



Ramakrishna Mission Vidyamandira

STATISTICS (MINOR) SYLLABUS

SEMESTER I/III

PAPER I/III

Group A

DESCRIPTIVE STATISTICS I

[25 Marks]

Unit-1:

Introduction to Statistics. Population and sample. Data: Primary and secondary data, Non-frequency and frequency data. Scales of measurement. Tabulation. Graphical representation of non-frequency data: line, bar, pie and component bar diagram. Frequency distribution. Graphical representation of frequency distributions: column diagram, histogram, step diagram and ogive. [6L]

Unit-2:

Analysis of univariate data: concepts of central tendency, A.M. – G.M. and Cauchy-Schwarz inequality (Statement only), dispersion, skewness and kurtosis and their measures with properties and applications. Outliers and their detection. Box-plot. Use of box-plot in detecting outliers. [13L]

Analysis of bivariate data: Scatter plot. Correlation and Linear regression. Related results. Residual plot and its interpretation. [6L]

PROBABILITY THEORY I

[25 Marks]

Unit-1:

Random experiment. Sample space and events. Operations with events. Classical definition of probability and its limitations. Theorem on union of mutually exclusive events. Conditional probability. Theorem of compound probability. Bayes' Theorem. Independence of events. Repeated trials. Simple problems. Frequency and Axiomatic definition of probability. [16L]

Unit-2:

Random variable and probability distribution. Cumulative distribution function. Probability mass function and Probability density function. Moment and quantile

measure of central tendency, dispersion, skewness and kurtosis (concepts only).
Simple problems. Chebyshev and Markov inequality (statement only). [10L]

References :

1. A.M. Gun, M.K. Gupta and B. Dasgupta: Fundamentals of Statistics (Vol. 1)
2. J. Pitman: Probability
3. S.M. Ross: Introduction of Probability and Statistics for Engineers and Scientists
4. R.V. Hogg and E.A. Tanis: Probability and Statistical Inference
5. I. Miller and M. Miller: J.E. Freund's Mathematical Statistics.

Group B

Practical based on the topics of Group A

[25 Marks]

SEMESTER II/IV

PAPER II/IV

Group A

DESCRIPTIVE STATISTICS II

[25 Marks]

Unit-1: Analysis of Multivariate Quantitative Data: Multiple Linear Regression, Multiple Correlation and Partial Correlation in three variables; their measures and related results. [14L]

Unit-2: Categorical Data: Contingency Tables. Association & Independence. Odds ratio, Yule and Cramer's measures. Pearson and Goodman-Kruskal measures of association. [11L]

PROBABILITY THEORY II

[25 Marks]

Unit-1: Standard univariate distributions: Discrete uniform, Binomial, Hypergeometric and Poisson, Geometric and Negative Binomial distributions. Rectangular, Normal, Lognormal, Gamma, Exponential and Beta distributions. [12L]

Unit-2: Joint Distribution of two random variables: Marginal & Conditional distributions, Covariance & Correlation Coefficient. Expectation & Variance of the Sum and the Product of two random variables. [7L]

Bivariate Normal distribution and its properties. [3L]

Weak Law of large Numbers and its applications. De Moivre Laplace limit Theorem. Statement of central Limit Theorem for iid random variables and its applications. [3L]

References:

1. A.M. Gun, M.K. Gupta and B. Dasgupta: Fundamentals of Statistics (Vol. 1)
2. J. Pitman: Probability
3. S.M. Ross: Introduction of Probability and Statistics for Engineers and Scientists
4. R.V. Hogg and E.A. Tanis: Probability and Statistical Inference
5. I. Miller and M. Miller: J.E. Freund's Mathematical Statistics.

Group B

Practical based on the topics of Group A

[25 Marks]

SEMESTER V/VI

PAPER V/VI

Group A

SAMPLING DISTRIBUTIONS AND STATISTICAL INFERENCE [30 Marks]

Unit-1:

Sampling Distributions : Concepts of Population and sample, Random Sampling and Sampling Distributions of Statistics, Distributions arising from Normal distribution – x^2 , t and F distributions (derivations excluded). [3L]

Statistical Inference : Point Estimation of a population parameter – concepts of Bias and Standard Error of an estimator, concepts of Unbiasedness, Minimum Variance, Consistency and Efficiency of an estimator, Method of Moments, Maximum Likelihood Method of estimation, Method of Least Squares, Point estimators of the parameters of Binomial, Poisson, and univariate Normal distributions. [9L]

Unit-2:

Statistical tests of Hypotheses : Null and Alternative hypotheses, Types of Errors, Critical Region, Level of Significance, Power and p-values, Exact tests of hypotheses under Normal set-up for a single mean, the equality of two means, a single variance and the equality of two variances, Test of Significance of sample correlation coefficient (null case) and tests of hypotheses for the equality of means and equality of variances of a bivariate Normal distribution. [9L]

Interval Estimation : Confidence Interval and Confidence Coefficient, Exact confidence interval under Normal set-up for a single mean, single variance, the difference of two means and the ratio of two variances. [4L]

Large sample tests
[5L]

References:

1. Gun A.M, Gupta M & Dasgupta B (1997): An Outline of Statistics (Vol I), World Press
2. Gun A.M, Gupta M & Dasgupta B (2001): Fundamentals of Statistics (Vol I), World Press
3. Mood A.M., Graybill F. & Boes D.C. (1974): An Introduction to the theory of Statistics (3rd Ed.), McGraw Hill
4. Rohatgi V.K. (1984): An Introduction to Probability Theory and Mathematical Statistics, John Wiley

Group B

ECONOMIC STATISTICS AND TIME SERIES ANALYSIS

[20 Marks]

Unit-1: *Economic Statistics*: Index Number – construction and use of price index numbers and tests in connection with them, Consumer and Wholesale price index numbers, their uses and major steps in their construction. [10L]

Unit-2: *Time Series Analysis*: Different components of a times series, determination of Trend by method of simple moving-averages and by fitting mathematical curves by least squares principle, determination of seasonal indices by methods of trend ratios and ratios to moving averages. [10L]

References:

1. Gun A.M, Gupta M & Dasgupta B (2001): Fundamentals of Statistics (Vol II), World Press
2. Yule G.U. & Kendall M.G. (1950): Introduction to the Theory of Statistics, Charles Griffin
3. Nagar A.L. & Das R.K. (1976): Basic Statistics
4. Mukhopadhyay P. (1999): Applied Statistics
5. Croxton F.E., Cowden D.J. & Klein (1969): Applied General Statistics, Prentice Hall.

Group C

Practical on selected topics using R (Solving basic probability problems, fitting of theoretical distributions, basic problems of hypothesis testing) **[25 Marks]**

SEMESTER VII/VIII

PAPER VII/VIII

Group A

SAMPLE SURVEY METHODS AND ANALYSIS OF VARIANCE [25 Marks]

Unit:1

Sample Survey Method: Concepts of population and sample, Need for sampling, Stages in the design and conduct of sample surveys. Concepts of probability sampling, Random Number tables. Simple random sampling with and without replacement.

Stratified random sampling – associated unbiased estimators of population mean, total and proportion, their variables and unbiased variance estimators. [12L]

Unit:2

Analysis of Variance: Comparison of factor effects, one-way classified data and two-way classified data with equal number of observations in each cell. [9L]

Design of experiments (CRD and RBD)
[4L]

References:

1. Gun A.M, Gupta M & Dasgupta B (2001) : Fundamentals of Statistics (Vol II), World Press
2. Cochran W.G. (1984) : Sampling Techniques (3rd ed.) Wiley Eastern
3. Nagar A.L. & Das R.K. (1976) : Basic Statistics
4. Mukhopadhyay P. (1999) : Applied Statistics
5. Kempthorne O. (1965) : The Design & Analysis of Experiments, Wiley Eastern

Group B

1. Project based on the topics taught in semester I-IV
2. Practical on Group-A [50 Marks]