# Savitribai Phule Pune University

*(Formerly University of Pune)*

**Four Year B.Sc. / B. A Degree Program in Statistics**

**(Faculty of Science & Technology)**

## F. Y. B. Sc./ F. Y. B. A. Statistics Syllabi in NEP

**(Level 4.5)**

**National Education Policy Syllabus**

**To be implemented from Academic Year 2024-2025**

# **Title of the program:** F. Y. B. Sc. / F. Y. B. A. Statistics

**Preamble of the syllabus:**

The word ***Statistics*** is used in different ways in different contexts. To a cricket fan, Statistics is the information about runs scored or wickets taken by a player. To the manager of a manufacturing unit, Statistics may be the information about the process control. To a medical researcher investigating the effects of a new drug, Statistics are evidence of research efforts. To a college student, Statistics are the grades or marks scored in a course. Thus, in all these illustrations Statistics word refers to quantitative data in the area under study. Statistics as a subject is an important branch of knowledge and is devoted to various techniques of collection, presentation, analysis, and interpretation of data. It is a science of learning from data.

Statistics provides tools for making decisions when conditions of uncertainty prevail. Hence these tools and techniques are used in almost all fields. Statistics is indispensable for people working in fields like agriculture, business, management, economics, finance, insurance, education, biotechnology, and medical science etc. Since last two decade, with the help of computers large amount of data can be handled and more sophisticated statistical techniques can be used in an effective manner. Knowledge of different aspects of Statistics has become crucial. There is a continuous demand for statisticians in every field – education, industry, software, insurance, clinical trials data and research. The syllabus of the three-Year B. Sc. degree course in Statistics is framed in such a way that the students at the end of the course can apply judiciously the statistical tools to a variety of data sets to arrive at some conclusions.

Statistics can be divided into two broad categories, (1) exploratory statistics or descriptive statistics, which is concerned with summarizing data and describing these data, and (2) confirmatory statistics or inferential statistics, which is concerned with making decisions about the population based on the sample.

Up to higher secondary school, students are mostly exposed to descriptive statistics. These techniques are briefly reviewed but the emphasis in degree course is on inferential statistics. At the end of the degree course a student is expected to apply statistical tools to real life data and analyze it.

**Introduction: National Education Policy (NEP) 2023.**

B. Sc. in Statistics program is of four years duration, with semester pattern for all the four years.

At **first year of under-graduation**, students will be given the basic information that includes – methods of data representation and summarization. Correlation and regression are the forecasting tools that are frequently used in statistical analysis. These topics are studied in one of the papers

each semester. Further they are introduced to probability and different discrete probability distributions along with applications in the other paper. Relevant experiments on these topics will be included in the practical course. Further the students are expected to start using statistical software MS-Excel and verify the computations during practical. It is a skill-oriented part of the course. Also, students are expected to study skills Counting Principles, Permutations and Combinations, Scope of Statistics and Statistical Organizations in India: binomial theorem and its applications, preparation of questionnaire statistical population and sampling methods:

At **second year of under-graduation,** students are expected to study various probability distributions and its applications to real life situations. It is a foundation for further theory. An important branch of Statistics, viz. testing of hypotheses related to mean, variance, proportion, correlation etc. will be introduced. Some topics related to applications of Statistics will also be introduced. Further the students are expected to start using statistical software *R* and verify the computations during practical. It is a skill-oriented part of the course.

At **third year of under-graduation**, theory papers deal with theoretical as well as applied aspect of statistics. Some papers such as distribution theory, theory of estimation, and regression analysis are core and mathematical in nature. Some papers such as sampling methods are core and applied but less mathematical. In the Design of Experiments paper, various designs used in agriculture and industry. Actuarial statistics, time series, optimization techniques (operations research), and clinical trials, are elective courses, There are some skill oriented courses C programming and R software. There are four practical courses based on core courses. Some statistical methods and practicals on it are in minor subjects. Ongoing job training program is included.

At **fourth year of under-graduation** theory papers deal with theoretical as well as applied aspect of statistics. Some papers such as fundamentals of analysis and calculus and, linear algebra are core mathematical in nature. Probability distributions, modern statistical inference, regression analysis and applications, multivariate analysis and applications are core statistics in nature. There are four practical courses based on core courses Papers. Ongoing job training program is included. One minor paper Research Methodology is included.

# Structure of Four Year-degree Program

Structure of the course for four years, the pattern of examination and question papers are as per Savitribai Phule Pune University:

**Statistics as Major (Core) Subject and any other subject as Minor (each theory / practical paper has 2 credits).**

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| I 4.5/100 | I | STS-101-T | Univariate and bivariate data analysis | 02 | 02 |
| | | STS-102-P | Statistics Practical–I | 02 | 04 |
| | II | STS-151-T | Theory of Probability and Discrete Probability Distributions | 02 | 02 |
| | | STS-152-P | Statistics Practical–II | 02 | 04 |
| II 5.0/200 | III | STS-201-MJ | Expectation of bivariate Probability Distribution and Discrete Probability Distributions | 02 | 02 |
| | | STS-202-MJ | Continuous Probability Distributions | 02 | 02 |
| | | STS-203-MJP | Statistics Practical–III | 02 | 04 |
| | IV | STS-251-MJ | Testing and Statistical Methods | 02 | 02 |
| | | STS-252-MJ | Sampling Distributions and Exact Tests | 02 | 02 |
| | | STS-253-MJP | Statistics Practical–IV | 02 | 04 |
| III 5.5/300 | V | STS-301-MJ | Distribution Theory | 02 | 02 |
| | | STS-302-MJ | Theory of Estimation | 02 | 02 |
| | | STS-303-MJ | Design and Analysis of Experiments | 02 | 02 |
| | | STS-304-MJ | Regression Analysis | 02 | 02 |
| | | STS-305-MJP | Statistics Practical–V (based on STS-301-MJ and STS-302-MJ) | 02 | 04 |
| | | STS-306-MJP | Statistics Practical–VI (based on STS-303-MJ and STS-304-MJ) | 02 | 04 |
| | VI | STS-351-MJ | Testing of Hypothesis | 02 | 02 |
| | | STS-352-MJ | Sampling Theory | 02 | 02 |
| | | STS-353-MJ | Statistical process and product control | 02 | 02 |

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|---|---|---|---|---|---|
| | | STS-354-MJ | Survival analysis | **02** | **02** |
| | | STS-355-MJP | Statistics Practical–X (based on STS-351-MJ and STS-352-MJ) | **02** | **04** |
| | | STS-356-MJP | Statistics Practical–XI (based on STS-353-MJ and STS-354-MJ) | **02** | **04** |
| **Four years UG Honours with Research degree in Major and Minor with 176 Credits** | | | | | |
| **IV 6.0/400** | **VII** | STS-401-MJ | Fundamentals of Analysis and Calculus | **02** | **02** |
| | | STS-402-MJ | Linear Algebra | **02** | **02** |
| | | STS-403-MJ | Probability Distributions | **02** | **02** |
| | | STS-404-MJP | Statistics Practical XV | **02** | **04** |
| | | STS-405-MJP | Statistics Practical XVI | **02** | **04** |
| | **VIII** | STS-451-MJ | Modern Statistical Inference | **02** | **02** |
| | | STS-452-MJ | Regression Analysis and Applications | **02** | **02** |
| | | STS-453-MJ | Multivariate Analysis & Applications | **02** | **02** |
| | | STS-454-MJP | Statistics Practical XX | **02** | **04** |
| | | STS-455-MJP | Statistics Practical XXI | **02** | **04** |
| **Four years UG Honours degree in Major and Minor with 176 Credits** | | | | | |
| **IV 6.0/400** | **VII** | STS-401-MJ | Fundamentals of Analysis and Calculus | **02** | **02** |
| | | STS-402-MJ | Linear Algebra | **04** | **04** |
| | | STS-403-MJ | Probability Distributions | **04** | **04** |
| | | STS-404-MJP | Statistics Practical XV : Data Analytics using R | **04** | **08** |
| | **VIII** | STS-451-MJ | Modern Statistical Inference | **02** | **02** |
| | | STS-452-MJ | Regression Analysis and Applications | **04** | **04** |
| | | STS-453-MJ | Multivariate Analysis & Applications | **04** | **04** |
| | | STS-454-MJP | Statistics Practical XIX (Based on Data Analytics using R and/or Python) | **04** | **08** |

## List of major Electives:

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| III 5.5/300 | V | STS-310-MJ | Time Series analysis **OR** | 02 | 02 |
| | | STS-311-MJ | Operation Research **OR** | 02 | 02 |
| | | STS-312-MJ | Reliability theory | 02 | 02 |
| | | STS-313-MJP | Statistics Practical VII (based on Time Series analysis) **OR** | 02 | 04 |
| | | STS-314-MJP | Statistics practical – VIII (based on Operation Research) **OR** | 02 | 04 |
| | | STS-315-MJP | Statistics practical – IX (based on Reliability theory) | 02 | 04 |
| | VI | STS-360-MJ | Stochastic Processes **OR** | 02 | 02 |
| | | STS-361-MJ | Medical Statistics and Clinical Trials **OR** | 02 | 02 |
| | | STS-362-MJ | Operations Management (inventory models, replacement theory, decision theory, sequencing, simulation) | 02 | 02 |
| | | STS-363-MJP | Statistics Practical-XII (based on Stochastic processes) **OR** | 02 | 04 |
| | | STS-364-MJP | Statistics Practical -XIII (based on Medical Statistics and Clinical Trials) **OR** | 02 | 04 |
| | | STS-365-MJP | Statistics Practical- XIV (based on Operations Management) | 02 | 04 |
| **Four years UG Honours with Research degree in Major and Minor with 176 Credits** | | | | | |
| IV 6.0/400 | VII | STS-410-MJ | Optimization Techniques **OR** | 02 | 02 |
| | | STS-411-MJ | Statistical Quality Control **OR** | 02 | 02 |
| | | STS-412-MJ | Actuarial Statistics | 02 | 02 |
| | | STS-413-MJP | Statistics Practical- XVII (based on Optimization Techniques) **OR** | 02 | 04 |
| | | STS-414-MJP | Statistics Practical- XVIII (based on Statistical Quality Control) **OR** | 02 | 04 |

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|---|---|---|---|---|---|
| | | STS-415-MJP | Statistics Practical- XIX (based on Actuarial Statistics) | **02** | **04** |
| | **VIII** | STS-460-MJ | Advances in Generalized Linear Models | **02** | **02** |
| | | | **OR** | | |
| | | STS-461-MJ | Statistical Methods in Epidemiology | **02** | **02** |
| | | | **OR** | | |
| | | STS-462-MJ | Discrete Data Analysis | **02** | **02** |
| | | STS-463-MJP | Statistics Practical- XXII (based on Advances in Generalized Linear Models) **OR** | **02** | **04** |
| | | STS-464-MJP | Statistics Practical- XXIII (based on Statistical Methods in Epidemiology) | **02** | **04** |
| | | | **OR** | | |
| | | STS-465-MJP | Statistics Practical- XXIV (based on Discrete Data Analysis) | **02** | **04** |
| **Four years UG Honours degree in Major and Minor with 176 Credits** | | | | | |
| **IV 6.0/400** | **VII** | STS-410-MJ | Optimization Techniques **OR** | **02** | **02** |
| | | STS-411-MJ | Statistical Quality Control **OR** | **02** | **02** |
| | | STS-412-MJ | Actuarial Statistics | **02** | **02** |
| | | STS-413-MJP | Statistics Practical- XVI (based on Optimization Techniques) **OR** | **02** | **04** |
| | | STS-414-MJP | Statistics Practical- XVII (based on Statistical Quality Control) **OR** | **02** | **04** |
| | | STS-415-MJP | Statistics Practical- XVIII (based on Actuarial Statistics) | **02** | **04** |
| | **VIII** | STS-460-MJ | Advances in Generalized Linear Models | **02** | **02** |
| | | | **OR** | | |
| | | STS-461-MJ | Statistical Methods in Epidemiology | **02** | **02** |
| | | | **OR** | | |
| | | STS-462-MJ | Discrete Data Analysis | **02** | **02** |
| | | STS-463-MJP | Statistics Practical- XX (based on Advances in Generalized Linear Models) | **02** | **04** |
| | | | **OR** | | |

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|---|---|---|---|---|---|
| | | STS-464-MJP | Statistics Practical- XXI (based on Statistical Methods in Epidemiology) | **02** | **04** |
| | | | **OR** | | |
| | | STS-465-MJP | Statistics Practical- XXII (based on Discrete Data Analysis) | **02** | **04** |

## List of Vocational Skill Courses (VSC):

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| **II 5.0/200** | **III** | STS-221-VSCP | Introduction to MS-EXCEL -I (Practical Course) | **02** | **04** |
| | **IV** | STS-271-VSCP | Introduction to MS-EXCEL -II (Practical Course) | **02** | **04** |
| **III 5.5/300** | **V** | STS-321-VSCP | Practical on C-Programming (Turbo C) (Practical Course) | **02** | **04** |
| | **VI** | STS-371-VSCP | Data Analysis with Python (Practical Course) | **02** | **04** |

## Field Project (FP) / On Job Training (OJT)/ Community Engagement Project (CEP):

| Year / Level | Sem. | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| **II 5.0/200** | **III** | STS-231-FP | Field Project | **02** | |
| | **IV** | STS-281-CEP | Community Engagement Project | **02** | |
| **III 5.5/300** | **V** | STS-331-FP/CEP | Field Project / Community Engagement Project | **02** | |
| | **VI** | STS-381-OJT | On Job Training | **04** | |
| **Four years UG Honours with Research degree in Major and Minor with 176 Credits** | | | | | |
| **IV 6.0/400** | **VII** | STS-431-RP | Research Project | **04** | |
| | **VIII** | STS-481-RP | Research Project | **08** | |

| Four years UG Honours degree in Major and Minor with 176 Credits | | | | | |
|---|---|---|---|---|---|
| **IV 6.0/400** | **VIII** | STS-481-OJT | On Job Training | **04** | |

## Statistics as Minor Subject and any other subject as Major (each theory / practical paper has 2 credits)

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| **II 5.0/200** | **III** | STS-241-MN | Probability Distributions and Demography | **02** | **02** |
| | | STS-242-MNP | Statistics Practical on Probability Distributions and Demography | **02** | **04** |
| | **IV** | STS-291-MN | Sampling Distributions Statistical Inference | **02** | **02** |
| | | STS-292-MNP | Practical on Sampling Distributions and Statistical Inference | **02** | **04** |
| **III 5.5/300** | **V** | STS-341-MN | Statistical Methods | **02** | **02** |
| **Four years UG Honours with Research degree in Major and Minor with 176 Credits** | | | | | |
| **IV 6.0/400** | **VII** | STS-441-MN | Research Methodology | **04** | |
| **Four years UG Honours degree in Major and Minor with 176 Credits** | | | | | |
| **IV** | **VII** | STS-441-MN | Research Methodology | **04** | |

## List of Generic / Open Electives (OE):

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| I 4.5/100 | I | OE-101-STS<br>OE-102-STS | Elementary Commercial Statistics **OR**<br>Elementary Statistics for Social Sciences | **02**<br>**02** | **02**<br>**02** |
| | II | OEP-151-STS<br><br>OEP-152-STS | Practical on Elementary Commercial Statistics **OR**<br>Practical on Elementary Statistics for Social Sciences | **02**<br><br>**02** | **04**<br><br>**04** |
| II 5.0/200 | III | OE-201-STS<br>OE-202-STS | Business Statistics **OR**<br>Applied Statistics | **02**<br>**02** | **02**<br>**02** |
| | IV | OEP-251-STS<br><br>OEP-252-STS | Practical based on Business Statistics<br>**OR**<br>Practical based on Applied Statistics | **02**<br><br>**02** | **04**<br><br>**04** |

## List of Skill Enhancement Courses (SEC):

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| I 4.5/100 | I | SECP-101-STS | MS-EXCEL for Data Analysis (Practical Course) | **02** | **04** |
| | II | SECP-151-STS | Computational Statistics using MS-EXCEL (Practical Course) | **02** | **04** |
| II 5.0/200 | IV | SECP-251-STS | Descriptive Statistics using R-software (Practical Course) | **02** | **04** |

## Indian Knowledge System (IKS):

| Year / Level | Sem | Code Number | Title of the paper (Theory / Practical) | Credits allotted | Lecture/Practical hours per week |
|---|---|---|---|---|---|
| **I 4.5/100** | **I** | STS-101-IKS | Generic | **02** | **02** |
| **II 5.0/200** | **III** | STS-201-IKS | Evolution / Development of Statistics in India | **02** | **02** |

# SEMESTER -I

**Paper Code and Title: STS-101-T: Univariate and bivariate data analysis**

**Course type- Theory No. of credits – 2 No. of contact hours - 30**

## Course Outcomes:

By the end of the course, students should be able to:

1. Identify the appropriate scale of measurement for a particular characteristic under study.
2. Calculate and describe data through measures of central tendency and dispersion.
3. Interpret the utilization of measures of central tendency and dispersion to compare groups.
4. Calculate and interpret coefficients of skewness and kurtosis.
5. Fit linear and non-linear regression models.

| Unit No. | Content | No. of Hours |
|---|---|---|
| 1 | **Population and Sample** | 04 |
| | **1.1** Types of characteristics: a) Attributes: Nominal scale, ordinal scale, b) Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale. Real life illustrations. | |
| | **1.2** Types of data: Primary data, Secondary data, Cross-sectional data, time series data, directional data. | |
| | **1.3** Notion of a statistical population: Finite population, infinite population, homogeneous population, and heterogeneous population. Notion of a sample and a random sample. Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR), stratified random sampling, systematic sampling, cluster sampling and two-stage sampling. | |
| 2 | **Summary Statistics:** | 12 |
| | **2.1** Classification of data: Raw data and its classification, ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, cumulative frequency distribution, Inclusive and exclusive methods of classification, Open end classes, relative frequency distribution and frequency density. Numerical problems. | |

**2.2 Measures of Central Tendency:**

Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average.

Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of several groups, merits and demerits, trimmed arithmetic mean.

Geometric Mean (G.M.): Definition, formula, merits, and demerits.

Harmonic Mean (H.M.): Definition. Formula, merits, and demerits.

Order relation between arithmetic mean, geometric mean, harmonic mean.

Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits. Empirical relation between mean, median and mode.

Partition Values: Quartiles, Deciles and Percentiles (for ungrouped and grouped data).

Weighted Mean: weighted A.M., G.M. and H.M.

Situations where one kind of average is preferable to others. Numerical problems.

**2.3 Measures of Dispersion:**

Concept of dispersion, characteristics of good measure of dispersion. Absolute and relative measure of dispersion. Range and coefficient of range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits and coefficient of Quartile deviation, Mean deviation: Definition, merits, and demerits, minimality property (without proof) and coefficient of Mean deviation, Mean square deviation: Definition, minimality property of mean squared deviation (with proof), coefficient of mean square deviation. Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, combined variance for n groups. Coefficient of variance. Numerical problems.

**3 Moments, Skewness and Kurtosis** **04**

**3.1** Raw moments for ungrouped data and frequency distribution.

Central moments for ungrouped data and frequency distribution, Effect of change of origin and scale (without proof). Relations between central moments and raw moments, up to $4^{th}$ order (without proof).

**3.2** Concept of skewness for frequency distribution, positive skewness, negative skewness, symmetric frequency distribution. Assessment of skewness from Box plot. Bowley's coefficient of skewness. Bowley's coefficient of skewness lies between −1 to 1 (with proof). Karl Pearson's coefficient of skewness. Measures of skewness based on moments (Pearsonian's coefficient).

**3.3** Concepts of kurtosis, Types of kurtosis: leptokurtic, mesokurtic, and platykurtic frequency distributions. Measures of kurtosis based on moments (Pearsonian's coefficient).

**4 Correlation and Regression** **10**

**4.1** Bivariate data, Scatter diagram and its interpretation.

Concept of correlation between two variables. Types of correlation (positive correlation, negative correlation, no correlation). Covariance between two variables. Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data with interpretation. Its properties.

Spearman's rank correlation coefficient: Definition, computation (without ties).

**4.2** Meaning of regression, relation between correlation and regression.

Simple linear regression model: $Y= a + b X + \varepsilon$, where $\varepsilon$ is a continuous random variable with $E(\varepsilon)=0$, $V(\varepsilon)= \sigma^2$. Assumptions of regression model, Estimation of parameters of the model by method of least squares. Interpretation of parameters.

Concept of error in regression, mean residual sum of squares, Explained and unexplained variation, coefficient of determination. Concept of residual, plot of residual against X. Standard error of an estimate of line of regression.

**4.3** Non-linear regression, Necessity and importance of drawing second degree curve. Fitting of second-degree curve ($Y = a + bX + cX^2$), Fitting of exponential curves of the type $Y = a\, b^X$ and $Y = a\, X^b$. In all these curves constants or parameters are estimated by the method of least squares. (Justification via determinant of matrix of second derivative/second derivative test). Mean residual sum of squares as a criterion to decide the best fit of the curve.

## References:


1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Brase C. H., Brace C. P (2016). Understandable Statistics, Concepts and Methods, 12th Edition, Cengage Learning.
3. Freedman D., Pisani R., Purves R. (2007). Statistics, 4th Edition, W. W. Norton, and Company.
4. Freund J. E. (1977). Modern Elementary Statistics. 4th Edition, Prentice Hall of India Private Limited, New Delhi.
5. Ghosh, J. K. and Mitra, S. K., Parthsarthi, K. R. (1993). Glimpses of India's Statistics Heritage, Wiley publishing Co.
6. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
7. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
8. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
9. Heumann C., Schomaker, M., Shalabh (2016). Introduction to Statistics and Data Analysis. 1st Edition, Springer, Germany.
10. Moore D. S., Notz W. I., Fligner M. A. (2013). The Basic Practice of Statistics, 6th Edition, Ruth Baruth.
11. Utts J. M., Heckard R. F. (2010). Mind On Statistics, 4th Edition, Richard Stratton Publisher.
12. Zealure C. H. (1998). Fundamentals of Descriptive Statistics. 1st Edition, Routledge, U. K. (Taylor and Francis Group).
13. Neil A. Weiss, (2016). Introductory Statistics, Tenth Edition, Pearson.
14. Snedecor G. W. and Cochran W. G. (1989). Statistical Methods, Eighth Ed. East- West Press.


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**Paper Code and Title: STS-102-P: Statistics Practical -I**

**Course type- Practical No. of credits – 02 No. of contact hours –60(48+12)**

## Course Outcomes:

By the end of the course, students should be able to:

1. have knowledge of preparing the frequency distribution and presentation using tabular form.
2. use various diagrammatic and graphical techniques to represent statistical data and interpret.
3. analyze data pertaining to discrete variables and to interpret the results.
4. compute various measures of central tendency, dispersion, skewness, and kurtosis.
5. compute correlation coefficient for given data and interpret results

| Sr. No. | Title of the experiment |
|---|---|
| 1. | Preparation of frequency distribution for discrete and continuous variables for raw data. |
| 2. | Tabulation |
| 3. | Diagrammatic representation of statistical data I: simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram. |
| 4. | Diagrammatic representation of statistical data-II: pie diagram, spike plot for Likert scale. Data interpretation from diagrams. |
| 5. | Graphical representation of statistical data I: Histogram and frequency curve. Determination of mode graphically. |
| 6. | Graphical representation of statistical data-II: ogive curves and Pareto chart. Determination of median graphically. Data interpretation from graphs. |
| 7 | Use of random number tables to draw SRSWOR, SRSWR, stratified sample and systematic sample. |
| 8. | Summary statistics – I: Computation of measures of central tendency and dispersion (ungrouped data). Use of an appropriate measure and interpretation of results and computation of partition values. |
| 9. | Summary statistics – II: Computation of measures of central tendency and dispersion |

| | |
|---|---|
| | (grouped data). Use of an appropriate measure and interpretation of results and computation of partition values. |
| 10 | Computations of central moments |
| 11 | Measures of skewness and kurtosis. Box plot. |
| 12 | Scatter diagram and computation of Karl Pearson's correlation coefficient |

**Note: Every practical is equivalent to four theory lectures per batch per week.**

# Generic / Open Elective (OE)

**Paper Code and Title: OE-101-STS: Elementary Commercial Statistics**

**Course type- Theory** **No. of credits – 2** **No. of contact hours –30**

## Course Outcomes:

By the end of the course, students should be able to:

1. Identify the appropriate scale of measurement for a particular characteristic under study.

2. Represent data using appropriate diagram/graph.

3. Calculate and describe data through measures of central tendency, dispersion, skewness, and kurtosis.

4. To compute the correlation coefficient for bivariate data and interpret it.

5. To fit linear regression.

6. Interpret the utilization of measures of central tendency and dispersion to compare group results.

| Unit No. | Content | No. of Hours |
|---|---|---|
| 1 | **Types of data and Basic Exploratory Analysis:** | 05 |
| | **1.1** Primary data, Secondary data, Time Series data, Cross-sectional data, Directional data, Survival data. | |
| | **1.2** Primary data, Secondary data, Time Series data, Cross-sectional data, Directional data, Survival data. | |
| | **1.3** Diagrammatic representation of statistical data: simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram, pie diagram. | |
| | **1.4** Graphical representation of statistical data: Line graph, histogram (with equal and unequal class width) frequency curve, ogive curves, Steam and leaf chart and scatter plot. | |
| | **1.5** Numerical problems related to real life situations. | |

**2 Measures of central tendency** **05**

**2.1** Concept of central tendency, requisites of good measures of central tendency.

**2.2** Arithmetic mean: Definition, computation for ungrouped and grouped data, combined mean, weighted mean, merits and demerits

**2.3** Geometric mean and harmonic mean.

**2.4** Median and Mode: Definition, formula for computation for ungrouped and grouped data, graphical method, merits, and demerits. Empirical relation between mean, median and mode. (without proof)

**2.5** Partition Values: Quartiles, Percentiles, Deciles, Box Plot.

**2.6** Numerical problems related to real life situations.

**3 Measures of Dispersion** **04**

**3.1** Concept of dispersion and measures of dispersion, requisites of good measures of dispersion, absolute and relative measures of dispersion.

**3.2** Range and Quartile Deviation: definition for ungrouped and grouped data and their coefficients, merits and demerits.

**3.3** Variance and Standard deviation: definition for ungrouped and grouped data, coefficient of variation, combined variance & standard deviation, merits and demerits.

**3.4** Numerical problems related to real life situations.

**4 Moments, Skewness and Kurtosis:** **04**

**4.1** Notion of Moments: Raw moments and Central moments (For ungrouped and grouped data), Relationship between raw and central moments (up to fourth order, without proof).

**4.2** Concept of symmetry and skewness, types of skewness, assessing skewness from boxplots, coefficients of skewness with interpretation: Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness and its range, Pearsonian’s coefficient of skewness, comparison of datasets with respect to

type and extent of skewness.

**4.3** Concept of kurtosis, types of kurtosis, Pearsonian's coefficient of kurtosis, and its interpretation.

**4.4** Numerical Examples

**5 Correlation and Regression Analysis** **12**

**5.1** Bivariate data, Scatter diagram and interpretation

**5.2** Concept of correlation between two variables, positive correlation, negative correlation, no correlation.

**5.3** Covariance between two variables: Definition, computation, effect of change of origin and scale (without proof).

**5.4** Karl Pearson's coefficient of correlation (r): Definition, computation for ungrouped data and interpretation. Properties: i) $-1 \leq r \leq 1$(without proof), ii) Effect of change of origin and scale (without proof).

**5.5** Spearman's rank correlation coefficient: Definition, computation, and interpretation (without ties). In the case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)

**5.6** Concept of dependent and independent variables in regression.

**5.7** Identification of response and predictor variables and relation between them.

**5.8** Meaning of regression, difference between correlation and regression, Connection between correlation and regression.

**5.9** Fitting of line $Y = a + bX$, a and b are estimated using least square principle method (without proof). Interpretation of regression coefficient.

**5.10** Numerical Problems related to real life situations

## References:

1. Brase C. H., Brace C. P (2016). Understandable Statistics, Concepts and Methods, 12th Edition, Cengage Learning.

2. Freedman D., Pisani R., Purves R. (2007). Statistics, 4th Edition, W. W. Norton and Company.

3. Freund J. E. (1977). Modern Elementary Statistics. 4th Edition, Prentice Hall of India Private Limited, New Delhi.

4. G.W. Snedecor, W.G. Cochran (1989), Statistical Methods, John Wiley & sons.

5. Goon A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1. 6th Revised Edition, The World Press Pvt. Ltd., Calcutta.

6. Gupta S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics. 8th Edition, Sultan Chand and Sons Publishers, New Delhi.

7. Kennedy, W.J. and Gentle, J.E., (2021). Statistical computing. Routledge.

8. Moore D. S., Notz W. I., Fligner M. A. (2013). The Basic Practice of Statistics, 6th Edition, Ruth Baruth.

9. Utts J. M., Heckard R. F. (2010). Mind On Statistics, 4th Edition, Richard Stratton Publisher.

10. Zealure C. H. (1998). Fundamentals of Descriptive Statistics. 1st Edition, Routledge, U.K. (Taylor and Francis Group).

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# Generic / Open Elective (OE)

**Paper code and title – OE-102-STS-Elementary Statistics for Social Sciences**

**Course type: Theory** **No. of Credits: 02** **No. of Contact Hours: 30**

**Course Outcomes:**

At the end of this course, students will be able:

1. To identify the appropriate data type suitable for an intended survey.

2. To identify the most suited sampling method for an intended survey.

3. To anticipate difficulties/problems in data collection and take proactive measures to resolve them.

4. To create structured and organized survey forms.

5. To compute coefficients used to assess internal consistency of collected data.

6. To effectively represent collected data through diagrams and/or graphs.

| Unit No. | Content | No. of Hours |
|---|---|---|
| **1** | **Types of Data** | **03** |
| | **1.1** Types of characteristics: Attributes and Variables, Measurement scale for attributes: Nominal and Ordinal scale, Measurement scale for variables: Ratio and Interval scale, Likert scale. (all with relevant illustrations). | |
| | **1.2** Types of data: Primary data, Secondary data, Cross sectional data, Time series data. (all with relevant illustrations). | |
| **2** | **Methods of Sampling** | **07** |
| | Statistical population, Finite population, Infinite population, homogeneous population, heterogeneous population, Random sampling: Simple random sampling with and without replacement, Stratified sampling, Systematic sampling, Cluster Sampling, Two-stage sampling, Non-random sampling: Purposive sampling, Snowball sampling, Convenience sampling, Crowdsourcing sampling. (only descriptions and illustrations of all methods). | |
| **3** | **Questionnaires, Errors and Consistency** | **12** |
| | **3.1** Characteristics of a good questionnaire, Problems faced in data collection: problem of non- response, sampling errors, non-sampling errors, validity (internal consistency) using Cronbach's alpha and Kuder Richardson's | |

coefficient (KR-20).

**3.2** Designing questionnaires for surveys (i.e. survey forms) (with various sections if required) using various online platforms such as Google Forms, Survey Monkey, Form Façade (an add-on to customize Google Forms), etc., Aesthetic presentation of survey forms, Flow of questions.

**3.3** Processing Survey Data: Downloading responses as MS-Excel sheets, computation of summated scores (for Likert scale-based questions), coding data, computation of Cronbach's alpha and Kuder Richardson's coefficient (KR-20).

**4 Basic Exploratory Analysis** **08**

Selection of appropriate diagram/graph type, Construction of diagrams (simple bar, subdivided bar, multiple bar, pie), graphs (histogram, boxplot, etc.)

## References:

1. R. M. and et.al. (2009), Survey Methodology, Second Edition, Wiley Series in Survey Groves Methodology.
2. Mukhopadhyay P. (2008), Theory and Methods of Survey Sampling, Prentice-Hall India, New Delhi.
3. Murthy M. N., (1977), Sampling Theory and Methods, Statistical Publishing Society, Kolkata.
4. Sukhatme P. V., Sukhatme B. V. (1984), Sampling Theory of Surveys with Applications, Indian Society of Agricultural Statistics, New Delhi.

# Skill Enhancement Course (SEC)

**Paper code and title SECP-101-STS— MS-EXCEL for Data Analysis**

**Course type: Practical No. of Credits: 02 No. of Contact Hours: 60(48+12)**

**Course Outcomes:**

At the end of this course, students will be able:

1. Students will be familiar with MS-Excel.

2. Students will be able to create spreadsheets, enter data, and maintain data.

3. Students will be able to handle data using existing MS-Excel functions.

4. Students will be able to draw appropriate diagrams or graphs to the given data.

| Unit No. | Content |
|---|---|
| **1** | **Getting Acquainted with MS-Excel** |
| **1.1** | Introduction to MS-Excel |
| **1.2** | The Excel Environment: Cells, Rows, and Columns, Title Bar, Ribbon, Scroll Bars, Quick Access Toolbar, Formula Bar, Workbook View Buttons, Zoom Slider, Mini Toolbar, Keyboard Shortcuts, Formulas, Sheet Tabs, Page Margins, Page Orientation, Page Breaks and Printing. |
| **1.3** | Worksheets and Workbooks: Definition of Worksheets and Workbooks, creating and saving new worksheet, Naming of Worksheets, Adding and Deleting Worksheets, Hiding/ Unhiding Worksheets, Hiding Columns and Rows, Saving Workbooks, Saving an Existing File, Headers and Footers, Inserting, Deleting, copy and Renaming of Worksheets. Conditional Formatting and cell styles |
| **2** | **Entering and Editing Information** |
| **2.1** | Import external data, Entering Data, create a table, Labels and Values, Copying Cells, Rows and Columns, Pasting Cells, Rows, and Columns, Paste an Item from the Clipboard |
| **2.2** | Inserting and Deleting Rows and Columns, Filling and Editing Cell Data, Find and |

Replace, Go To Cell Data, Locking Rows and Columns, Spell Check, AutoCorrect.

## 3 Formatting & Adding Elements to a Worksheet

**3.1** Change Font Styles and Sizes, Adding Borders and Colours to Cells, change Column Width, change Row Height, Merge Cells, Applying Number Formats

**3.2** Creating Custom Number Formats, Align Cell Contents, Cell Styles, Conditional Formatting, Freeze and Unfreeze Rows and Columns, Adding and Modifying Images

**3.3** Removing A Background, Cropping and Rotating an image, compressing a Picture, Inserting AutoShapes, Adding WordArt, Clip Art, and a Hyperlink.

## 4 Inbuild MS-Excel Functions

**4.1** Logical: IF, AND, NOT, OR, LET, LAMBDA, TRUE, FALSE, SWITCH, etc.

**4.2** Mathematical: ABS, EXP, CEILING, FLOOR, INT, EVEN, ODD, COMBIN, COMBINA, FACT, FACTDOUBLE, GCD, LCM, LN, LOG, LOG10, MOD, MULTINOMIAL, POWER, PRODUCT, RAND, RANDARRAY, RANDBETWEEN, ROUND, SIGN, SQRT, etc.

**4.3** Lookup: LOOKUP, HLOOKUP, VLOOKUP, XLOOKUP, etc.

**4.4** Other functions: Date and Time Functions, Text functions, sort, duplicate, Pivot table and Pivot chart

## 5 Graphical Representation

**5.1** Titles, legend, data labels, creating a New Chart, Formatting the Chat, Types of charts, Using Chart Templates.

**5.2** Simple bar diagram, subdivided bar diagram, multiple bar diagram, percentage bar diagram, pie diagram, rod or spike plot, histogram, frequency curve and ogive curves, Pareto chart.

## List of practical:

| Sr. No. | Title of the Experiment | No. of Experiments |
|---|---|---|
| 1 | Introduction to MS-Excel | 3 |
| 2 | Basic Mathematical Functions | 2 |
| 3 | Conditional Logic Functions | 1 |
| 4 | Lookup Functions | 1 |
| 5 | Diagrammatic or graphical representation using MS-Excel | 3 |
| 6 | Pivot Table | 1 |
| 7 | Pivot Chart | 1 |

**Note: Every practical is equivalent to four theory hours per batch per week.**

## References:

1. Frag Curtis (2013). Step by Step Microsoft Excel 2013, MS Press.

2. Frye Curtis D. (2007). Step by step Microsoft Office Excel 2007, Microsoft Press.

3. John Walkenbach (2013). 101 Excel 2013 Tips, Tricks and Time severs, Wiley.

4. Kumar Bittu (2013). Microsoft Office 2010, V&S Publishers.

5. Salkind Neil J. and Frey Bruce B. (2021). Statistics for people who (Think They) Hate Statistics, Using MS- Excel, Sage Publications.

6. Sanjay Saxen (2007). MS Office 2000 for everyone, Vikas Publishing House.

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# SEMESTER II

**Paper Code and Title: STS-151-T: Theory of Probability and Discrete Probability Distributions**

**Course type- Theory No. of credits – 02 No. of contact hours - 30**

## Course Outcomes:

By the end of the course, students should be able to:

1. familiarized with basic concepts of random experiments, random variable, probability, etc.
2. get ideas regarding the use of probability in real life situations. Also, can find out the probability of real-life events.
3. identify the nature of data using moments, skewness, kurtosis, etc.
4. see the dependency of events using probability.
5. apply standard discrete probability distribution to different real situations.

| Unit No. | Content | No. of Hours |
|---|---|---|
| **1** | **Basics of Probability** | **04** |

**1.1** Experiments/Models, Ideas of deterministic and non-deterministic models. Random Experiment, concept of statistical regularity.

**1.2** Definitions: i) Sample space, ii) Discrete sample space: finite and countably infinite, iii) Event, iv) Elementary event, v) Complement of an event. vi) Certain event, vii) Impossible event. Concept of occurrence of an event.

Algebra of events and its representation in set theory notation.

Occurrence of following events: i) at least one of the given events, ii) none of the given events, iii) all the given events, iv) mutually exclusive events, v) mutually exhaustive events, vi) exactly one event out of the given events. Numerical problems.

**1.3** Classical definition of probability and its limitations. Probability model, probability of an event, equiprobable and non-equiprobable sample space,

**1.4** Axiomatic definition of probability. Theorems and results on probability with proofs based on axiomatic definition such as $P(AUB)=P(A)+P(B)-P(A \cap B)$. Generalization to $P(AUBUC)$, $0 \leq P(A) \leq 1$, $P(A) + P(A') = 1$ , $P(\Phi) = 0$, $P(A) \leq P(B)$ when $A \subset B$. Boole's inequality. Numerical problems.

**2 Conditional Probability and Bayes' Theorem** **04**

**2.1** Definition of conditional probability of an event. Results on conditional probability. Definition of independence of two events P(A ∩ B) = P(A)·P(B). Independence of A and $B'$ , $A'$ and B, and $A'$ and $B'$. Pairwise independence and mutual independence for three events. Multiplication theorem P(A∩ B) = P(A) · P(B|A). Generalization to P(A ∩ B ∩C).

**2.2** Partition of the sample space, prior and posterior probabilities. Proof of Bayes' theorem. Applications of Bayes' theorem in real life. True positive, false positive and sensitivity of test as application of Bayes' theorem.

**3 Univariate Probability Distributions (Defined on Discrete Sample Space)** **02**

Concept and definition of a discrete random variable. Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), F(·) of discrete random variable, properties of c.d.f.. Mode and median of a univariate discrete probability distribution

**4 Mathematical Expectation (Univariate Random Variable)** **07**

**4.1** Definition of expectation (Mean) of a random variable, expectation of a function of a random variable, m.g.f. and c.g.f. Properties of m.g.f and c.g.f.

**4.2** Definitions of variance, standard deviation (s.d.) and Coefficient of variation (c.v.) of univariate probability distribution, effect of change of origin and scale on mean, variance and s.d.

**4.3** Definition of raw, central, and factorial raw moments of univariate probability Distributions and their interrelations (without proof). Coefficients of skewness and kurtosis based on moments.

**5 Bivariate Discrete Probability Distribution** **05**

**5.1** Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties.

**5.2** Concept of identically distributed random variables

**5.3** Computation of probabilities of events in bivariate probability distribution.

**5.4** Concepts of marginal and conditional probability distributions.

**5.5** Independence of two discrete random variables based on joint and marginal p.m.f.s

**6 Some Standard Discrete Probability Distributions: 08**

**6.1 Degenerate distribution** (one point distribution): P(X=c) =1, mean and variance.

**6.2 Uniform discrete distribution on integers 1 to n:** p.m.f., c.d.f., mean, variance, real life situations, comments on mode and median.

**6.3 Bernoulli Distribution:** p.m.f., mean, variance.

**6.4 Binomial Distribution:** p.m.f.

$$P(x) = \begin{cases} \binom{n}{x} p^x q^{n-x}, & x = 0, 1, 2, \cdots, n \\ 0, & otherwise \end{cases}$$

Notation: X ~ B(n, p). Recurrence relation for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, m. g. f. and c. g. f. moments, skewness (comments when p = 0.5, p > 0.5, p < 0.5). Situations where this distribution is applicable.

**References:**

1. Agarwal B. L. (2003). Programmed Statistics, 2nd edition, New Age International Publishers, New Delhi.

2. Brase C. H., Brace C. P (2016). Understandable Statistics, Concepts and Methods, 12th Edition, Cengage Learning.

3. Freedman D., Pisani R., Purves R. (2007). Statistics, 4th Edition, W. W. Norton and Company.

4. Gupta S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, 8th Edition, Sultan Chand and Sons Publishers, New Delhi.

5. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.

6. Hogg R.V. and Craig R.G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.

7. Mayer P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co. London.

8. Mood A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, 3rd Edition, McGraw Hill Book Company.

9. Moore D. S., Notz W.I., Fligner M.A. (2013). The Basic Practice of Statistics, 6th Edition, Ruth Baruth.

10. Rohatgi V.K. and Saleh, A. K. (2015). An Introduction to Probability and Statistics, 3rd Edition, John Wiley & Sons, Inc.

11. Ross S.( 2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc.& Dorling Kindersley Publishing, Inc.

12. Utts J. M., Heckard R. F. (2010). Mind On Statistics, 4th Edition, Richard Stratton Publisher.

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**Paper Code and Title: STS-152-P: Statistics Practical -II**

**Course type- Practical No. of credits – 02 No. of contact hours –60(48+12)**

## Objectives:

At the end of this course students are expected to be able:

1. To fit line of regression, second-degree curve, and exponential curve.
2. To construct bivariate probability distributions, marginal probability distribution, and conditional probability distribution
3. To fit binomial distributions
4. To compute probabilities of bivariate probability distributions.
5. To draw random samples from binomial distributions

| Sr. No. | Title of the experiment | No. of Experiments |
|---|---|---|
| 1 | Computation of Spearman's rank correlation coefficient. | 01 |
| 2 | Fitting of line of regression $Y = a + bX$ | 01 |
| 3 | Fitting of second-degree curve $Y = a + bX + cX^2$ | 01 |
| 4 | Fitting of exponential curve of type $Y = ab^X, Y = aX^b$. | 01 |
| 5 | Construction of joint probability distribution and marginal probability distribution, independence, and computations of joint probabilities | 01 |
| 6 | Construction of conditional probability distribution and problems on conditional mean and conditional variance. | 01 |
| 7 | Computations of covariance, correlations, and variance of linear combination. | 01 |
| 8 | Fitting of Binomial distribution and computation of expected frequencies. | 01 |
| 9 | Model sampling from Binomial distributions. | 01 |
| 10 | Applications of Binomial | 01 |
| 11 | Project | 03 |

**Note: Every practical is equivalent to four theory lectures per batch per week**

## Generic / Open Elective (OE)

**Paper Code and Title: OEP-151-STS: Practical on Elementary Commercial Statistics**

**Course type- Practical No. of credits –02 No. of contact hours –60(48+12)**

## Course Outcomes:

At the end of the course, students should be able to:

1. Represent data using appropriate diagram/graph.
2. Calculate and describe data through measures of central tendency, dispersion, skewness and kurtosis.
3. To compute the correlation coefficient for bivariate data and interpret it's value.
4. To fit linear, quadratic, and exponential curves to the bivariate data.
5. Interpret the utilization of measures of central tendency and dispersion to compare group results.

## List of Practical:

| Sr. No. | Title of the experiment | No. of Experiments |
|---|---|---|
| 1 | Diagrammatic representation of statistical data. | 01 |
| 2 | Graphical representation of statistical data. | 01 |
| 3 | Data Interpretation from various graphs and diagrams. | 01 |
| 4 | Tabulation | 01 |
| 5 | Computation of measures of central tendency (ungrouped data). | 01 |
| 6 | Computation of measures of central tendency (grouped data). | 01 |
| 7 | Computation of measures of dispersion (ungrouped data and grouped data). | 01 |
| 8 | Computation of Karl Pearson's coefficient and Bowley's coefficient of skewness, and Box plot. | 01 |
| 9 | Measures of skewness and kurtosis based on moments. | 01 |
| 10 | Scatter diagram, correlation coefficient (grouped and ungrouped | 01 |

| | | |
|---|---|---|
| | data). | |
| 11 | Fitting of line of regression. | 01 |
| 12 | Fitting of second-degree curve. | 01 |

**Note - Every practical is equivalent to four theory hours per batch per.**

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# Generic / Open Elective (OE)

**Paper code and title – OEP-152-STS- Practical on Elementary Statistics for Social Sciences**

**Course type: Practical No. of Credits: 02 No. of Contact Hours: 60(48+12)**

1. For General/Open Elective course, concerned teacher should conduct at least 12 practicals covering all topics in the prescribed syllabus.

2. Students must complete all practical to the satisfaction of the concerned teacher.

## Course Outcomes:

At the end of this course, students will be able:

1. Identify data type and use of Likert scale to collect data.
2. Identification of appropriate sampling method.
3. Design questionnaire and conduct survey.
4. Process collected data using existing MS-Excel functions.
5. Students will be able to draw appropriate diagrams or graphs to the given data.

## List of Practical:

| Sr. No. | Title of the experiment | No. of Experiments |
|---|---|---|
| 1 | Data type identification corresponding to given scenario. | 01 |
| 2 | Designing Likert scales. | 01 |
| 3 | Identification of appropriate sampling method for a given scenario. | 01 |
| 4 | Designing questionnaire / survey form for given scenario and identification of probable sampling and non-sampling errors for a given scenario. | 01 |
| 5 | Designing questionnaire for given scenario using digital platforms. | 03 |
| 6 | Managing and processing responses to digital survey forms. | 02 |
| 7 | Computation of Cronbach's $\alpha$ and KR-20 using MS-Excel. | 01 |
| 8 | Exploratory data analysis. | 02 |

**Note: Every practical is equivalent to four theory hours per batch per week.**

# Skill Enhancement Course (SEC)

**Paper code and title – SECP-151-STS: Computational Statistics using MS-EXCEL**

**Course type: Practical No. of Credits: 02 No. of Contact Hours: 60(48+12)**

## Objectives:

The main objective of this course is to introduce basics of statistics to the students using MS-Excel.

## Course Outcomes:

At the end of the course, students are expected to be able,

1. To analyze data pertaining to discrete variables and to interpret the results.
2. To compute various measures of central tendency, dispersion, skewness, and kurtosis using MS-Excel and interpret the values of summary statistics.
3. To summarize and analyze the data using MS-Excel.
4. To apply standard discrete probability distribution to different real situations.
5. To compute Correlation and fit regression to the real data using MS-Excel.

| Unit No. | Content |
|---|---|
| 1 | **Summary Statistics (Grouped and Ungrouped Data):** |
| | **1.1** Measures of central tendency: A.M., G.M., H.M., Trimmed arithmetic mean, Mode Partition values: Median, Quartiles, Deciles, percentiles. |
| | **1.2** Measure of Dispersion: Range and coefficient of range, Quartile Deviation and coefficient of Quartile Deviation, Mean deviation about: mean, median and mode, Mean square deviation, variance and standard deviation, Coefficient of Variation (C.V.). |
| | **1.3** Measures of skewness and kurtosis: raw moments, central moments, Karl Pearson's coefficient of skewness, Bowley's coefficient of skewness, Pearson coefficient of skewness and kurtosis, boxplot. |
| 2 | **Computation of probabilities:** |
| | **2.1** Degenerate, Discrete Uniform |
| | **2.2** Bernoulli, Binomial, |
| | **2.3** Hypergeometric, |

**2.4** Poisson, Geometric, Negative Binomial, (p. m. f. and c. d. f. plot for all above distributions.)

**3 Model Sampling, correlation, and regression**

**3.1** Random number generation, scatter plot, Covariance, Correlation.

**3.2** Karl Pearson's coefficient of correlation.

**3.3** Regression Models: linear, exponential, second degree, power.

**3.4** coefficient of determination.

## List of practicals:

| Sr. No. | Title of the Experiment | No. of Experiments |
|---|---|---|
| 1 | Measures of Central Tendency (Ungrouped Data) | 1 |
| 2 | Measures of Central Tendency (Grouped Data) | 1 |
| 3 | Measures of Dispersion (Ungrouped Data) | 1 |
| 4 | Measures of Dispersion (Grouped Data) | 1 |
| 5 | Measures of Moments, Skewness, Kurtosis (Ungrouped Data) | 1 |
| 6 | Measures of Moments, Skewness, Kurtosis (Grouped Data) | 1 |
| 7 | Computation of probabilities | 2 |
| 8 | Model Sampling | 1 |
| 9 | Correlation | 1 |
| 10 | Fitting of regression models | 2 |

**Note: Every practical is equivalent to four theory hours per batch per week.**

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