

B.A./B.Sc. (STATISTICS)**Semester Pattern Syllabus (CBCS) : w. e. f. : Academic Year : 2020-21****(With Mathematics Combination)**

Year	Semester	Theory / Practical	Paper Title	Work Load (Hrs/Week)	# Credits	Marks
I	FIRST	Paper - I (DSC - A)	Descriptive Statistics and probability	4	4	100
		<i>Practical - 1</i>	<i>Descriptive Statistics and probability</i>	3	1	50
	SECOND	Paper - II (DSC - B)	Probability distributions	4	4	100
		<i>Practical - 2</i>	<i>Probability distributions</i>	3	1	50
II	THIRD	SEC - 1	University Specified	2	2	50
		SEC - 2	Data Collection, Presentation and Interpretation	2	2	50
		Paper - III (DSC - C)	Statistical Methods and Estimation	4	4	100
		<i>Practical - 3</i>	<i>Statistical Methods and Estimation</i>	3	1	50
	FOURTH	SEC - 3	University Specified	2	2	50
		SEC - 4	Data Scaling Techniques and Report writing	2	2	50
		Paper - IV (DSC - D)	Statistical Inference	4	4	100
		<i>Practical - 4</i>	<i>Statistical Inference</i>	3	1	50
III	FIFTH	Paper – V (A) (DSE - A)	Applied Statistics - 1	4	4	100
		Paper – V (B) (DSE - A)	Analytical Statistics - 1	4	4	100
		<i>Practical – 5(A)</i>	<i>Applied Statistics - 1</i>	3	1	50
		<i>Practical – 5(B)</i>	<i>Analytical Statistics - 1</i>	3	1	50
		<i>Paper VI - GE</i>	<i>Basic Statistics</i>	4	4	100
	SIXTH	Paper – VII (A) (DSE - B)	Applied Statistics - 2	4	4	100
		Paper – VII (B) (DSE - B)	Analytical Statistics - 2	4	4	100
		<i>Practical – 7(A)</i>	<i>Applied Statistics - 2</i>	3	1	50
		<i>Practical – 7(B)</i>	<i>Analytical Statistics - 2</i>	3	1	50
		Paper - VIII Project / DSE - C	Operations Research	4	4	100

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

B.A/B.Sc. I Year I Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)
(Examination at the end of Semester - I)

Paper – I : Descriptive Statistics and Probability

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit-I

Descriptive Statistics: Concept of primary and secondary data, Classification of data, Measures of central tendency (Arithmetic mean, median, mode, geometric mean and harmonic mean) with simple applications, Absolute and relative measures of dispersion (range, quartile deviation, mean deviation, standard deviation and variance) with simple applications. Importance of moments, central and non-central moments, their inter-relationships, Sheppard's correction for moments for grouped data, Measures of skewness based on quartiles and moments, kurtosis based on moments with real life examples.

Unit-II

Probability: Basic concepts of probability, deterministic and random experiments, trial, outcome, sample space, event, operations of events, mutually exclusive and exhaustive events, equally likely and favorable events with examples, Mathematical, Statistical and Axiomatic definitions of probability, their merits and demerits. Properties of probability based on axiomatic definition.

Conditional probability and independence of events, Addition and multiplication theorems for 'n' events, Boole's inequality and Bayes' theorem, Problems on probability using counting methods and theorems.

Unit-III

Random Variables: Definition of random variable, discrete and continuous random variables, functions of random variables, probability mass function and probability density function with illustrations. Distribution function and its properties, Transformation of one-dimensional random variable (simple 1-1 functions only).

Notion of bivariate random variable, bivariate distribution, statements of its properties, Joint, marginal and conditional distributions, Independence of random variables.

Unit-IV

Mathematical Expectation: Mathematical expectation of a function of a random variable, Raw and central moments, covariance using mathematical expectation with examples, Addition and multiplication theorems of expectation. Chebyshev's and Cauchy-Schwartz's inequalities and their applications.

Definitions of moment generating function (m.g.f), characteristic function (c.f), cumulant generating function (c.g.f), probability generating function (p.g.f) and statements of their properties with applications.

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

Reference books:

1. **Fundamentals of Statistics, (Vol-I)** - Goon A M, Gupta M K, Das Gupta B, The World Press (Pvt) Ltd., Kolkata.
2. **Fundamentals of Mathematical Statistics** - V. K. Kapoor and S. C. Gupta, Sultan Chand & Sons, New Delhi.

Additional References:

1. Sanjay Arora and Bansilal: New Mathematical Statistics, Satya Prakashan , New Delhi.
2. William Feller: Introduction to Probability theory and its applications, (Vol-I), Wiley.
3. M. Jagan Mohan Rao and Papa Rao: A Text book of Statistics (Paper-I).
4. Hogg,Tanis, Rao: Probability and Statistical Inference, (7th edition), Pearson.
5. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC, PHI.
6. Gerald Keller: Applied Statistics with Microsoft Excel, Duxbury, Thomson Learning.
7. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel (4th edition), Pearson Publication.

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

B.A/B.Sc. I Year I Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)
(Examination at the end of Semester - I)

Practical-1 : Descriptive Statistics and Probability
[3 HPW :: 1 Credit :: 50 Marks]

Part - 1 (Using Calculator)

1. Graphical presentation of data (Histogram, frequency polygon, Ogives) and its interpretation.
2. Diagrammatic presentation of data (Bar and Pie).
3. Computation of central tendency and dispersion measures for ungrouped and grouped data.
4. Computation of non-central and central moments – Sheppard's corrections for grouped data.
5. Computation of coefficients of Skewness - Karl Pearson's, Bowley's, β_1 and Kurtosis – β_2 and their interpretation.

Part - 2 (Using MS-Excel)

1. **Basics of Excel** - Data entry, editing and saving, establishing and copying formulae, Built in Functions - copy and paste, Find and Replace, Sorting.
2. **Basics of Excel** - Built in Functions - Filtering, Conditional formatting and creating Hyperlinks, Exporting to MS word document
3. Computation of descriptive Statistics using Pivote table - Univariate.
4. Data visualization through diagrams.
5. Computation of central tendency and dispersion measures, Coefficient of Variation for ungrouped and grouped data.
6. Computation of Coefficients of Skewness, Kurtosis using MS-Excel and interpretation.

**Note : Training shall be on establishing formulae in Excel cells and deriving the results.
The Excel output shall be exported to MSWord for writing inferences.**

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

B.A/B.Sc. I Year II Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - II)

Paper – II : Probability Distributions

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit-I

Discrete distributions – I : Uniform and Bernoulli distributions : definitions, mean, variance and simple examples. Definition and derivation of probability mass functions of Binomial distribution, Poisson distribution, properties of these distributions: median, mode, m.g.f, c.g.f., p.g.f., c.f., and moments upto fourth order, reproductive property (wherever exists) and their real life applications. Poisson approximation to Binomial distribution.

Unit-II

Discrete distributions – II: Negative binomial, Geometric distributions: Definitions and real life applications, properties of these distributions: m.g.f, c.g.f., p.g.f., c.f. and moments upto fourth order, reproductive property (wherever exists), lack of memory property for Geometric distribution. Poisson approximation to Negative binomial distribution.

Hyper-geometric distribution: definition, real life applications, derivation of probability function, mean, variance. Binomial approximation to Hyper-geometric distribution.

Unit-III

Continuous distributions – I : Normal distributions – definition, properties such as m.g.f., c.g.f., c.f. and moments up to fourth order, reproductive property, wherever exists and their real life applications. Normal distribution as a limiting case of Binomial and Poisson distributions.

Unit-IV

Continuous distributions – II : Rectangular, Exponential, Gamma distributions - definition, properties: m.g.f., c.g.f., c.f. and moments upto fourth order, reproductive property (wherever exists) and their real life applications. Beta distribution of two kinds: Definitions, mean and variance.

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

Reference books:

3. **Fundamentals of Statistics, (Vol-I)** - Goon A M, Gupta M K, Das Gupta B, The World Press (Pvt) Ltd., Kolkata.
4. **Fundamentals of Mathematical Statistics** - V. K. Kapoor and S. C. Gupta, Sultan Chand & Sons, New Delhi.

Additional References:

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11. Hogg, Tanis, Rao: Probability and Statistical Inference, (7th edition), Pearson.
12. K.V.S. Sarma: Statistics Made Simple: Do it yourself on PC, PHI.
13. Gerald Keller: Applied Statistics with Microsoft Excel, Duxbury, Thomson Learning.
14. Levine, Stephen, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel (4th edition), Pearson Publication.

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

B.A/B.Sc. I Year II Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)
(Examination at the end of Semester - II)

Practical-2 : Probability Distributions
(3 HPW :: 1 Credit :: 50 Marks)

Part - 1 (Using Calculator)

1. Fitting of Binomial distribution-Direct method.
2. Fitting of Binomial distribution-Recurrence relation Method.
3. Fitting of Poisson distribution-Direct method
4. Fitting of Poisson distribution-Recurrence relation Method.
5. Fitting of Negative Binomial distribution.
6. Fitting of Geometric distribution.
7. Fitting of Normal distribution-Areas method.
8. Fitting of Normal distribution - Ordinates method.
9. Fitting of Exponential distribution.

Part - 2 (Using MS-Excel)

1. Data Visualization through graphs (Histogram, frequency polygon, Ogives) using MS-Excel and their interpretation.
2. Computation of descriptive Statistics using Pivote table – Bivariate.
3. Fitting of Binomial distribution-Direct method.
4. Fitting of Poisson distribution-Direct method.
5. Fitting of Normal distribution-Areas method.
6. Fitting of Exponential distribution.

**Note : Training shall be on establishing formulae in Excel cells and deriving the results.
The Excel output shall be exported to MSWord for writing inferences.**

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (First year)

B.A./B.Sc. (STATISTICS)
Theory Question Paper Pattern
(With Mathematics Combination)

Time : 3 hours]

[Max. Marks : 80

Section - A

Answer any EIGHT questions. All questions carry equal marks. (8Qx4m=32)

1. From Unit I
2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit II
7. From Unit III
8. From Unit III
9. From Unit III
10. From Unit IV
11. From Unit IV
12. From Unit IV

Section - B

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

13. a) From Unit I
(or)
b) From Unit I
14. a) From Unit II
(or)
b) From Unit II
15. a) From Unit III
(or)
b) From Unit III
16. a) From Unit IV
(or)
b) From Unit IV

B.A./B.Sc. (STATISTICS)
Practical Question Paper Pattern
(With Mathematics Combination)

Time: 3 hours]

[Max. Marks: 50

Solve any THREE problems choosing at least one from each Section.
(3Qx15m=45m) and Record: 5m

Section-A

1. From Part 1
2. From Part 1
3. From Part 1

Section - B

4. From Part 2
5. From Part 2

B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)

(Examination at the end of Semester - III)

Paper – III : Statistical Methods and Theory of Estimation

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit –I

Bivariate data, Scattered diagram, Principle of least squares, fitting of straight line, quadratic and power curves. Concept of correlation, computation of Karl-Pearson correlation coefficient for grouped and ungrouped data and its properties.

Correlation ratio, Spearman's rank correlation coefficient and its properties. Simple linear regression, correlation versus regression, properties of regression coefficients.

Unit –II

Concepts of partial and multiple correlation coefficients (only for three variables). Analysis of categorical data, their independence, Association and partial association of attributes. Various measures of association: (Yule's) for two way data and coefficient of contingency (Pearson and Tcherprow) and coefficient of colligation.

Unit – III

Concepts of Population, Parameter, Random sample, Statistic, Sampling distribution and Standard error. Standard error of sample mean(s) and sample proportion(s). Exact sampling distributions - Statement and properties of χ^2 , t and F distributions and their interrelationships. Independence of sample mean and variance in random sampling from normal distributions.

Point estimation of a parameter, concept of bias and mean square error of an estimate. Criteria of a good estimator- consistency, unbiasedness, efficiency and sufficiency with examples.

Unit – IV

Statement of Neyman's Factorization theorem, derivations of sufficient statistics in case of Binomial, Poisson, Normal and Exponential (one parameter only) distributions. Estimation by the method of moments, Maximum likelihood estimation (MLE), statements of asymptotic properties of MLE. Concept of interval estimation. Confidence intervals of the parameters of normal population by Pivot method.

Reference Books:

1. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., Kolkata.
2. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi

Additional References:

1. Hoel P.G : Introduction to Mathematical statistics, Asia Publishing house.
2. Sanjay Arora and Bansilal :.New Mathematical Statistics Satya Prakashan , New Delhi
3. Hogg and Craig : Introduction to Mathematical statistics. Prentice Hall
4. Siegal, S., and Sidney: Non-parametric statistics for Behavioral Science. McGraw Hill.
5. Gibbons J.D and Subhabrata Chakraborti : Nonparametric Statistical Inference. Marcel Dekker.
6. Parimal Mukhopadhyay : Mathematical Statistics. New Central Book agency.
7. Conover : Practical Nonparametric Statistics. Wiley series.
8. V. K. Rohatgi and A. K. Md. Ehsanes Saleh : An introduction to probability and statistics, Wiley series.
9. Mood A M, Graybill F A, Boe's DC. Introduction to theory of statistics. TMH
10. Paramiteya Mariyu Aparameteya Parikshalu. Telugu Academy.
11. K.V. S. Sarma: Statistics made simple do it yourself on PC. PHI
12. Gerald Keller : Applied Statistics with Microsoft excel. Duxbury. Thomson Learning
13. Levin, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel.4th Edition, Pearson Publication.
14. Hogg, Tanis, Rao. Probability and Statistical Inference.7th edition. Pearson Publication.
15. Milton and Arnold (fourth Edition):Introduction to Probability and Statistics, Tata McGraw Hill Publication.

B.A/B.Sc. II Year III Semester (CBCS): Statistics Syllabus
(With Mathematics Combination)
(Examination at the end of Semester - III)
Practical – 3 : *Statistical Methods and Theory of Estimation*
(3 HPW, Credits 1 and Marks 50)

Part – A (Using Calculator)

1. Generation of random samples from Uniform (0,1), Uniform (a,b), Normal and Poisson and Exponential Distributions.
2. Fitting of straight line and parabola by the method of least squares.
3. Fitting of power curves of the type $y = a x^b$, $y = a b^x$ and $y = a e^{bx}$ by the method of least squares.
4. Computation of Yule's coefficient of association and Pearson's, Tcherprows coefficient of contingency.
5. Computation of correlation coefficient and regression lines for ungrouped data.
6. Computation of correlation coefficient, forming regression lines for ungrouped data.
7. Computation of correlation coefficient, forming regression lines for grouped data.
8. Computation of multiple and partial correlation coefficients.
9. Computation of correlation ratio

Part – B (Using Excel)

10. Simulation of random samples from Uniform (0,1), Uniform (a,b), Exponential, Normal and Poisson distributions using MS Excel.
11. Fitting of straight line and parabola by the method of least squares using MS Excel.
12. Fitting of power curves of the type $y = a x^b$, $y = a b^x$ and $y = a e^{bx}$ by the method of least squares using MS Excel.
13. Computation of correlation coefficient, forming regression lines using MS Excel.
14. Computation of multiple and partial correlation coefficients using MS Excel.

B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - III)

SEC – 1 : University Specified

[2 HPW with 2 Credits and 50 Marks]

B.A/B.Sc. II Year III Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)

(Examination at the end of Semester - III)

SEC - 2 : Data Collection, Presentation and Interpretation

[2 HPW with 2 Credits and 50 Marks]

UNIT –I

Basic Concepts on Population, Sample, Sampling unit, Parameter, Statistic, Standard error, Sample Size and its Determination.

Steps in Sample design. Selecting the Problem and necessity of defining the Problem, Designing a questionnaire and a schedule for collecting data for a set of objectives under study with illustrated examples.

Methods for collecting Primary and Secondary data and their merits and demerits.

UNIT II

Graphical computation of Data and Interpretation : Histogram, frequency curve, frequency polygon, ogive curves.

Diagrammatic computation of Data and Interpretation : Bar diagrams (simple, component, multiple, percentage Bars), Pie diagram.

Classification and Tabulation of data. Data Interpretation techniques, Precaution in Interpretation. Data interpretation problems.

Reference Books :

1. Kotahri, C.R (2009): Research Methodology: Methods and Techniques, 2nd Revised Ed. Reprint, New Age International Publishers
2. S. P. Gupta : Statistical Methods.

B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - IV)

Paper - IV : Statistical Inference

[4 HPW :: 4 Credits :: 100 Marks (External:80, Internal:20)]

Unit-I

Concepts of statistical hypotheses, Null and Alternative hypothesis, Critical region, two types of errors, Level of significance and Power of a test. One and two tailed tests, test function (non-randomized and randomized). Statement and Proof of Neyman-Pearson's fundamental lemma for Randomized tests. Examples in case of Binomial, Poisson, Exponential and Normal distributions and their power of the test functions.

Unit-II

Large sample tests for single sample mean, difference of means, single sample proportion, difference of proportions and difference of standard deviations. Fisher's Z-transformation for population correlation coefficient(s) and testing the same in case of one sample and two samples. Definition of order statistics and statement of their distributions.

Unit – III

Tests of significance based on χ^2 - χ^2 -test for specified variance, goodness of fit and test for independence of attributes (rxs, 2xk and 2x2 contingency tables). Tests of significance based on student's - t – t-test for single sample specified mean, difference of means for independent and related samples, sample correlation coefficient. F - test for equality of population variances.

Unit – IV

Non-parametric tests - their advantages and disadvantages, comparison with parametric tests. Measurement scale - nominal, ordinal, interval and ratio. Use of Central Limit Theorem in testing. One sample runs test, sign test and Wilcoxon-signed rank tests (single and paired samples). Two independent sample tests: Median test, Wilcoxon –Mann-Whitney U test, Wald Wolfowitz's runs test. Use of central limit theorem in testing.

Reference Books:

1. Goon AM, Gupta MK, Das Gupta B : Outlines of Statistics , Vol-II, the World Press Pvt. Ltd., Kolkata.
2. V. K. Kapoor and S. C. Gupta: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, New Delhi

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5. Gibbons J.D and Subhabrata Chakraborti : Nonparametric Statistical Inference. Marcel Dekker.
6. Parimal Mukhopadhyay : Mathematical Statistics. New Central Book agency.
7. Conover : Practical Nonparametric Statistics. Wiley series.
8. V. K. Rohatgi and A. K. Md. Ehsanes Saleh : An introduction to probability and statistics, Wiley series.
9. Mood A M, Graybill F A, Boe's DC. Introduction to theory of statistics. TMH
10. Paramiteya Mariyu Aparameteya Parikshalu. Telugu Academy.
11. K.V. S. Sarma: Statistics made simple do it yourself on PC. PHI
12. Gerald Keller : Applied Statistics with Microsoft excel. Duxbury. Thomson Learning
13. Levin, Stephan, Krehbiel, Berenson: Statistics for Managers using Microsoft Excel.4th Edition, Pearson Publication.
14. Hogg, Tanis, Rao. Probability and Statistical Inference.7th edition. Pearson Publication.
15. Milton and Arnold (fourth Edition):Introduction to Probability and Statistics, Tata McGraw Hill Publication.

B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - IV)

Practical – 4 : Statistical Inference

[3 HPW, Credits 1 and Marks 50]

Part – A (Using Calculator)

1. Large sample tests for mean(s), proportion(s), Standard deviation(s) and correlation coefficient.
2. Small sample tests for single mean and difference of means and correlation coefficient.
3. Paired t-test.
4. Small sample test for single and difference of variances.
5. χ^2 – test for goodness of fit and independence of attributes.
6. Nonparametric tests for two independent samples (Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test)

Part – B (Using Excel)

7. Use of Look up and Reference functions for data analysis.
8. Creating and assigning Macros.
9. Small sample tests for mean(s), paired t-test and correlation coefficient using MS Excel.
10. Small sample test for single and difference of variances using MS Excel.
11. χ^2 – test for goodness of fit and independence of attributes using MS Excel.
12. Nonparametric tests for single and related samples (sign test and Wilcoxon signed rank test) and one sample runs test.

**Note : Training shall be on establishing formulae in Excel cells and deriving the results.
The Excel output shall be exported to MSWord for writing inferences.**

B.A/B.Sc. II Year IV Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - IV)

SEC – 3 - University Specified

[2 HPW with 2 Credits and 50 Marks]

Syllabus Approved by BOS in Statistics w. e. f. 2020-21 (Second year)

B.A/B.Sc. II Year IV Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)

(Examination at the end of Semester - IV)

SEC - 4 : Data Scaling Techniques and Report writing
[2 HPW with 2 Credits and 50 Marks]

UNIT – I

Qualitative and Quantitative data, Measurement of Scales: nominal, ordinal, interval and ratio scales. Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques. Developing Likert-type Scales, Factor scales and Cumulative Scales their advantages and limitations.

UNIT-II

Interpretation and Report Writing: meaning of interpretation, technique of interpretation, precautions in interpretation, significance of report writing, different steps in writing report. layout of the research report, types of reports, oral presentation, mechanics of writing a research report.

Reference Books :

1. SC Gupta and VK Kapoor : Fundamentals of Applied Statistics, Sultan Chand & Sons
2. Goon AM, Gupta MK, Das Gupta B : Fundamentals of Statistics , Vol-I, The World Press Pvt. Ltd., Kolkata.

Syllabus Approved by BOS in Statistics w. e. f. 2021-22

B.A/B.Sc. III Year V Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - V)

Paper – V(A) : Applied Statistics - I

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

UNIT-I

Sample Surveys: Concepts of population, sample, sampling unit, parameter, statistic, sample frame and standard error. Principal steps in sample surveys - need for sampling, census versus sample surveys, sampling and non- sampling errors, sources and treatment of non-sampling errors, advantages and limitations of sampling.

Sampling Methods: Types of sampling: Subjective, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean, total, and proportion, their variances and the estimates of variances in Simple Random Sampling With and Without Replacement

UNIT-II

Estimates of population mean, total, and proportion, their variances and the estimates of variances in the following methods.

- (i) Stratified Random Sampling with Proportional and Neyman allocation, and
- (ii) Systematic Sampling when $N = nk$.

Comparison of relative efficiencies. Advantages and disadvantages of SRS, Stratified and Systematic sampling methods.

UNIT-III

Time series: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares and moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

UNIT-IV

Statistical Quality Control: Importance of SQC in industry. Dimensions of quality, Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np with fixed and varying sample sizes) and their Interpretation.

Control charts for attributes (c and u charts with fixed and varying sample sizes) and their Interpretation.

Syllabus Approved by BOS in Statistics w. e. f. 2021-22

B.A/B.Sc. III Year V Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)

(Examination at the end of Semester - V)

Practical – 5(A) : Applied Statistics - I
[with 3 HPW, Credits 1 and 50 Marks]**Practical using R – Software and MS – Excel**

R – Software : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Running R, Packages in R, Variable names and assignment, Operators, Integers, Factors, Logical operations. Operations of Scalars, Vectors, Lists, Arrays, Matrices, Data Frames. Control structures, Functions.

1. Data Visualization using R - Frequency polygons and curves, Ogives, Histogram using R.
2. Data Visualization using R - Bar diagrams (simple, compound, percentage and multiple) and Pie diagram (single and multiple) using R.
3. Computation of Descriptive Statistics using R (Measures of Central tendencies and Dispersion, Moments, Skewness and Kurtosis) using R.
4. Computation of expected frequencies for Binomial, Poisson, Normal and Exponential distributions using R.
5. Computation of Karl Pearson's coefficient of correlation and rank correlation using R.
6. Computation of partial and multiple correlations using R.
7. Time series Analysis : Computation of Secular trend by least squares and moving averages methods using R and MS-Excel.
8. Computation of Seasonal variations by Ratio to moving averages, Ratio to trend and Link Relatives methods using R and MS-Excel.
9. Construction of control charts for variables (\bar{x} , \mathbf{R} and σ - charts) using R and MS – Excel.
10. Construction of control charts for attributes (p, np with fixed and varying sample size, C and u charts) using R and MS – Excel.

Syllabus Approved by BOS in Statistics w. e. f. 2021-22

B.A./B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - V)

Paper - V(B) : Analytical Statistics - I

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

UNIT-I

Sample Surveys : Principal steps in sample surveys, census versus sample surveys, sampling and non- sampling errors, advantages and limitations of sampling.

Sampling Methods: Types of sampling : Subjective, Quota, probability and mixed sampling methods. Methods of drawing random samples with and without replacement. Estimates of population mean and total, their variances and the estimates of variances in Simple Random Sampling With and Without Replacement, Stratified Random Sampling with Proportional and Neyman optimum allocation and Systematic Sampling when $N = nk$.

UNIT-II

Time series: Time series and its components with illustrations, additive, multiplicative and mixed models. Determination of trend by least squares and moving average methods. Growth curves and their fitting with reference to Modified exponential, Gompertz and Logistic curves. Determination of seasonal indices by Ratio to moving average, ratio to trend and link relative methods.

UNIT-III

Statistical Quality Control : Importance of SQC in industry. Dimensions of quality, Statistical basis of Shewart control charts. Construction of control charts for variables (mean, range and standard deviation) and attributes (p , np, c and u- charts with fixed and varying sample sizes). Interpretation of control charts.

UNIT-IV

Analysis of Variance and Design of Experiments : Concept of Gauss-Markov linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell, Statistical analysis, Importance and applications of design of experiments.

Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square design (LSD) including one missing observation.

B.Sc. III Year V Semester (CBCS): Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - V)

Practical – 5(B) : Analytical Statistics – I

[with 3 HPW, Credits 1 and 50 Marks]

Practical using R – Software

R – Software : Overview of R, R data types and objects, reading and writing data, sub setting R Objects, Essentials of the R Language, Running R, Packages in R, Variable names and assignment, Operators, Integers, Factors, Logical operations. Operations of Scalars, Vectors, Lists, Arrays, Matrices, Data Frames. Control structures, Functions.

1. Data Visualization using R - Frequency polygons and curves, Ogives, Histogram.
2. Data Visualization using R - Bar diagrams (simple, compound, percentage and multiple) and Pie diagram (single and multiple).
3. Computation of Descriptive Statistics using R (Measures of Central tendencies and Dispersion, Moments, Skewness and Kurtosis).
4. Computation of expected frequencies for Binomial, Poisson using R.
5. Computation of expected frequencies of Normal and Exponential distributions using R.
6. Computation of Karl Pearson's coefficient of correlation and rank correlation using R.
7. Computation of partial and multiple correlations using R.
8. Analysis of Variance for one way and two way classified data using R.
9. Analysis of Variance for CRD and RBD two way classified data using R.
10. Time series Analysis : Computation of Secular trend by least squares and moving averages methods using R.
11. Computation of Seasonal variations by Ratio to moving averages, Ratio to trend and Link Relatives methods using R.
12. Construction of control charts for variables (\bar{x} , \mathbf{R} and σ - charts) using R.
13. Construction of control charts for attributes (p, np with fixed and varying sample size, C and u charts) using R.

Reference Books :

1. V.K. Kapoor and S.C. Gupta : Fundamentals of Applied Statistics. Sultan Chand
2. A. M. Goon, M. K. Gupta, B. Das Gupta : Fundamentals of Statistics Vol - II World Press Private Ltd.,Calcutta
3. A. M. Goon, M. K. Gupta, B. Das Gupta : An outline of Statistical Theory Vol – II, World Press Private Ltd.,Calcutta17.
4. Anuvarita Sankhyaka Sastram – Telugu Academy.

Additional References :

5. Arora, Sumeet Arora, S.Arora : Comprehensive Statistical Methods, S. Chand.
6. B. L. Agarwal : Basic Statistics, New Age publications.
7. S. P. Gupta : Statistical Methods. Sultan Chand and Sons.
8. Parimal Mukhopadhyay : Applied Statistics, New Central Book agency.
9. Daroga Singh and Chowdhary : Theory and Analysis of Sample survey designs. Wiley Eastern.
10. M. R. Saluja : Indian Official Statistics. ISI publications.

Syllabus Approved by BOS in Statistics w. e. f. 2021-22

B.A/B.Sc. III Year V Semester (CBCS) : Statistics Syllabus
(With Mathematics Combination)

(Examination at the end of Semester - V)

Paper – VI - GE : Basic Statistics

[4 HPW :: 4 Credits :: 100 Marks]

UNIT I

Introduction: Definition and scope of Statistics, concepts of statistical population and sample. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives.

UNIT II

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

UNIT III

Bivariate data: Definition, scatter diagram, simple, partial and multiple correlation (3 variables only), rank correlation. Simple linear regression, principle of least squares and fitting of polynomials and exponential curves.

UNIT IV

Theory of attributes, consistency of data, independence and association of attributes, measures of association and contingency.

Reference Books :

1. Goon A.M., Gupta M.K. and Dasgupta B. (2002): Fundamentals of Statistics, Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Miller, Irwin and Miller, Marylees (2006): John E. Freund's Mathematical Statistics with Applications, (7th Edn.), Pearson Education, Asia.
3. Mood, A.M. Graybill, F.A. and Boes, D.C. (2007): Introduction to the Theory of Statistics, 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd. PRACTICAL/ LAB WORK

Syllabus Approved by BOS in Statistics w. e. f. 2021-22

B.A/B.Sc. III Year VI Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - Vi)

Paper - VII(A) : Applied Statistics - II

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Unit –I

Analysis of Variance and Design of Experiments : Concept of Gauss-Markoff linear model with examples, statement of Cochran's theorem, ANOVA – one-way, two-way classifications with one observation per cell Expectation of various sums of squares, Statistical 1 analysis, Importance and applications of design of experiments.

Unit –II

Principles of experimentation, Analysis of Completely randomized Design (C.R.D), Randomized Block Design (R.B.D) and Latin Square Design (L.S.D) including one missing observation, expectation of various sum of squares. Comparison of the efficiencies of above designs.

Unit – III

Vital statistics : Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Unit –IV

Indian Official Statistics: Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in estimation of national income.

Index Numbers : Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as an ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

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B.A/B.Sc. III Year VI Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Practical – 7(A) : Applied Statistics - II

[with 3 HPW, Credits 1 and Marks 50]

Practical using R – Software and MS – Excel

1. Generation Random Samples from the Uniform, Binomial, Poisson, Normal and Exponential distributions using R.
2. Fitting of straight line, parabola and power curves of the type $y = a x^b$, $y = a b^x$ and $y = a e^{bx}$ using R.
3. Large sample tests : Testing population means, proportions, variances based on single and two samples using R.
4. Parametric Tests : Testing means, variances based on single and two samples using R.
5. Tests based on χ^2 distribution using R using R.
6. Nonparametric Tests : one sample run test, Sign test and Wilcoxon sign rank test for one and two samples using R.
7. Nonparametric Tests : Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs Test using R.
8. Analysis of Variance for CRD and RBD data using R and MS - Excel.
9. Analysis of Variance for RBD without and with one missing observation using R and MS - Excel.
10. Analysis of Variance for LSD without and with one missing observation using R and MS - Excel.
11. Computation of Morality rates, Fertility rates and Reproduction rates using MS-Excel.
12. Construction of life tables using MS-Excel.

B.Sc. III Year VI Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Paper - VII(B) : Analytical Statistics - II

[4 HPW :: 4 Credits :: 100 Marks (External : 80, Internal : 20)]

Unit –I

Multivariate distributions : Introduction, concept of Multivariate, Definitions and Statements of properties of Multinomial and Multivariate Normal Distributions with Real life applications.

Regression Analysis : Definition, procedure of Least square estimation, methods of analysis and interpretation, Simple Linear Regression and Multiple Linear Regression for 'n' variables : estimation of parameters, Lack of fit, Mean Square Error, R^2 and adjusted R^2 values, Testing Regression coefficients.

Logistic regression : Definition and model assumptions, estimation of parameters, statements of properties for simple and Multiple Logistic regression. Interpretation of the same.

UNIT-II

Multivariate Data Analysis Techniques : Definitions, Statements of properties of Principal Component Analysis, Factor Analysis, Cluster analysis and Linear Discriminant Analysis (Bayesian and Fishers approaches), Multidimensional Scaling, Applications and interpretation of above techniques to Image processing / pattern recognition.

Unit – III

Vital statistics : Introduction, definition and uses of vital statistics. Sources of vital statistics, registration method and census method. Rates and ratios, Crude death rates, age specific death rate, standardized death rates, crude birth rate, age specific fertility rate, general fertility rate, total fertility rate. Measurement of population growth, crude rate of natural increase- Pearl's vital index. Gross reproductive rate sand Net reproductive rate, Life tables, construction and uses of life tables and Abridged life tables.

Unit –IV

Indian Official Statistics: Functions and organization of CSO and NSSO. Agricultural Statistics, area and yield statistics. National Income and its computation, utility and difficulties in estimation of national income.

Index Numbers : Concept, construction, uses and limitations of simple and weighted index numbers. Laspeyer's, Paasche's and Fisher's index numbers, criterion of a good index numbers, problems involved in the construction of index numbers. Fisher's index as an ideal index number. Fixed and chain base index numbers. Cost of living index numbers and wholesale price index numbers. Base shifting, splicing and deflation of index numbers.

Note : In first two Units emphasis will be on concepts and applications of techniques only.

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B.Sc. III Year VI Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Practical - 7(B) : Analytical Statistics - II

[with 3 HPW, Credits 1 and Marks 25]

Practical using R – Software

1. Generation Random Samples from the Uniform, Binomial, Poisson, Normal and Exponential distributions using R
2. Fitting of straight line, parabola and power curves of the type $y = a x^b$, $y = a b^x$ and $y = a e^{bx}$ using R.
3. Large sample tests : Testing population means, proportions, variances based on single and two samples and tests based on χ^2 distribution using R.
4. Parametric Tests : Testing means, variances based on single and two samples using R.
5. Nonparametric Tests : one sample run test, Sign test and Wilcoxon sign rank test for one and two samples, Median test, Wilcoxon Mann Whitney - U test, Wald - Wolfowitz's runs test using R.
6. Principal Component Analysis using R.
7. Factor Analysis using R.
8. Cluster analysis and Linear Discriminant analysis using R.
9. Model fitting by Simple and Multiple Linear Regression methods using R.
10. Model fitting by simple Logistic regression using R.
11. Computation of Morality rates, Fertility rates and Reproduction rates using R.
12. Construction of life tables using R.

Reference Books:

E-Book : <https://onlinelibrary.wiley.com/doi/book/10.1002/9781118391686>

1. V.K.Kapoor and S.C.Gupta : Fundamentals of Applied Statistics. Sultan Chand
- 2. Multivariate Analysis by Johnson and Wrichon**
3. Prathirupa Sidhanthamulu – Telugu Academy,
4. Prayoga Rachana and Visleshana – Telugu Academy.

Additional References:

- 5. ParimalMukhopadhyay : Applied Statistics . New Central Book agency.**
6. M.R.Saluja : Indian Official Statistics. ISI publications.
7. B.L.Agarwal: Basic Statistics.New Age publications.
8. S.P.Gupta : Statistical Methods. Sultan Chand and Sons.

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B.A/B.Sc. III Year VI Semester (CBCS) : Statistics Syllabus

(With Mathematics Combination)

(Examination at the end of Semester - VI)

Paper - VIII : Operations Research / Project

[4 HPW :: 4 Credits :: 100 Marks]

Unit –I

Operations Research: Meaning and scope of OR. Convex sets and their properties. Definition of general LPP. Formulation of LPP. Solution of LPP by graphical method. Fundamental theorem of LPP. Simplex algorithm.

Unit –II

Concept of artificial variables. Big –M /Penalty method and two-phase simplex methods. Concept of degeneracy and resolving it. Concept of duality, duality as LPP. Dual Primal relationship.

Unit –III

Definition of transportation problem, TPP as a special case of LPP, Initial basic feasible solutions by North-West Corner Rule, Matrix minimum method and VAM. Optimal solution through MODI tableau and stepping stone method for balanced and unbalanced transportation problem. Degeneracy in TP and resolving it. Concept of Transshipment problem.

Unit –IV

Formulation and description of Assignment problem and its variations. Assignment problem as special case of TP and LPP. Unbalanced assignment problem, traveling salesman problem. Optimal solution using Hungarian method. Problem of Sequencing. Optimal sequence of N jobs on two and three machines without passing.

Reference Books:

1. Kanti Swaroop, P. K. Gupta and Man Mohan : Operations Research, Sultan Chand.
2. S. D. Sarma : Operations Research
3. Parikriya Parishodhana - Telugu Academy.

Additional References :

4. Gass : Linear Programming. Mc Graw Hill.
 5. Hadly : Linrar programming. Addison-Wesley.
 6. Wayne L. Winston : Operations Research. Thomson, India edition. 4th edition.
 7. Anuvartita Sankhyaka sastram – Telugu Academy.
 8. Taha : Operations Research: An Introduction : Mac Millan.
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B.A./B.Sc. (STATISTICS)
Theory Question Paper Pattern
w.e.f: Academic Year: 2020-21
(With Mathematics Combination)

Time: 3 hours]

[Max. Marks: 80

Section - A

Answer any EIGHT questions. All questions carry equal marks.
(8Qx4m=32)

1. From Unit I
2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit II
7. From Unit III
8. From Unit III
9. From Unit III
10. From Unit IV
11. From Unit IV
12. From Unit IV

Section - B

Answer ALL questions. All questions carry equal marks. (4Qx12m=48)

13. a) From Unit I
(or)
b) From Unit I
14. a) From Unit II
(or)
b) From Unit II
15. a) From Unit III
(or)
b) From Unit III
16. a) From Unit IV
(or)
b) From Unit IV

B.A./B.Sc. (STATISTICS)
Practical Question Paper Pattern
w.e.f: Academic Year: 2020-21
(With Mathematics Combination)

Time: 3 hours]

[Max. Marks : 50

Solve any THREE problems choosing at least one from each Section
(3Qx15m=45m) and Record: 5m

Section-A

1. From Part 1
2. From Part 1
3. From Part 1

Section - B

4. From Part 2
5. From Part 2
