The University of Burdwan

Syllabus for B.Sc. (General) Examination in Statistics

Part I Examination   **Total Marks 100**

Theoretical

Paper I :   **100 marks**

 Probability

 Descriptive Statistics

 Numerical Analysis

Part II Examination   **Total Marks 200**

Theoretical   **100 marks**

Paper II: **100 marks**

 Sampling Theory and Statistical Inference,

 Sample survey, Design of Experiments ,S.Q.C,

 Vital Statistics, Economic Statistics, Official Statistics.

Paper III   **100 marks**

Practical

Practical I : Based on topics of Paper I & Sampling Theory and Statistical Inference in Paper II
         (50 marks).

Practical II : Based on topics of Paper II excluding   Sampling Theory and Statistical Inference .
         (50 marks).

Part III Examination   **Total Marks 100**

Theoretical

Paper IV :   **65 marks**

Practical   **35 marks**

Practical IV :   Based on topics of paper IV   (30 marks)

Viva-Voce and Practical Note Book   (5 marks)

Detailed Syllabus

L denotes lecture hours

Part I

Paper 1 :

Probability:

Random Experiments and Random Events, Statistical regularity and meaning of Probability, Classical and Axiomatic definitions of Probability (discrete sample space only), Conditional Probability, Independence of Events, Principal Theorems including union and intersection of events and Bayes Theorem. (10L)

Random Variable and its Probability Distribution, Cumulative Distribution Function, Probability Mass Function and Probability Density Function, Mathematical Expectation, Variance and Moments. Joint Distribution of two random variables, Marginal and Conditional distributions, Covariance and Correlation, Simple Theorems including theorems on expectation and variance of a sum of random variables and expectation of product of random variables. (10L)

Chebychev's Inequality, Weak Law of Large Numbers, Bernoulli's Theorem (3L)

Descriptive Statistics:

Types of statistical data, Compilation, Classification, Tabulation and Diagrammatic representation of data, Frequency Distribution, Cumulative Distribution and their graphical representation, Histogram, Frequency Polygon, Frequency Curve and Ogive. (10L)

Analysis of Univariate Quantitative Data – concepts of central tendency, dispersion, relative dispersion, skewness and kurtosis and their measures based on quantiles and moments. Fitting of Binomial, Poisson and Normal distributions. (10L)

Analysis of Bivariate Quantitative Data – Scatter Diagram, Product Moment Correlation Coefficient and its properties, Correlation Ratio, Regression Analysis, Fitting of Linear and Polynomial equations by the principle of Least Squares, Correlation Index, Spearman's Rank Correlation Coefficients. (10L)

Analysis of Multivariate Quantitative Data – Multiple Regression, Multiple Correlation and Partial Correlation in three variables, their measures and related results. (6L)

Analysis of Categorical Data – Independence and Association of Attributes, Measures of association for two-way classified data. (4L)

Standard Univariate Discrete Distributions and their properties – Discrete Uniform,Binomial,Poisson,and Hypergeometric distributions (10L)

Standard Univariate Continuous Distributions – Uniform, Normal, Exponential, Bivariate Normal distribution and statement of its general properties. (10L)

Numerical Analysis:

Approximation of numbers and functions, Absolute and Relative errors. (2L)

Interpolation : Polynomial approximation, Difference Table, Newton's Forward and Backward interpolation formulae and Lagrange's general interpolation formula, Error terms. (7L)

Numerical differentiation and its applications. (2L)

Numerical Integration : Trapezoidal and Simpon's 1/3 rules. (3L)

Numerical solution of equations : method of false position, method of fixed point iteration and Newton-Raphson method in one unknown, Conditions of convergence, rates of convergence. (3L)

References :

1. Goon A.M., Gupta M. & Dasgupta B.(1997): An Outline of Statistics(Vol 1),
                                                    World Press

2. Feller W.(1968) : An Introduction to Probability Theory & its Applications,
                    John Wiley

3. Yule G.U.& Kendall M.G.(1950) : Introduction to the Theory of Statistics,
                                        Charles Griffin

4. Cacoullos T. (1973) : Exercises in Probability, Narosa

5. Nagar A.L. & Das R.K. (1976) : Basic Statistics

6. Bhattacharyya G. K. & Johnson R. A. (1977) : Concepts & Methods of
                                        Statistics, J.Wiley

7. Freund J.E. (2001) : Mathematical Statistics, Prentice Hall

8. Pitman J. (1993) : Probability, Narosa

9. Stirzaker D. (1994) : Elementary Probability, Cambridge University Press

10. Goon A.M., Gupta M. & Dasgupta B.(2001) : Fundamentals of Statistics
                                                    (Vol 1), World Press

11. Rathie and Mathai : Probability and Statistics

Paper II :

Sampling Distributions:

Population and Sample, Random Sampling and Sampling Distributions of Statistics, sampling distribution of sum of independent Binomial and Poisson variables, χ^2, t and F distributions (derivations excluded), sampling distribution of mean and variance of independent Normal variables.   (6L)

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 and Maximum Likelihood Method of estimation, point estimators of the parameters of Binomial, Poisson, and univariate Normal distributions.   (10L)

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) 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.   (6L)

Large Sample Tests and related Interval Estimates of a single mean and a single proportion and difference of two means & two proportions, Fisher's z-transformation and its uses, Pearsonian χ^2 tests for goodness of fit & for homogeneity and independence in a contingency table.   (6L)

Sample Survey:

Concepts of Population and sample, Need for sampling, Stages in the design and conduct of sample surveys. (4L)

Concept 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 variances and Unbiased variance estimators (7L)

Design & Analysis of Experiments:

Analysis of Variance in one-way classified data and two-way classified data with equal number of observations in each cell. (6L)

Basic principles of design – Randomization, Replication and Local Control, Completely Randomized design, Randomized Block design and Latin Square design, applications of the technique of Analysis of Variance for the analysis of data collected under these designs. (8L)

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. Ideas of National Income. (10L)

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)

Population Statistics:

Vital events, Rates and Ratios, Measurement of Mortality – Crude, Specific and Standardized death rates, Infant Mortality Rate, Complete Life Table, Measurement of Fertility and Reproduction – Crude Birth Rate, General, Specific and Total fertility rates, Gross and Net reproduction rates. (13L)

Statistical Quality Control:

Advantages of statistical quality control, construction and use of Control Charts for mean, R, number of defectives d, p and number of defects c.　　　　(9L)

Indian Statistical System:

The Statistical System in India – the Central and State Government organizations, Activities of CSO and NSSO, sources of official statistics relating to Population, Agriculture, Price, Trade and Industry.　　　　(5L)

References :

1. Goon A.M.,Gupta M.& Dasgupta B.(2001): Fundamentals of Statistics (Vol 2),
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

6. C.S.O. (1984) : Statistical Systems in India

7. Cochran W.G. (1984) : Sampling Techniques (3rd ed.), Wiley Eastern

8. Kempthorne O.(1965): The Design & Analysis of Experiments, Wiley Eastern

9. Scarborough J.B. (1958) : Numerical Mathematical Analysis, Oxford Univ. Press

10. Atkinson K. (1985) : Elementary Numerical Analysis

11. Sastry S.S. (1998) : IntriductoryMethods of Numerical Analysis

12. Hildebrand F.B. (1974) : Introduction to Numerical Analysis, Tata McGraw-Hill

Part – III

Paper – IV

Group A: (Theoretical)　　　　**(Marks:65)**

SQC in Industry:

AQL, LTPD, Producer's Risk, Consumer's Risk, O.C, AOQL, ATI Sampling inspection plan by attributes: Single and Double sampling inspection plan ,use of IS 2500 (attribute) Table for determination of plan parameters.   (10L)

Economic Statistical Analysis:

Demand Analysis: Price elasticity and income elasticity of demand (concept and definition). Engel curve - Fitting of Engel curve from family budget data using least squares method.   (15L)

Elements of Business Decision Theory:

Courses of action, State of nature, Pay off.. Types of Decision- making Environments.Decision under uncertainty – Criterion of optimism (Maximum or Minimix), Criterion of Pessimism (Minimax or maximin), Equally likely Decision (Laplace) criterion, Criterion of Realism (Hurwicz), Criterion of Regret (Savage), Decision under Risk –Expected Monetary Value (EMV),Expected Opportunity Loss(EOL). Expected Value of Perfect Information (EVPI), Posterior Probabilities and Bayesian Analysis.   (15L)

Population Studies:

Population Projection, Fitting of population growth curves (without derivation), Gompertz, Makeham's and logistic (Rhodes method).   (10L)

Computation Techniques:

Computer system: Components and functions. The central processing Unit, Main Memory, Bit, Byte, Word, Input/Output Devices, Speeds and Memory Capacities in Computer Systems.

Over view of operating system, Types and Functions of Operating Systems, Flow charts, Basics of Algorithm, Digital Number System, Binary, Representation of Integers, Binary Representation of Real Numbers.   (15L)

Group B: (Practical)   **(Marks 35)**

Viva voce – 5 marks

Practical Note Book – 5 marks

Practical Problems based on paper – IV group A – 25 marks

Reference:

1. Goon AM,Gupta MK,Dasgupta B(2001): Fundamentals of Statistics (V-2),World Press

2. Spiegelman M. (1980) : Introduction to Demography, Harvard University Press

3. Cox P.R. (1976) : Demography

4. Biswas S. (1988) : Stochastic Processes in Demography and Applications

5. Mishra B.D. (1980) : An Introduction to the Study of Population, South Asian Pub.

6. Duncan A.J. (1953) : Quality Control and Industrial Statistics, Richard D Irwin

7. Cowden D.J. (1957) : Statistical Methods in Quality Control, Prentice Hall

8. Grant E.L. & Leavenworth (1964) : Statistical Quality Control, McGraw Hill

9. Bowley A.H. & Goode H.P. (1952) : Sampling Inspection by Variables, McGraw Hill

10. Ekambaram SK(1960): The Statistical Basis of Quality Cont. Charts, Asia Pub.Home

11. Montgomery D.C. (1985) : Introduction to Statistical Quality control, John Wiley

12. H. Taha: Operations Research

13. N. D. Vohra: Quantitative Techniques in Management, Tata Mcgrawhill

14. Yule G.U.& Kendall M.G(1953): An Introduction to the Theory of Statistics, C.Griffin

15. Croxton F.E., Cowden D.J. & Klein (1969) : Applied General Statistics, Prentice Hall

16. Allen R.G.D. (1975) : Index Numbers in Theory and Practice, Macmillan

17. Rajaraman V. : Fundamentals of Computers, Prentice Hall