	ENGLISH -IV		6	3	25	75
22	P - III	CORE - VI	THEORETICAL CONTINUOUS DISTRIBUTIONS	6	4	25	75
23		CORE - P V	COMPUTER LAB FOR DATA ANALYSIS USING MS-OFFICE	4	4	25	75
24		ALLIED - P V	COMPUTER LAB FOR C	2	3	25	75
25		ALLIED - VI	STATISTICAL SOFTWARE PACKAGES	4	3	25	75
26	P - IV	NME - I	ELEMENTS OF STATISTICS	2	2	25	75
			TOTAL	**30**	**22**	**175**	**525**
V - SEMESTER							
27	P - III	CORE - VII	APPLIED STATISTICS	6	5	25	75
28		CORE - VIII	STATISTICAL INFERENCE - I	6	5	25	75
29		CORE - IX	DESIGN OF EXPERIMENTS	6	4	25	75
30		CORE - P X	PRACTICAL-(BASED ON CORE VII AND CORE IX)	4	4	25	75
31		ME - II	ACTUARIAL STATISTICS	5	5	25	75
32	P - IV	NME - II	SAMPLING THEORY AND QUALITY ENHANCEMENT	2	2	25	75
33	P - V	EA	EXTENSION ACTIVITIES	1	1	25	75
			TOTAL	**30**	**26**	**175**	**525**
VI - SEMESTER							
34	P - III	CORE - XI	SAMPLING THEORY	6	5	25	75
35		CORE - XII	STATISTICAL INFERENCE - II	6	4	25	75
36		CORE - XIII	OPERATIONS RESEARCH	5	4	25	75
37		CORE - P XIV	PRACTICAL – (BASED ON CORE XI CORE XII)	5	4	25	75
38		ME - III	STATISTICAL QUALITY CONTROL	5	4	25	75
39	P - IV	SBE - III	OFFICIAL STATISTICS	2	4	25	75
40	P - V	GE	GENDER EQUALITY	1	1	25	75
			TOTAL	**30**	**26**	**175**	**525**
			GRAND TOTAL	**180**	**140**	**1000**	**3000**

CORE – I

DESCRIPTIVE STATISTICS

Semester – I **Hours : 6**

Code: **Credits : 5**

Objective: To give a clear idea to the under graduate Statistics Students about the basics of statistics

Unit - I

Meaning and definition of Statistics, importance and scope of statistics, functions of statistics and limitations of statistics.

Unit - II

Diagrammatic representations of data - Bar diagrams - simple, component, multiple and percentage. Pie diagram. Graphical representations - Histogram, Frequency curve, frequency polygon and Ogives (Construction and uses).

Unit –III

Measures of Central Tendency – Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean - derivation of their properties, Merits and Demerits and problems.

Unit - IV

Measures of Dispersion - Range, Quartile deviation. Mean Deviation, Standard Deviation and Coefficient of variation. Skewness - concept, Measures of Skewness – Karl Pearson's and Bowley's coefficient of skewness. Moments – Raw and Central. Kurtosis - Concept and measures. Problems.

Unit - V

Correlation - Definitions, Types and Properties of correlation coefficient (statement and proof). Scatter diagrams, Karl Pearsons's Co-efficient of Correlation and Spearman's Rank Correlation. Regression lines and its properties, uses and problems.

Text Book:

Gupa S,C and Kapoor V.K (2013), Fundamental of Mathematical Statistics. - Sultan Chand & Sons, New Delhi.

Book for Reference:

Gupta S.B (1995), Statistical Methods, Sultan Chand & Sons, New Delhi.

CORE – P II

PRACTICAL

Semester – I & II (Non-Sitting) **Hours : 6**

Code: **Credits : 4**

Objective: To impart to the students computational skills

Unit – I

Measures of Central Tendency - Calculation of Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean for Raw and Grouped Data.

Unit – II

Measures of Dispersion – Calculation of Quartile Deviation, Mean Deviation, Standard Deviation and their co–efficients. Measures of Skewness - Calculation of Karl Pearson's and Bowley's Co – efficient of Skewness.

Unit –III

Calculation of Karl Person's co – efficient of correlation and Spearman's Rank Correlation co – efficient. Finding the two Regression Equations X on Y and Y on X and estimating unknown values of X and Y.

Unit – IV

Discrete and continuous random variables – Finding Probabilities, Distribution functions and moments.

Unit –V

Bivariate Distributions (Discrete Random Variables) – Finding Marginal Distributions, Conditional Distributions. Expectation of random variables,Conditional expectation, moments and correlation.

Text Books:

Gupta.S.C. and Kapoor.V.K(2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Book for Reference:

Gupta.S.P, Statistical Methods, Sultan Chand & Sons, New Delhi.

SKILL BASED ELECTIVE - I

STATISTICAL SURVEY

Semester - I **Hours : 2**

Code: **Credits : 4**

Objective: To give a practical knowledge as to how to organize a statistical survey

Unit - I

Organizing a statistical survey- Planning the survey, Executing the survey - Drafting an effective questionnaire, difference between questionnaire and schedule.

Unit - II

Sampling - Census and Sample method. Sampling and Non-sampling errors.

Unit - III

Collection of data - Primary data - methods of collecting primary data. Internet Survey and Telephone Survey. Secondary data - methods of collecting secondary data and precautions while using secondary data.

Unit - IV

Classification of data – Types of Classification - Chronological classification, Geographical classification, Quantitative classification and Qualitative classification. Formation of discrete frequency distribution and Formation of continuous frequency distribution.

Unit - V

Tabulation of data - Parts of a table and general rules of tabulation. Types of tables - simple and complex table, Machine tabulation and Cross tabulation – Practical Survey and Report Writing.

Text Book:

Gupta. S.P, Statistical Methods , Sultan Chand & Sons, New Delhi.

CORE – III

THEORY OF PROBABILITY

Semester - II **Hours : 6**

Code : **Credits : 4**

Objective : To develop the knowledge about the probability theory and its application

Unit – I

Random experiment, sample space, events, operations on events. Classical and Statistical Probability, Axiomatic approach to probability. Basic theorems on probabilities of events - simple problems.

Unit – II

Addition theorem of Probability (for two and n-events). **C**onditional Probability - Independence of events and Multiplication theorem. Baye's theorem(with proof) and its applications.

Unit – III

Definition of discrete and continuous random variables – probability mass function, distribution functions and probability density function and their properties - simple problems.

Unit – IV

Bivariate distributions – discrete and continuous, cumulative distributiuon functions, joint probability mass function, joint probability density function, marginal and conditional probability functions - simple problems.

Unit – V

Expectation of random variables – addition and multiplication theorem of expectations (Discrete and Continuous), Conditional expectation and Conditional variance - simple problems.

Text Books :

Gupta. S. C. and Kapoor. V.K. (2013), Fundamentals of Mathematical Statistics.

Books for Reference:

1. Kapur. J.N. and Saxena. H.C. (1989), Mathematical Statistics.
2. John E.Freund(1971), Mathematical Statistics.

CORE – IV

THEORETICAL DISCRETE DISRIBUTIONS

Semester - III **Hours : 4**

Code : **Credits : 4**

Objective : To impart knowledge about discrete distributions to the undergraduate students.

Unit - I

Discrete distribution: Binomial distribution – Definition, Concept and Derivation of Moments, Moment Generating Function, Additive property, Characteristic function and Recurrence relation for moments – Simple problems.

Unit -II

Poisson Distribution - Definition, Concept, Derivation of Moments, Moment Generating Function, Recurrence relation for moments and Poisson Distribution as a Limiting case of Binomial Distribution – Simple problems.

Unit - III

Negative Binomial Distribution – Definition, Derivation of Constants and Poisson distribution as a limiting case of the Negative Binomial distribution.

Unit - IV

Geometric distribution – Definition, Moments, Derivation of Moment Generating Function and Lack of memory property.

Unit -V

Hyper Geometric distribution - Definition, Derivation of Mean and Variance, approximation to Binomial distribution and Recurrence relation. Definition of Power series distribution.

Text Book:

Gupta. S,C and Kapoor V.K (2013), Fundamentals of Mathematical Statistics.

Book for Reference:

Johnson and Kotz, Discrete distributions, John Wiley Publications, New York.

Core –P V

COMPUTER LAB FOR DATA ANALYSIS USING MS-OFFICE

Semester – III & IV (Non-Sitting) **Hours : 6**

Code: **Credits: 4**

Objective : To equip the students with the knowledge of MS-Office package and to compute the various statistical measures using computers.

Unit – I

Introduction to work processing, Applying basic formatting, Adding a table to document, Designing and reviewing a word document, Page margins, page orientation and page breaks. Spelling and grammar checks.

Unit – II

Introduction to MS-EXCEL, Applying basic formatting, Creating a table, Adding rows, coloumns of a table, Designing a table.

Unit - III

Diagrammatic Representation of Data - Simple bar diagram, Sub-divided bar diagram, Multiple bar diagram and Percentage bar diagram. Graphical representation of data – Histogram.

Measures of central tendency - Arithmetic Mean, Median, Mode, Geometric mean and Harmonic mean.

Unit - IV

Measures of dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Co-efficient of Variation. Measure of Skewness: Karl-Pearson's Co.efficient of Skewness.

Unit - V

Correlation Analysis: Scatter diagram, Karl-Pearson's Co.efficient of Correlation, Spearman's Co-efficient of Correlation.

Text books:

1. Office 2010 in simple steps, Kogent solutions Team, DreamTech, 2010.
2. Statistics made simple, K.V.S.Sharma, PHI, 2006

Books for reference:

1. Carry N. Prague and Michael R.Irwin(1997): Access for Windows 95 Bible,Edition .
2. Katherine Murray. Mastering Power Point
3. John Walkenbach. Excel for Windows 95 Bible

ALLIED - IV
PROGRAMMING IN C

Semester - III **Hours : 4**

Code: **Credits : 3**

Objective : To introduce the C- language and programming skills for statistical concepts.

Unit - 1

Introduction to C - Character set - Key words and identifiers -Data types- Constants & Variables and their declarations – Operators: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators- Expressions: Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators.

Unit - II

Input & output operations – Reading a Character, Writing a character – Formatted Input: Inputting Integer Numbers, Inputting Real Numbers, Inputting Character Strings-Formatted Output: Output of Integer Numbers, Output of Real Numbers – Printing of a Single Character and Printing of Strings.

Unit - III

Decision making and branching: Decision Making with IF Statement, Simple IF statement , IF-ELSE statement – Nesting of IF-ELSE statements, the ELSE-IF ladder, The Switch Statement, The ?: Operator, The GOTO Statement.

Unit – IV

Decision making and looping: The WHILE statement , the DO statement, the FOR statement – Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Two-dimensional Arrays, Initializing Two-dimensional Arrays. Character Arrays and Strings: Declaring and Initializing string Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, Putting Strings Together, Comparison of Two Strings.

Unit – V

User-defined Functions: Introduction, Elements of User-defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions, Arguments with Return Values, Nesting of Functions, Recursion, Passing Arrays to Functions. Structures and Unions

Text Book :

Balagurusamy, E,"Programming in ANSI-C", (Fourth Edition), Tata Mc Graw Hill publishing Company. New Delhi

Book for Reference:

Byrons Gottfried , "Theory and Practice of programming with C", Schaum Outline Series, McGraw Hill publishing company.

ALLIED – P V

COMPUTER LAB FOR C

Semester – III & IV (Non-Sitting) **Hours : 4**

Code: **Credits : 3**

Objective : To write programs of various statistical measures in the C Programming language.

Unit - I

Program for arranging a given set of n numbers in ascending order, descending order, finding the smallest value of given n-values, finding the largest value given n-values, finding n-factorial, finding ${}^{N}C_{r}$ value and solving Quadratic equations.

Unit - II

Program to find the value of Range and Co-efficient of Range of 'n' given values, Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic Mean,

Unit - III

Standard deviation, Co-efficient of Standard deviation, Variance and Co-efficient of Variation.

Unit - IV

Program to find correlation co-efficient, Regression co-efficients, Regression equations.

Unit - V

Fitting of Binomial and Poisson distributions. Program to check for Palindrome and Amstrong number.

Text Book :

Balagurusamy, E,"Programming in ANSI-C", (Fourth Edition), Tata Mc Graw Hill publishing Company. New Delhi

Book for Reference:

Byrons Gottfried , "Theory and Practice of programming with C", Schaum Outline Series, McGraw Hill publishing company.

MAJOR ELECTIVE - I

NUMERICAL ANALYSIS

Semester - III **Hours : 4**

Code : **Credits : 5**

Objective: To enable the students to have knowledge about interpolation, Numerical differentiation and Integration and to enhance the numerical skills.

Unit -I

Finite differences – Introduction, Properties of operators E and Δ - one or more missing values, Newton's Forward, Backward (for equal intervals) and Lagrange's Formulae.

Unit –II

Central differences interpolation formulae - Gauss forward, Gauss Backward and Stirlings formulae (Numerical problems only)

Unit - III

Numerical differentiation by Newton's Forward and Newton's Backward formulae (upto 2^{nd} order) .

Unit -IV

Numerical Integration- Trapezoidal Rule, Simpson's $1/3^{rd}$ Rule, Simpson's $3/8^{th}$ Rule and Weddle's rules. (numerical problems only)

Unit -V

Numerical Solution of ordinary differential equations - Taylor series method, Euler's Method and Second order Runge-Kutta Method (Numerical Problems only)

Text Books:

1. S.S. Sastry(2000), Introduction methods of numerical Analysis, Prentice –Hall of India Pvt-India III Editions.
2. P.Kandasamy, K.Thilagavathy, and K.Gunavathy (2005), Numerical Methods

Book for Reference:

E.Balagusamy (2004), Numerical Methods, Tata McGraw Hill Publishing Company Limited, New Delhi.

SKILL BASED ELECTIVE - II

BIO-STATISTICS

Semester – III **Hours : 2**

Code : **Credits : 4**

Objective : To impart knowledge on applications of Statistics in medical field.

Unit - I

Scope of Statistical methods in medicine, Role of Statistics in clinical medicine, Areas of application of Statistics, Role of Statistics in preventive medicine and Areas of application. Observations in medicine: Qualitative and Quantitative observation – Scale of measurement.

Unit - II

Health Statistics: Utilization of the basic data, Sources of Health Statistics, Problems in the Collection of sickness data and Measurement of sickness - Hospital Statistics – International classification of diseases: General Principles and Numbering system of the classification problems in applications of ICD.

Unit - III

Probability – Measurement of Probability – Laws of probability for independent events: Addition law, multiplication law – Conditional probability – Bayes theorem (statement only) – Application of Baye's theorem in determining diagnostic efficacy – Sensitivity, Specificity, False Negative Rate, False Positive Rate, Predictive value positive, Predictive value negative.

Unit - IV

Biological Assay: Direct assays, Indirect Assays – Sequential medical Trials – Special features – Scope – Steps involved

Unit - V

Clinical trials – Types of Clinical trials, Therapetic trials, Design and Random Allocation, Mode of Administration of Therapy, Observations and Records – Deviations from Design, Prophylactic trials, Ethical considerations and Community trials.

Text Book:

P.S.S. Sundar Rao and J. Richard (2006), Introduction to Biostatistics and Research Methods, Fourth Edition, Prentice – Hall of India Private Limited, New Delhi – 1.

Book for Reference:

1. Arora, P.N & Malham, P.K.(1998), Bio-Statistics, Himalaya Publishing House, Mumbai.
2. Wayne W.Daniel (2013), BIO-STATISTICS, Basic Concepts and Methodology for the Health Sciences, 9th Edition, John Wiley and Sons Inc. UK.

CORE – VI
THEORETICAL CONTINUOUS DISTRIBUTIONS

Semester – IV **Hours : 6**
Code : **Credits : 4**

Objective: To impart the knowledge and applications of distributions in various fields.

Unit – I

Rectangular Distribution – Definition and Derivation of Moments, Moment Generating Function, Characteristic Function and Mean Deviation about Mean

Unit – II

Normal Distribution – Definition and Characteristics of Normal Distribution, Derivation of Mode, Median, Moment Generating Function, Cumulant Generating Function, and Moments.

Unit –III

Derivation of Additive property of Normal Distribution, Mean Deviation about Mean, and points of Inflection of Normal curve. Importance of Normal Distribution – Simple Problems.

Unit – IV

Gamma Distribution – Definition and Derivation of Moment Generating Function, Cumulant Generating Function, Moments and Additive Property of Gamma Distribution. Beta Distribution of First and Second kind – Derivation of Moments, β_1, β_2 and harmonic mean

Unit –V

Exponential Distribution –. Definition and Derivation of Moment Generating Function. Derivation of lack of memory property of Exponential Distribution. Weibul Distribution – Moments and Characterisation of Weibul distribution

Text Books:

Gupta,S.C. & Kapoor,V.K.(2013), Fundamentals of Mathematical Statistics, Sultan Chand & Sons, NewDelhi

Book for Reference:

Gupta. S.P: Statistical Methods, Sultan Chand & Sons, New Delhi.

ALLIED - VI

STATISTICAL SOFTWARE PACKAGES

Semester - IV **Hours : 4**

Code : **Credits : 3**

Objective: To create the awareness about the Statistical Software Packages.

Unit - I

Introduction to SPSS – Starting SPSS – SPSS Main Menus – Working with the Data Editor – SPSS Viewer – Importing and Exporting data.

Unit - II

Types of variables – Assessing Reliability and Validity – Type I and Type II errors – probability value(p-value) – Descriptive Statistics, Frequencies using SPSS.

Unit - III

Basic Concepts of One Sample t-test, Independent Samples t-test, Paired samples t-test using SPSS with interpretation.

Unit - IV

Basic concepts of ANOVA – Factors and Covariates – Between, Within and Mixed) Designs – Main and Interaction effects. One Way and Two Way ANOVA with interpretation.

Unit - V

Chi-square Test for Independence using SPSS – Bi-variate Correlation and Partial Correlation using SPSS with interpretation.

Text Book:

Ajai J Gaur and Sanjaya S. Gaur (2008), Statistical Methods for Practice and Research A guide to data analysis using SPSS, First Edition, Sage Publications.

NON-MAJOR ELECTIVE – I

ELEMENTS OF STATISTICS

Semester - IV **Hours: 2**

Code: **Credits: 2**

Objective: To learn the basic concept of Statistics.

Unit - I

Meaning and definition of Statistics, importance and scope of statistics, functions of statistics and limitations of statistics.

Unit - II

Collection of Data **-** Introduction- Primary data: Direct Personal Interview method, Indirect oral interview method, Mailed Questionnaire method, Information from correspondents and Schedule sent through enumerators. Secondary data - Published Source and Unpublished source - Precautions while using secondary data.

Unit III

Classification and Tabulation of Data **-** Introduction- Classification of data- Chronological Classification, Geographical Classification, Qualitative Classification and Quantitative Classification. Tabulation - parts of a table.

Unit - IV

Diagrammatic Representation of Data **-** Introduction - General rules for construction of diagrams - Types of diagrams - Simple Bar diagram, Sub-divided bar diagram, Multiple bar diagram and Percentage bar diagram, Pie diagram, Pictogram and Cartogram.

Unit - V

Graphical Representation of Data **-** Introduction- Techniques of construction of Graphs- Graphs for frequency distributions: Histogram, Frequency Polygon, Frequency Curve and Ogive Curve- Determination of Median and Mode by graphical method.

Text Book:

Gupta. S.P: Statistical Methods-Sultan Chand & Sons, New Delhi.

Book for Reference:

Gupta. S,C and Kapoor V.K (2013), Fundamentals of Mathematical Statistics.

CORE – VII

APPLIED STATISTICS

Semester – V **Hours : 6**

Code: **Credits : 5**

Objective: To give an exposure to the students as to how statistics is applied in real life situations.

Unit – I

Analysis of Time Series – Its definition and uses, Additive and Multiplicative Models in Time Series, Components of Time Series - Secular Trend, Seasonal variation, Cyclic Variations and Irregular fluctuations- Definition and Concepts.

Unit – II

Measurement of Trend – Graphic method, Method of Semi-Averages, Method of Moving Averages and Method of Least Squares. Fitting of Straight line trend and Parabolic trend (theory and problems).

Unit – III

Measurement of Seasonal Variations – Method of Simple Averages, (problems) Ratio to Moving Average method by additive and multiplicative model (problems), Ratio to Trend Method and Link Relative Method (concepts and procedure only).

Unit – IV

Index Numbers – Definition and Uses, Types of Index Numbers, Problems involved in the construction of Index Numbers. Construction of Simple Index Numbers. – Simple aggregate method and Simple average of Price Relatives using A.M & G.M. Construction of Weighted Index Numbers – Laspeyre's, Paasche's, Dorbish Bowley, Marshall Edge worth and Fisher's Ideal Index Number's(Problems). Definition of Deflation, Splicing, Inflation, and Real wages.

Unit – V

Construction of Weighted Average of Price relatives Index Numbers using A.M & G.M. Fixed Base Index Numbers and Chain Base Index Numbers. Tests of adequacy of a good Index Number – Time Reversal Test, Factor Reversal Test, Unit test and Cyclic test.

Text Book:

Gupta S,C and Kapoor V.K (2013): Fundamental of Applied Statistics. - Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Gupta S.P (1995) , Statistical Methods, Sultan Chand & Sons, New Delhi.

2. Goon A.M, Gupta M.A and Das Gupta (1987) , Fundamentals of Statistics, Sultan Chand & Sons, New Delhi.

CORE - VIII

STATISTICAL INFERENCE- I

Semester - V **Hours : 6**

Code : **Credits : 5**

Objective : To focus on the importance of the estimation theory

Unit – I

Point Estimation – Properties of estimators. Consistency and efficiency of an estimator. Sufficiency of a statistic. Simple problem.

Unit – II

Unbiasedness – properties, minimum variance unbiased estimators, Rao-Blackwell theorem. Sufficiency and completeness, Lehman -Scheffe's Theorem, Cramer – Rao Inequality- simple problems.

UNIT – III

Methods of Estimation: Maximum Likelihood Estimation method – Asymptotic properties of MLE. simple problems.

UNIT – IV

Interval Estimation - confidence level and confidence co- efficient, Confidence interval for single proportion, difference between proportions, single mean and difference between proportions – simple problems.

UNIT – V

Construction of Confidence intervals for variance based on chi square, Student's- t, and F distributions. simple problems

Text Books:

1.Rohatgi.V.L, "An introduction to probability theory and Mathematical Statistics", Wiley Eastern limited.

2.Gupta.S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, Sultan Chad & Sons.

Books for Reference:

C.Radhakrishna Rao, "Linear Statistical Inference and its Applications", Wiley Eastern limited

CORE - IX

DESIGN OF EXPERIMENTS

Semester - V **Hours : 6**

Code : **Credits : 4**

Objective : To focus on the design and analysis of variance techniques in field experiments.

Unit - I

Analysis of Variance: Definition and assumptions. Cochran's theorems (statement only) ANOVA - One way and Two way classifications (with one observation per cell). Experimental error.

Unit - II

Design of Experiment: Need, terminology Randomization, Replication and Local control; Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD) - Estimation of missing values in RBD and LSD (one and two).

Unit - III

Factorial experiment - main effects and interactions; definitions of contrast and orthogonal contrast; Analysis of 2^2 and 2^3 experiments.

Unit - IV

Confounding in factorial design –Total Confounding and Partial confounding in 2^3 experiments.

Unit - V

Analysis of co-variance for a one way layout with one concomitant variable and an RBD with one concomitant variable.

Text Books:

1. S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.
2. Das, M.N. and Giri, N.C, (1997), Design and analysis of experiments, Wiley Eastern Ltd., New Delhi.

Books for Reference:

1.Douglas C.Montgomery (2010), Design and Analysis of experiment, Wiley International Edition, India.

2.Cochran.W.G. & G.M.Cox(1957), Experimental designs, Wiley International edition, India.

CORE – P X

PRACTICAL

Semester - V **Hours : 4**

Code : **Credits : 4**

Objective : To impart to the students computational skills in Design of Experiment and Index Numbers.

Unit - I

Design of Experiments - Completely Randomized Design (CRD), Randomized Block Design (RBD), Latin Square Design (LSD).

Unit - II

Estimation of missing values in RBD and LSD (one and two). Factorial experiment - Analysis of 2^2 and 2^3 experiments.

Unit - III

Confounding in factorial design –Total Confounding and Partial confounding in 2^3 experiments.

Unit - IV

Time series - Fitting of linear, Quardratic and Exponential trend by the method of least squares. Finding trend values by the method of moving averages.

Unit - V

Calculation of Laspeyre's, Pasche's, Fisher's, Dorbish-Bowley's and Marshall-Edgeworth Index Numbers, Time Reversal test and Factor Reversal test. Calculation of weighted average of price relatives using Arithmetic Mean and Geometric Mean.

Text Book:

S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Douglas C.Montgomery (2010), Design and Analysis of experiment, Wiley International Edition, India.

2. Cochran.W.G. & G.M.Cox(1957), Experimental designs, Wiley International edition, India.

MAJOR ELECTIVE - II

ACTUARIAL STATISTICS

Semester – V **Hours : 5**

Code : **Credits : 5**

Objectives: (i) **To impart basic concepts in Actuarial Studies,**
(ii) To prepare students to take up a career in Actuarial Practice

Unit – I

Compound Interest – Accumulated Value – Present Value – Nominal and Effective Rates of Interest – Discount and Discount Value – Varying Rates of Interest (Lesson I) (Simple problems only).

Unit – II

Annuity – Classification of annuities – Present Value of an Immediate Annuity certain – Accumulated Value of Annuity – Present Value of a Deferred Annuity certain – Perpetuity – Variable annuities (Lesson II) (Simple problems only).

Unit – III

Redemption of loan: Redemption of loans by a Sinking fund – Lender's Sinking fund – Capital Redemption policies – Office Premium (Lesson II) (Simple problems only).

Unit – IV

Life Assurance premiums: General considerations – Assurance benefits – Pure Endowment Assurance , Endowment Assurance, Temporary assurance, Whole life assurance – Commutation Functions Dx, Cx, Mx and Rx – Expressions for present values of Assurance benefits in terms of Commutation Functions. (Lesson IX) (Simple problems only)

Unit – V

Net Premiums for Assurance Plans – Natural Premiums – Level Annual Premium – Net Premium for Annuity Plans. (Lesson XI and XII) (Simple problems only).

Text book:

Mathematical basis of life assurance IC-81, Insurance institute of India.

Book for reference:

Donald, DWA (1975): Compound interest and annuities certain, Heinemann, London.

NON-MAJOR ELECTIVE –II

SAMPLING THEORY AND QUALITY ENHANCEMENT

Semester - V **Hours: 2**

Code: **Credits: 2**

Objective: To impart knowledge on statistical methods for Quality Improvement and sampling.

Unit – I

Sampling – Introduction, Census and sample method, Methods of Sampling – Probability sampling methods: Simple random sampling, Lottery method and Random number table method, Stratified Random Sampling and Systematic sampling.

Unit – II

Non-Probability sampling methods - Judgment sampling, Quota Sampling, Convenient Sampling, Purposive Sampling.

Unit – III

Quality: The Meaning of Quality and Quality Improvement, Dimensions of Quality, Statistical methods for Quality Control and Improvement, Management aspects of Quality Improvement, Quality Philosophy and Deming's 14 points.

Unit – IV

Six Sigma – Lean Six Sigma, the DMAIC problem solving process, tools used in DMAIC. The Define phase - Project Charter, SIPOC diagram. The Measure phase - Process Map, Cause and effect diagram.

Unit – V

The Analyze phase – Simple Control charts. The Improve phase – The Control phase – Examples of DMAIC: Improving on-time Delivery – Improving Service Quality in a Bank.

Text Books:

1. Douglas C. Montgomery (2013), Statistical Quality Control A modern Introduction, Sixth Edition, Wiley Student Edition. (Units I, II and III).
2. Gupta, S.P. Statistical Methods, Sultan Chand & Sons, New Delhi. (Units IV and V).

Book for reference:

S.C. Gupta and V.K. Kapoor (2013), Fundamentals of Applied Statistics, Sultan Chand & Sons, New Delhi.

CORE – XI

SAMPLING THEORY

Semester - VI **Hours: 6**

Code: **Credits: 5**

Objective : To develop the knowledge about the sampling theory and its applications.

Unit - I

Basic concept of sample survey - Introduction, definitions and preliminaries, fields of application of sampling techniques and limitations, Census and sample surveys, their advantages and disadvantages, principles of sampling theory, principal steps in a sample survey. Probability and non-probability sampling, sampling unit, sampling frame, sampling and non-sampling errors.

Unit - II

Simple random sampling, procedures of selecting a random sample, estimation of population parameters, estimation of population of proportion, Estimation of sample size.

Unit - III

Stratified random sampling – Introduction, principles of stratification, Advantages of stratification, Estimation of population mean and its variance, Estimation of variance, Allocation of sample size in different strata - Equal allocation, Neyman allocation, optimum allocation and proportional allocation. Relative precision of stratified random sampling with simple random sampling.

Unit - IV

Systematic sampling – Introduction, sample selection procedures, Advantages and Disadvantages, Estimation of mean and its sampling variance, comparison of simple random sampling and stratified random sampling with systematic sampling.

Unit - V

Ratio estimators-Introduction, definitions and notations, Bias of Ratio estimators, comparison of the ratio estimate with the mean per unit. Regression estimators – Introduction, difference estimator, regression estimator, comparison with the mean per unit and ratio estimators

Text Book:

Daroga Singh and Choudry F.S(1986), Theory and Analysis of Sample Survey Design, Wiley Eastern Ltd: New Delhi.

Book for Reference:

Murthy M.N.(1976), Sampling theory and methods- statistical publishing society, Calcutta.

CORE - XII

STATISTICAL INFERENCE - II

SEMESTER – VI **Hours : 6**

Code : **Credits : 4**

Objective: To impart knowledge about testing of hypothesis.

Unit - I

Statistical hypothesis – Simple and Composite, Null and Alternative Hypothesis, Critical region, Types of errors, Level of Significance, Power of test. Steps involved in testing of Hypothesis.

Large sample test - Tests for single proportion, difference between proportions, single mean, difference between means and difference between standard deviations.

Unit - II

Small sample test – Student's 't' test – test for single mean, difference between means, paired 't' test and observed sample correlation coefficient.

Unit - III

Snedecor's F test - test for equality of two population variances – Testing the significance of an observed Multiple correlation coefficient, observed sample correlation ratio and linearity of regression (Concepts only).

Unit - IV

Chi-Square test – Inferences about a population variance and goodness of fit. Association of Attributes - Class Frequencies - order of frequencies, Nine Squares Contingency table - Finding missing frequencies, Yule's coefficient of association (problems).

Unit – V

Non-Parametric Tests – Meaning, advantages and disadvantages, Run test, Sign test (one sample and two samples), Median test and Mann-Whitney U-test.

Text book:

Gupta S.C. and Kapoor. V.K.(2013)- Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Book for Reference:

1. Goon A.M. Gupta M.A and Das Gupta.B (1980), An outline of Statistics Theory, World press, Volume I and II, Calcutta.

2. Radhakrishna Rao C., Linear Statistical Inference and its Applications, Second Edition, Wiley Eastern Limited.

CORE – XIII

OPERATIONS RESEARCH

Semester – VI **Hours : 5**

Code : **Credits : 4**

Objective: To equip the students with Optimization Techniques and apply them to solve decision making problems.

Unit – I

Operations Research – Meaning, Nature, History, Scope and Limitations. Linear Programming Problem(LPP) – General Form, Standard form and Canonical form, Basic Solution, Basic Feasible solution, Optimum solution. Assumption and Mathematical Formulation of LPP

Unit – II

Graphical Solution of LPP – Unique and special cases – Simplex Method and Big-M Method.

Unit –III

Transportation Problem (T.P.) – Meaning, Balanced and Unbalanced Transportation Problem. Initial Basic Feasible Solution (IBFS) – North-West Corner Rule(NWC), Least Cost Method(LCM) and Vogel's Approximation Method(VAM) and MODI method to solve an Transportation Problem. Maximization case in Transportation Problem.

Unit – IV

Assignment Problem(A.P.) – Meaning, Balanced and Unbalanced Assignment Problem – Hungarian method to solve an Assignment Problem. Maximization case in Assignment Problem.

Unit –V

Sequencing Problem – Meaning, Procedure for solving sequencing problems - Processing 'n' jobs through two machines, Processing 'n' jobs through 'm' machines and Processing of two jobs through 'm' machines.

Text Book:

Kanti Swarup, Gupta,P.K. & Manmohan, Operations Research, Sultan Chand & Sons, NewDelhi.

Book for Reference:

Taha, H.A., An Introduction to Operations Research, Colliat Macmillan.

CORE – P XIV

PRACTICAL

Semester – VI **Hours : 5**

Code : **Credits : 4**

Objective: To equip the students in practical applications of sampling and Statistical Inference.

Unit - I

Estimation of Mean and Variance of the population and variance of the estimator of the mean using Simple Random Sampling and Stratified random sampling with proportional allocation and optimum allocation.

Unit - II

Estimation of mean and variance of population using Systematic Random sampling, Ratio estimator and Regression estimators.

Unit - III

Large sample test - Tests for single proportion, difference between proportions, single mean, difference between means and difference between standard deviations.

Unit - IV

Small sample test – Student's 't' test – test for single mean, difference between means, paired 't' test and observed sample correlation coefficient.

Unit - V

Chi-Square test – Inferences about a population variance and goodness of fit. Association of Attributes - Class Frequencies - order of frequencies, Nine Squares Contingency table - Finding missing frequencies, Yule's coefficient of association (problems). Non-parametric tests – Run test, Sign test, Median test and Mann – Whitney U-test.

Text books:

1. Daroga Singh and Choudry F.S (1986), Theory and Analysis of Sample Survey Design, Wiley Eastern Ltd: New Delhi.

2. Gupta S.C. and Kapoor. V.K. (2007)- Fundamental of Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Books for Reference:

1. Goon A.M. Gupta M.A and Das Gupta.B (1980), An outline of Statistics Theory, World press, Calcutta.

2. Radhakrishna Rao C., Linear Statistical Inference and its Applications, Second Edition, Wiley Eastern Limited.

MAJOR ELECTIVE - III

STATISTICAL QUALITY CONTROL

Semester – VI **Hours : 5**

Code : **Credits : 4**

Objectives: i) To devise statistical techniques to separate the assignable causes from the chance causes

ii) To ensure quality all along the arrival of materials through each of their processing to the final delivery of goods.

Unit – I

Introduction to SQC – Chance and Assignable Causes of Variation – Uses of SQC – Process and Product Control – Control chart for Variables – X-Bar and R-Chart – Revised Control Charts

Unit – II

Control Chart for Attributes – Control Chart for Fraction Defective (p-Chart) – Control Chart for Number of Defectives (d-chart, for fixed and variable sample size) – Control Chart for Number of Defectives per unit (c- Chart) – Natural Tolerance Limit and Specification Limits.

Unit –III

Acceptance sampling by Attributes – Acceptance Quality Level (A.Q.L) – Lot Tolerance Proportion or Percent Defective (LTPD) – Process Average Fraction Defective (p) – Consumer's Risk(β) – Producer's Risk(α) – Rectifying Inspection Plan – Average Outgoing Quality Level (AOQL)

Unit – IV

Operating Characteristic Curve (OC-curve) – Average Sample Number (ASN) – Average Amount of Total Inspection (ATI) – Single Sampling Plan – Determination of 'n' and 'c', AOQL, OC-curve – Double Sampling Plan – ASN and ATI of Double Sampling Plan – Single sampling Vs Double Sampling plan

Unit –V

Sequential Sampling – Sequential Probability Ratio Test (SPRT) – ASN Function of Sequential Sampling Plan

Text Book:

Gupta,S.C. & Kapoor,V.K (2014), Fundamentals of Applied Statistics, 4th Edition, Sultan Chand & Sons, New Delhi.

Book for Reference:

Mahajan, M., Statistical Quality Control, Dhanpat Rai & Co.

SKILL BASED ELECTIVE - III

OFFICIAL STATISTICS

Semester – VI **Hours : 2**

Code : **Credits : 4**

Objective : To impart knowledge about the various Statistical Organizations in India.

Unit - I

Official Statistics: Definition – Growth of Indian Statistics – Statistical organizations of India: Central Statistical Organisation (CSO) – Divisions of Central Statistical Organisation – Functions – Publications.

Unit - II

National Sample Survey Organisation (NSSO) – Divisions of NSSO – Functions of NSSO – Procedure for collection of information – Agriculture Statistics, Yield Statistics – Official series: Traditional method, Random Sampling Method – NSS Series – Forest Statistics, Fisheries Statistics – Defects in agricultural Statistics.

Unit - III

National income: Definition – Methods of estimating national income: The Income method, the Output method and the Expenditure method – Uses of National income estimates – Difficulties of estimation.

Unit - IV

Social accounting – Population statistics – Sources – Different methods of collecting population census – Methods of enumeration – Merits and demerits of De Facto method, Merits and demerits of the De Jure system.

Unit - V

Price Statistics: Wholesale prices, Retail prices, Uses and limitations of price statistics. Industrial Statistics: Main Sources of industrial Statistics – Limitations.

Text Book:

R.S.N. Pillai and V. Bagavathi (1995), Statistics, Third Edition, S.Chand & Company, New Delhi – 110 055.

Books for Reference:

1. Central Statistical Organization (1979), Statistical Systems in India, Department of Statistics, Ministry of Planning, New Delhi.
2. Goon , A.M. Gupta, M.K and Das Gupta, B.(1986), Fundamentals of Statistics, Volume II, The World Press Private Limited, Calcutta.

ALLIED – I

MATHEMATICAL STATISTICS - I

(For B.Sc Mathematics)

SEMESTER – I **Hours : 4**

Code : **Credits : 4**

Objective: To enable the students to know the importance of Statistics and its applications in Mathematics.

Unit - I

Measures of central tendency- Mean, Median, Mode, Geometric Mean, Harmonic Mean and Quartiles. Measures of Dispersion- Quartile Deviation and Standard deviation, Measures of Skewness and Kurtosis.

Unit - II

Correlation – Definition, Types of Correlation, Karl Pearson's Co-efficient of correlation, Rank Correlation Co-efficient – Linear Regression Equation.

Unit - III

Probability- Axiomatic and Classical Probability – Simple problems. Addition and Multiplication Theorem of Probability – Simple problems .

Unit – IV

Concept of Random Variable –Discrete and Continuous , Distribution Functions, Probability Mass Function, Probability Density Function and Mathematical Expectations.

Unit - V

Bivariate Probability Distribution - Discrete and Continuous, Marginal and Conditional Distributions, Moment Generating Function

Text Book:

Gupta S.C and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons, New Delhi.

ALLIED – III

MATHEMATICAL STATISTICS - III
(For B.Sc Mathematics)

SEMESTER – II **Hours : 4**

Code : **Credits : 4**

Objective: To impart knowledge on the very imperative part of Statistics – Discrete and Continuous Distributions and Tests of Significance.

Unit - I

Discrete Distribution- Binomial and Poison distribution-Moments and M.G.F.

Unit - II

Continuous distributions – Normal, exponential and uniform distributions-Moments and M.G.F.

Unit - III

Beta Distribution of First and Second kind and Gamma Distribution – Definition and Derivation of MGF and moments. 't' , F and chi-square distributions (Derivation of the probability density function only)

Unit - IV

Test of Significance for large Samples- Single Mean, difference between mean, proportion and difference between proportions and difference between two standard deviations.

Unit - V

Test of significance for Small Sample- 't' test for single mean, Difference between means, Paired 't' test. Simple Correlation, Chi-square test for goodness of fit and independence of attributes and F-test.

Text Book:

Gupta S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Book for Reference:

Kapoor and Saxena, Mathematical Statistics, Chand & Co, New Delhi

ALLIED - P II

MATHEMATICAL STATISTICS – II

(For B.Sc Mathematics)

SEMESTER – I & II (Non-sitting) **Hours : 6**

Code : **Credits : 4**

Objective: To develop the computational skills in Statistics.

Unit - I

Calculation of Arithmetic Mean, Median, Mode, Geometric Mean and Harmonic and Quartiles.

Unit - II

Computation of M.D , S.D., and Co-efficient of Variation - Karl Pearson's and Bowley's Co-efficient of Skewness.

Unit- III

Karl Pearson's co-efficient of Correlation, Spearman's rank correlation, Regression lines.

Unit - IV

Fitting of Binomial and Poisson distributions. Fitting of Normal distribution

Unit - V

Tests of significance based on Normal distribution and Student's t-distribution for mean. Proportions and simple correlation. Chi-square test for goodness of fit and independence of attributes and F-test.

Text Book:

Gupta, S.C. and V.K. Kapoor, Fundamental of Mathematical Statistics, Sultan & Sons. New Delhi

Book for Reference:

Kapoor and Saxena, Mathematical Statistics, Chand & Co, New Delhi