

31. STATISTICS

Paper-I: Probability Theory

Max. Marks : 30+5
Time : 3 Hours

Note :- The examiner is requested to set ten questions in all, two questions from each unit. The candidate will be required to attempt five questions, selecting one question from each unit.

Unit-I

Important concepts in probability : Definition of probability-classical and relative frequency approach to probability. Richard Von Mises, merits and demerits of these approaches. Only general ideas to be given.

Random Experiment : Trial, sample point and sample space, definition of an event, operation of events, mutually exclusive and exhaustive events. Discrete sample space, properties of probability based on axiomatic approach, conditional probability, independence of events, Bayes' theorem and its applications.

Unit-II

Random Variables : Definition of discrete random variables, properties mass functions, idea of continuous random variable, probability density function, illustrations of random variables and its properties --moments measures of location, dispersion, skewness and kurtosis, probability generating function (if its exists), their properties and uses.

Unit-III

Standard univariate discrete distributions and their properties: Discrete Uniform, Binomial, Poisson and Negative Binomial distributions.

Unit-IV

Continuous univariate distributions--uniform, normal, exponential.

Unit-V

Chebyshev's inequality and applications, statements and applications of weak law of large numbers and central limit theorem.

Books Recommended :

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|---|---|
| 1. Bhat, B.R.,
Srivenkattaramana,
T.Rao,
Madhava, K.S. | Statistics : A Beginner's
Text Vol. II, New Age International (P) Ltd., 1997. |
| 2. Edward, P.J. Ford, J.S.
and Lin | Probability for Statistical
Decision-Making, Prentice
Hall, 4. |
| 3. Goon, A.M., Gupta,
M.K., Das Gupta, B | Fundamentals of Statistics. |
| 4. Mood, A.M. Graybill,
F.A. & Boes, D.C. | Introduction to Theory of
Statistics, McGraw Hill
(1974). |
| 5. Cooke, Cramer & Clarke | Basic Statistical Computing,
Chapman & Hall. |
| 6. David, S. | Elementary Probability,
Oxford Press, 1996. |
| 7. Hoel, P.G. | Introduction to Mathematics,
Asia Pub. House,
1971. |
| 8. Meyer, P.J. | Introductory Probability
and Statistical Applications,
Addison Wesley (1970). |

Paper-II : Descriptive Statistics

Max. Marks : 30+5
Time : 3 Hours

Note :- The examiner is requested to set ten questions in all, two questions from each unit. The candidate will be required to attempt five questions selecting one question from each unit.

Unit-I

Types of data : Concepts of Statistical Population and sample from a population; qualitative and quantitative data; discrete and continuous data; frequency and non-frequency data.

Collection and Scrutiny of Data : Primary data, secondary data - its major sources including some Govt. publications, complete enumeration, controlled experiments, observational studies and sample surveys. Scrutiny data for internal consistency and detection of errors of recording. Presentation of Data. Construction of tables with one or more factors of classification. Diagrammatic and graphical representation of grouped data.

Unit-II

Frequency distributions, cumulative frequency distribution and their graphical representation, histogram, frequency polygon and ogives. Stem and leaf chart. Box Plot.

Analysis of Quantitative data; univariate data--Concepts of central tendency or location, dispersion and relative dispersion, skewness and kurtosis, and their measures including those based on quartiles and moments. Sheppard's corrections for moments for grouped data (without derivation).

Unit-III

Bivariate Data : Scatter diagram. Product moment correlation coefficient and its properties. Coefficient determination correlation ratio. Concepts of error in regression. Principle of least squares. Fitting of linear regression and related results. Fitting of curves reducible to polynomials by transformation. Rank correlation--Spearman's and Kendall's measures.

Unit-IV

Multivariate data : Multiple regression, multiple correlation and partial correlation in three variables. Their measures and related results.

Analysis of Categorical data : Consistency of categorical data. Independence and association of attributed. Various measures of association for two-ways and three-ways classified data.

Books Recommended :

1. Bhal, B.R., Srivenkatramana, : Statistics : A Beginner's Text, Vol. I, New Age International (P) Ltd., 1996.
2. Croxton, F.E., Cowden, D.J. & Klein, S. : Applied General Statistics, Prentice Hall of India, 1973.
3. Goon, A.M., Gupta M.K., Das Gupta, B. : Fundamentals of Statistics Vol. I, Goon World Press, Calcutta, 1991.
4. Anderson, T.W. & Selove, S.L. : An Introduction to the Statistical Analysis of Data, Houghton Mifflin Co., 1978.
5. Cooke, Cramer & Clarke : Basic Statistical Computing, Chapman & Hall.
6. Mood, A.M., Graybill, F.A. & Boes, D.C. : Introduction to the Theory of Statistics, McGraw Hill, 1974.
7. Snedecor, G.W. & Cochran, W.G. : Statistical Methods, Iowa State Univ. Press, 1967.
8. Speigel, M.R. : Theory and Problems of Statistics, Schaum's Publishing Series (1967).

Paper-III : Practical

Max. Marks : 30
Time : 3 Hours

1. Presentation of data by frequency tables, diagrams and graphs.
2. Calculation of measures of central tendency, dispersion, skewness and kurtosis.

3. Product moment correlation ratio.
4. Fitting of curves by the least square method.
5. Regression of two variables.
6. Spearman's rank correlation and Kendall's tau.
7. Multiple regression of three variables.
8. Multiple correlation and partial correlation.
9. Exercise on mathematical expectations and finding measures of central tendency, dispersion, skewness and kurtosis of univariate frequency distributions.
10. Fitting of standard univariate discrete and continuous distributions.

STATISTICS

Outlines of Test

	Max. Marks	Time
Paper-I (Theory) Statistical Methods	30	3 Hours
Paper-II (Theory) Sample Surveys and Design of Experiment Internal Evaluation (Theory)	30 10	3 Hours
Paper-III (Practical)	30	3 Hours

Max. Marks : 30

Paper-I Statistical Methods

Time : 3 Hours

Unit-I

Sampling from a distribution : Definition of a random sample. Concept of a statistic and its sampling distribution, point estimator of a parameter, concept of bias and standard error of an estimator. Standard errors of sample mean, sample proportion. Sampling distribution of

sum of Binomial, Poisson and Mean of normal distributions. Independence of sample mean and variance in random sampling from a normal distribution (without derivation).

Unit-II

Statistical Tests and Interval Estimation : Null and alternative hypothesis, types of errors, statistical tables, statement of chi-square, t and F statistics. Testing for the mean and variance of univariate normal distribution, testing of equality of two means and testing of equality of two variances of two univariate normal distributions.

Unit-III

Confidence intervals. Testing for the significance of sample correlation coefficient in sampling from bivariate normal distribution and for the equality of means and equality of variances in sampling from bivariate normal distributions.

Unit-IV

Large Sample Tests : Use of central limit Theorem for testing and interval estimation of a single mean and a single proportion and difference of two means and two proportions, Fisher's Z transformation and its uses. Pearson's chi-square test for goodness of fit and for homogeneity for standard distributions. Contingency table and test of independence in a contingency table.

Unit-V

Non parametric tests : Definition of order statistics and their distributions (without derivation). Non parametric tests : sign test for univariate distribution, run test, median test.

Books Recommended :

Sr. No.	Title of Book	Name of Author	Publisher
1.	Mathematical Statistics	Fround, J.E.	Prentice Hall of India (2001)
2.	Fundamentals of Statistics, Vol. I	Geon, A.M., Gupta M.K. Das Gupta B.	World Press Calcutta (1991)
3.	Basic Concepts of Probability and Statistics	Hodgen J.L., Lehman E.L.	Holden Day (1964)

4. Introduction to the theory of Statistics
Moore, A.M., Graybill F.A. & Boes, D.C. McGraw Hill (1974)

5. Statistics : A Beginner's Text, Vol. II
Bhat B.R., Srivenkatramana T. (P) Ltd. (1997)

6. An Introduction to Probability Theory & Mathematical Statistics
Rohagi, V.K. John Wiley & Sons (1967)

7. Statistical Methods
Snedecor, G.W. & Cochran, W.G. Iowa State Uni. Press (1967)

Paper-II Sample Surveys and Design of Experiments Max. Marks : 30
Time : 3 Hours

Unit-I

Sample Surveys, Concepts of population and sample, need for sampling, Census and Sample survey, basic concepts in sampling, organisational aspects of survey sampling, sample selection and sample size.
Some basic sampling methods--Simple Random Sampling (SRS) with and without replacement.

Unit-II

Stratified random sampling, systematic sampling, ratio and regression methods of estimation under SRS.

Unit-III

Non sampling errors, acquaintance with the working of NSSO, and other agencies undertaking sample surveys.
Analysis of variance for one-way and two-way classifications.

Unit-IV

Need of design of experiments, fundamental principles of design, basic design-CRD, RBD, LSD and their analysis.

Unit-V

Factorial designs- 2^2 and 2^3 designs, Illustrations, main effects and interaction effects and confounding in 2^3 design.

Books Recommended :

Sr. No.	Title of Book	Name of Author	Publisher
1.	Experimental Designs	Cochran W.G.A. Cox G.M.	John Wiley and Sons (1957)
2.	Design and Analysis of Experiments	Das M.N. & Giri	Springer Verlag (1986)
3.	Sampling Theory and Methods	Murthy, M.N.	Statistical Pb. Society, Calcutta (1967).
4.	Sampling Theory and Methods	Sampath, S.	Narosa Pub. House (2000)
5.	Sample Survey Methods and its Applications	Sukhatme, B. V.	Indian Society of Agricultural Statistics (1984)
6.	Sample Survey Theory	Des Raj	Narosa Pub. House (2000)
7.	Fundamentals of Statistics Vol. II	Goon A.M., Gupta M.K. & Das Gupta B.	World Press Calcutta (1986)
8.	The Design and Analysis of Experiments	Komphorne, O.	Wiley Eastern (1965)

Paper-III : Practical

Max. Marks : 30

Time : 3 Hours

1. Tests of significance based on t, Chi-square, F. Treating of significance of sample correlation coefficient, use of Z transformation. Testing of equality of means and equality of variances in sampling from bivariate normal distribution.
2. Large sample tests for means and proportions, Test of goodness of fit and independence of attributes in contingency tables.

3. Non-parametric Tests--Sign, Run, Median, Simple Random Sampling, Stratified SRS and Systematic Sampling, Allocation Problems in Stratified SRS.
4. Analysis of variance for one-way and two-way classifications. Analysis of CRD, RBD and LSD. Analysis of 2 and 2 factorial experiments.

✓ 29. STATISTICS
Outlines of Test

	Max. Marks	Time
Paper-I Applied Statistics	30	3 Hours
Paper-II Quality Control & Statistical Computational & Techniques	30	3 Hours
Internal Evaluation (Th.)	10	
Paper-III (Practical)	30	3 Hours

Paper-I: Applied Statistics

Max. Marks: 30
Time: 3 Hours

Unit-I

Indian Applied Statistical System : Present official statistical system in India, Methods of collection of official Statistics, their reliability and limitations, and the principal publications containing such statistics on the topics- population, agriculture, industry, trade, price, labour and

employment, transport and communications, Banking and personal fluctuation, construction of seasonal indices.
finance.

Unit-II ..

Demographic Methods : Sources of demographic data, census, register, adhoc survey, Hospital records, demographic profiles of Indian census, measurement of mortality and life tables-crude, death rates, infant mortality rates, standardized death rate, complete life table-its main features, mortality rate and probability of dying. Measurement of fertility-crude birth rate, general fertility rate, total fertility rate, gross reproduction rate, net reproduction rate.

Unit-III

Economic statistics: Index number-definition, application for Index number price-relatives and quantity or volume, relatives, link and chain relatives, problems involved in computation of index numbers, use of averages, simple aggregative and weighted average methods, Laspeyres and Fisher's Index numbers, time and factor reversal tests of index numbers. Consumer price index.

Unit-IV

Static laws of demand and supply, price elasticity of demand, analysis of income and allied size distribution- Pareto distribution, graphical test, fitting of Pareto's law, log normal distribution and its properties, Lorenz curve and estimation of elasticity from time series data, Gini's coefficient.

Unit-V

Time series analysis : Economic time series, its different components, illustrations, additive and multiplicative models, determination of trend, growth curves, analysis of

BOOKS RECOMMENDED :

- Applied General Statistics : Croxton, F.E. & Cowden
D.J., Prentice Hall of India (1969).
Fundamentals of Statistics Vol. II : Goon, A.M., Gupta,
M.R. Das Gupta, B. : World Press, Calcutta (1986).
Guide to Current Indian Official Statistics : Goon A.M.,
Gupta, M.R. Das Gupta, B. : CSO, Govt. of India, New
Delhi.
Indian Official Statistical Systems : Saluja M.P.,
Statistical Pub. Society, Calcutta.
A Text-book of Demography : Srivastava O.S., Vikas
Pub. (1983).
Applied Statistics : Gupta & Mukhopadhyay P.P.,
Central Book Agency.
Statistics Demography : Pressat R., Methuen & Co. Ltd
(1978).

Part-II: Statistical Quality Control AID Computational Technique

Max. Marks : 30

Time: 3 Hours

Unit-I

Importance of Statistical methods to Industrial research
and practice, types of inspection, determination of tolerance
limits. General, theory of control charts, causes of variation
quality, control limits, sub-grouping, summary of out of
control criteria, charts for attributes, np-chart, p-chart, chart

C-chart

Unit-II

Charts of variable : X- and R charts, design of X- and R charts versus p charts, principle of acceptance sampling, problem of lot acceptance, stipulation of good and bad lots, producer's and consumer's risks, single and double sampling plans, their OC functions, concepts of AQL, LTPD, AOQL, average amount of inspection and ASN function, rectifying inspection plans, sampling inspection of plans.

Unit-III

Computational techniques: Difference tables, methods of interpolation, Newton's and Lagrange's method of interpolation, Divided differences, numerical differentiation and integration, Trapezoidal rule, Simpson's one-third formula.

Unit-IV

Introduction, Origin. Development, uses and limitations, types of computers, computer structure, input unit, CPU, output unit, Secondary storage, High level and low level language compiler and Interpreter. Number systems, binary, decimal number systems and their conversions into each other. Binary Arithmetics (Addition, Subtraction, Multiplication and Division floating point representation of number arithmetic operation with normalised floating point numbers.

Unit-V

Introduction of FORTRAN, constants, variables, Arithmetic Operations/Expressions, Mathematical functions, Arithmetic Assignment statement, simple Input/Output statements. If, GOTO, DIMENSION and Do statements, Flow charts and FORTRAN programmes for mean, median, mode, standard deviation, straight line fitting, Simpson's 1/3 and 3/8 rules, Trapezoidal rule.

Note :- The Examiner is requested to set ten questions in all, 2 from each unit. The Candidate will be required to attempt five questions selecting one from each unit.

BOOKS RECOMMENDED :

1. Statistical Theory and Methodology in Science & Engineering : Brownlee K.A., John Wiley & Sons (1960).
2. Statistical Quality Control : Grant, E.L., McGraw Hill (1964).
3. Quality Control & Industrial Statistics : Duncan, A.J., Taraporewala & Sons, (1974).
4. Computer Oriented Numerical Methods : Rajaraman V., Prentice Hall (1981).
5. Introductory Methods of Numerical Analysis : Sastri S.S., Prentice Hall (1987).
6. Operations Research : An Introduction, Taha H.A., MacMillan Pub. Com. (1989).
7. Engineering Statistics : Bowker, H.A. and Liberman G.T., Prentice Hall (1962).
8. Statistical Methods in Quality Control : Cowden D.J., Asia Pub. Society (1960).
9. Statistical Quality Control : Mahajan M., Dhanpat Rai & Co. (P) Ltd. (2001).
10. Computer Based Numerical Algorithms, Krishnamurthy, E.V., & Sen S.K., Affiliated East West Press (1976).