

Complementary Course to First Degree Programme for Geography

I Semester: Complementary Course : 1

Course I- ST1131.3 Descriptive Statistics

- Module I Basic concepts: Need of Statistics in scientific studies, Constants and variables, qualitative and quantitative variables, Data- scales of data (nominal, ordinal, interval and ratio), Classification of data, Diagrammatic and graphical representation of data
- Module II Summarization of data 1: Measures of central tendency (averages)- Arithmetic mean, Median, Mode (concepts and problems only, mathematical derivation is not required)
- Module III Summarization of data 2: Measures of dispersion (scattering measures)- range, quartile deviation, mean deviation, variance, standard deviation, coefficient of variation and its significance (concepts and problems only, mathematical derivation is not required).
- Module IV Summarization of data 3: Skewness and kurtosis, Raw and central moments (definitions and relationships without proof), Karl Pearson's, Bowley's and moment measures of skewness, moment measure of kurtosis.
- Module V Bivariate data: Relationship of variables, curve fitting- principle of least squares. fitting of straight line, parabola and exponential curve of form $Y = Ae^{BX}$, Scatter diagram, Correlation-Karl Pearson's correlation coefficient and Spearman's rank Correlation coefficient, regression, regression lines (concepts and problems only, mathematical derivation is not required).

References:

1. Rogger Till: Statistical methods for the earth scientists- An Introduction: Mc Millan.
2. John Silk: Statistical Concepts in Geography, George Allan and Unwin
3. Prem S Mann: Introductory Statistics 5th Edition, Wiley.
4. Murray R. Spiegel, Larry J. Stephens, 3rd Edition, Schaums Outline Series
5. J. Medhi: Statistical Methods- An introductory text, Wiley

II Semester- Complementary Course 2

Course II- ST 1231.3 Sampling and Probability distributions

- Module I** Data collection: Population, sample, census, primary data, secondary data, sample unit, sampling frame, sampling methods- Probability and non-probability sampling, basic concepts of simple random, systematic and stratified sampling, sampling and non-sampling errors.
- Module II** Probability 1: Fundamental counting techniques- permutation and combination, Random experiment, sample space, equally-likely outcomes, simple and compound events, mutually exclusive and exhaustive events, definitions of probability- classical and frequency approaches, axioms of probability, addition theorem for two and three events (concepts and problems only, mathematical derivation is not required).
- Module III** Probability 2: Conditional probability, multiplication theorem, statistical independence, Baye's Theorem (statement only) (concepts and problems only, mathematical derivation is not required).
- Module IV** Random variable: Discrete and continuous types, probability distribution- probability mass function, probability density function, distribution function, mathematical expectation- simple problems on discrete case only.
- Module V** Standard distributions: Bernoulli, Binomial, Poisson and normal distributions (basic concepts and evaluation of probabilities).

References:

1. John E Freund, Ronald E Walpole: Mathematical Statistics 4th Edition, Prendice Hall.
2. Seymour Lipschuts: Theory and Problems of Probability, Schaum' Outline Series.
3. John Silk: Statistical Concepts in Geography, George Allan and Unwin.
4. Des Raj and Promod Chandhok: Sample Survey Theory, Narosa Publishing House

Semester III- Complementary Course
Course 3- ST 1331.3: Statistical Inference

- Module I Sampling distributions: Parameter, statistic, sampling distribution, distribution of sample mean, Chi square, Student's t and Snedecor's F distributions (definitions and statistics following these distributions without derivations), Uses, inter-relations. Central limit theorem (statement only).
- Module II Estimation: Point estimation- estimator, estimate, desirable properties of a good estimate, method of moments. Interval estimation- confidence interval for mean and proportion for large samples. □
- Module III Testing of hypothesis: Statistical hypothesis- null hypothesis, alternate hypothesis, simple and composite hypothesis, Decision problem in testing of hypothesis-Types of errors, level of significance.
- ✓ Module IV Large sample test: One sample test for mean, Test of equality of means of independent samples. Test of proportion for one sample, test of equality of proportions.
- Module V Small tests: One sample test for mean, Test of equality of means of independent samples, paired t-test, Chi square test for variance, F-test for equality of variance.

Reference:

1. John E Freund, Ronald E Walpole: Mathematical Statistics 4th Edition, Prentice Hall.
2. John Silk: Statistical Concepts in Geography, George Allan and Unwin.
3. David Ebson, Basin Blackwell: Statistics in Geography- A practical approach, Oxford.
4. Murray R Spiegel: Theory and Problems of statistics, Schuams Outline Series.
5. V. K. Rohatgi: Statistical Inference. Wiley.

IV Semester- Complementary course

Course 4 - ST 1431.3: Statistical Techniques for Geography

- Module I Introduction to nonparametric inference, its advantages and disadvantages, (Chi square test of goodness of fit (Binomial and Poisson distributions), Chi square test of independence/association/homogeneity. (Concepts and problems only, Derivations not required)
- Module II One sample non-parametric tests: Sign test, Wilcoxon's signed rank test, Kolmogorov-Smirnov test, Run test for randomness. (Concepts and problems only, Derivations not required).
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- Module III Two sample non-parametric tests: Median test, Mann Whitney U test, Run test, Kolmogorov -Smirnov test. (Concepts and problems only, Derivations not required).
- Module IV Analysis of variance: One way ANOVA, Two Way ANOVA, Kruskal Wallis test. (Concepts and problems only, Derivations not required).
- Module V Point Patterns: Random and systematic point patterns, quadrat analysis ; Area patterns: Lattice patterns-regular and irregular(elementary level), Contiguity test (Only for regular patterns at elementary level),, concept of spatial data, autocorrelation structure-definitions of variogram, semivariogram.

References:

1. Murray R Spiegel, Larry J Stephen, STATISTICS, IVth Edition, Schaum's Outline Series, Mc Graw Hill Education (India) Pvt. Ltd.
2. Murray R Spiegel, Theory and Problems of Statistics, Schaum's Outline Series, Mc Graw Hill Education (India) Pvt. Ltd.
3. Saroj K Paul, Statistical techniques: A basic approach in Geography, Tata Mc GrawHill.
4. John Silk, Statistical concepts in Geography, George Allan and Unwin.

Course V- ST 1432.3 Practical Using Excel

The students have to use statistical tools available in Microsoft Excel and have on hand training in data analysis. This course covers topics of courses I, II, III and IV.

Module I Use of Excel in Statistics (charts, functions and data analysis), practical covering semesters I, II, III & IV

Charts- column, pie and scatter.

Functions- Evaluation of numerical problems using the following functions.

AVEDEV ✓	AVERAGE ✓	BINORMDIST ✗	CHIDIST ✗	CHINV ✗	CHITEST ✗
CONFIDENCE ✓	CORREL ✓	COVAR ✓	DEVSQ ✓	FDIST ✗	FINV ✗
FREQUENCY ✓	FTEST ✗	GEOMEAN ✓	HARMEAN ✓	INTERCEPT ✓	KURT ✓
MEDIAN ✓	MODE ✓	LINEST ✗	LOGEST ✗	NORMDIST ✓	POISSON ✓
PROB ✓	SKEW ✓	SLOPE ✓	TDIST ✗	TREND ✗	TTEST ✗

Data analysis- Use the following tools in Data Analysis.

Histogram, Descriptive Statistics, Covariance, Correlation, Regression, t-test: paired two sample for mean, t-Test: Two Sampling Assuming Equal Variances, z-Test: Two Sample for Means, F-test: Two Sample for Variances, Anova- Single Factor and Two Factor without Replication.

References:

1. Dan Remenyi, George Onofrie, Joe English (2010): An Introduction to Statistics Using Microsoft Excel, Academic Publishing Ltd., UK.
2. Neil J Salkind (2010): Excel Statistics, A Quick Guide, Sage Publication Inc. New Delhi.
3. Vijai Gupta (2002): Statistical Analysis with Excel, VJ Books Inc. Canada.

Record of Practical

Presenting the certified record is mandatory to appear for the practical examination. Five questions are to be worked out in each sheet based on the topics in the syllabus as follows.

1. Diagrams and Graphs
2. Measures of Central Tendency and Dispersion
3. Moments, Skewness and Kurtosis
4. Fitting of Curves
5. Correlation and Regression
6. Probability evaluation of distributions
7. Large Sample Tests
8. Small Sample Tests
9. Analysis of Variance
10. Nonparametric Tests