

STATISTICS PAPER

Scheme of Examination of B.A./B.Sc. three year degree Course w.e.f. 2011-12.

There will be two theory papers of Statistics and Practical in B.A. / B.Sc. three year degree course Part-I, II & III consisting of two semesters each. Practical examinations will be held annually (based on constituent semesters).

B.A. /B.Sc. Part-I (Semester-I)

			Marks	
Paper	Time		B.A	B.Sc.
I	Code ST-101 3 hours	Nomenclature Statistical Methods-I	28+7*	40+10*
II	Code ST-102 3 hours	Probability Theory	28+7*	40+10*

(Semester-II)

I	Code ST-201 3 hours	Statistical Methods-II	28+7*	40+10*
II	Code ST-202 3 hours	Probability Distributions	28+7*	40+10*
III	Code ST-203 3 hours	Practical	60**	100**

Part-II (Semester-III)

I	Code ST-301 3 hours	Elementary Inference	28+7*	40+10*
II	Code ST-302 3 hours	Sample Surveys	28+7*	40+10*

(Semester-IV)

I	Code ST-401 3 hours	Parametric and Non-parametric tests	28+7*	40+10*
II	Code ST-402 3 hours	Design of Experiments	28+7*	40+10*
III	Code ST-403 3 hours	Practical	60**	100**

Part-III(Semester-V)

I	Code ST-501 3 hours	Applied Statistics	28+7*	40+10*
II	Code ST-502 3 hours	Numerical Methods and Fundamentals of Computers	28+7*	40+10*

(Semester-VI)

I	ST-601 3 hours	Statistical Quality Control	28+7*	40+10*
II	ST-602 3 hours	Operations Research	28+7*	40+10*
III	ST-603 3 hours	Practical	60**	100**

* Marks of internal assessment based on the following criteria:

- | | | | |
|-------|--|---|-----|
| (i) | Two Handwritten Assignments
(1 st Assignment after one month &
2 nd Assignment after two months) | : | 10% |
| (ii) | One Class Test
(one period duration) | : | 5% |
| (iii) | Attendance | : | 5% |

Marks for attendance will be given as under:

- | | | | | | | | |
|-----|-------------|---|---------|-----|------------|---|------------|
| (1) | 91% onwards | : | 5 Marks | (4) | 70% to 75% | : | 2 Marks*** |
| (2) | 81% to 90% | : | 4 Marks | (5) | 65% to 70% | : | 1 Marks*** |
| (3) | 75% to 80% | : | 3 Marks | | | | |

***For students engaged in co-curricular activities of the colleges only/authenticated medical grounds duly approved by the concerned Principal.

**Practical Examinations will be held annually in the even semesters i. e. II, IV & VI semester and distribution of marks will be as follows.

	B.A	B.Sc.
Practical	: 48	80
Class Record	: 06	10
Viva-Voce	: 06	10

B.A./B.Sc.I Semester-I

Paper-I(ST-101)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Statistical Methods-I

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Two questions)

Introduction of Statistics: Origin, development, definition, scope, uses and limitations.

Types of Data: Qualitative and quantitative data, cross sectional and time series data, discrete and continuous data, frequency and non-frequency data. Nominal, ordinal, ratio and interval scales.

Collection and Scrutiny of Data: Collection of primary and secondary data- its major sources including some government publications, scrutiny of data for internal consistency and detection of errors of recording, classification and tabulation of data.

Section-II (Three questions)

Presentation of Data: Frequency distribution and cumulative frequency distribution, diagrammatic and graphical presentation of data, construction of bar, pie diagrams, histograms, frequency polygon, frequency curve and ogives.

Measures of Central Tendency/Location: Arithmetic mean, median, mode, geometric mean, harmonic mean; partition values-quartiles, deciles, percentiles and their graphical location along with their properties, applications, merits and demerits.

Measures of Dispersion: Concept of dispersion, characteristics for an ideal measure of dispersion. Absolute and relative measures based on: range, inter quartile range, quartile deviation, coefficient of quartile deviation, Mean deviation, coefficient of mean deviation, standard deviation (σ), coefficient of variation and properties of these measures.

Section-III (Three questions)

Moments, Skewness and Kurtosis: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks; coefficients of Skewness and Kurtosis with their interpretations.

Theory of Attributes: Symbolic notations, dichotomy of data, class frequencies, order of class frequencies, consistency of data, independence and association of attributes, Yule's coefficient of association and coefficient of colligation.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Applied Statistics	Neter J., Wasserman W., & Whitmore G.A.	Allyn & Bacon, Inc.
2.	Applied General Statistics	Croxton F.E., Cowden D.J. & Kelin S.	Prentice Hall
3.	Fundamental of Statistics Vol. I	Goon A.M., Gupta M.K., Dasgupta B.	World Press, Calcutta
4.	Statistics	Johnson R.	Wiley Publishers
5.	Basic Statistics	Aggarwal B.L.	New Age International
6.	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons
7.	Programmed Statistics	Aggarwal B.L.	New Age International
8.	An Introduction To Theory of Statistics	G. Udny, Kendal M.G	Charles Griffin and co.

B.A./B.Sc.I Semester-I

Paper-II(ST-102)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Probability Theory

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Three questions)

Concepts in Probability: Random experiment, trial, sample point, sample space, operation of events, exhaustive, equally likely and independent events; Definition of probability-classical, relative frequency, statistical and axiomatic approach, conditional probability. Addition and multiplication laws of probability and their extension to n events. Boole's inequality; Bayes theorem and its applications.

Section-II (Three questions)

Random Variable and Probability Functions: Definition of random variable, discrete and continuous random variable, probability function, probability mass function and probability density functions, distribution function and its properties, functions of random variables, joint, marginal and conditional probability distribution function.

Mathematical Expectation: Definition and its properties-moments, addition and multiplication theorem of expectation. Conditional expectation and conditional variance.

Section-III (Two questions)

Generating Functions: Moments generating function, cumulant generating function, probability generating function along with their properties.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Fundamentals of Mathematical Statistics	Gupta S.C.& Kapoor V.K.	Sultan Chand & Sons
2.	Probability for Statistical Decision Making	Edward P.J., Ford J.S. and Lin	Prentice Hall
3.	Elementary Probability	David S.	Oxford Press
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Pub. House
5.	New Mathematical Statistics	Bansi Lal & Arora S.	Satya Prakashan
6.	Introduction to Mathematical Statistics	Hogg and Craig	Prentice Hall

B.A./B.Sc.I Semester-II

Paper-I(ST-201)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Statistical Methods-II

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Two questions)

Correlation: Concept and types of correlation, methods of finding correlation - scatter diagram, Karl Pearson's Coefficient of correlation (r), its properties, coefficient of correlation for a bivariate frequency distribution. Rank correlation with its derivation, its merits and demerits, limits of rank correlation coefficient, tied or repeated ranks, coefficient of determination.

Section-II (Three questions)

Linear Regression : Concept of regression, principle of least squares and fitting of straight line, derivation of two lines of regression, properties of regression coefficients, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values, distinction between correlation and regression. Angle between two lines of regression.

Curvilinear Regression: Fitting of second degree parabola, power curve of the type $Y=aX^b$, exponential curves of the types $Y=ab^X$ and $Y=ae^{bX}$.

Section-III (Three questions)

Multiple Regression: Plane of regression, properties of residuals, variance of the residual. Multiple and partial correlation coefficients: coefficient of multiple correlation and its properties, coefficient of partial correlation and its properties, multiple correlation in terms of total and partial correlations.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Introduction to Theory of Statistics	Mood A.M., Graybill F.A. & Boes D.C.	McGraw Hill
2.	Applied General Statistics	Croxton F.E., Cowden D.J. & Kelin S.	Prentice Hall
3.	Basic Statistical Computing	Cooke, Cramar & Clarke	Chapman & Hall
4.	Statistical Methods	Snedecor G.W. & Cochran W.G.	Low State Uni. Press
5.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons

B.A./B.Sc.I Semester-II

Paper-II(ST-202)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Probability Distributions

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Three questions)

Bernoulli distribution and its moments, Binomial distribution: Moments, recurrence relation for the moments, mean deviation about mean, mode, moment generating function (m.g.f), additive property, characteristic function (c.f), cumulants, probability generating function (p.g.f) and recurrence relation for the probabilities of Binomial distribution. Poisson Distribution: Poisson distribution as a limiting case of Binomial distribution, moments, mode, recurrence relation for moments, m.g.f., c.f., cumulants and p.g.f. of Poisson distribution, additive property of independent Poisson variates. Negative Binomial distribution: m.g.f. and p.g.f., deduction of moments of negative binomial distribution from those of binomial distribution.

Section-II (Two questions)

Discrete uniform distribution. Geometric distribution: Lack of memory, moments and m.g.f. Hypergeometric distribution: Mean and variance. Continuous uniform distribution: Moments, m.g.f., characteristic function and mean deviation.

Section-III (Three questions)

Normal distribution as a limiting form of binomial distribution, chief characteristics of Normal distribution; mode, median, m.g.f., c.g.f. and moments of Normal Distribution, A linear combination of independent normal variates, points of inflexion, mean deviation about mean, area property of Normal distribution, importance and fitting of normal distribution.

Gamma distribution: m.g.f., c.g.f., additive property. Beta distribution of first and second kind. Exponential Distribution: m.g.f., moments, lack of memory.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Statistics:A Beginner's Text Vol. II	Bhat B.R., Srivenkatramana T. & Rao Madhava K.S.	New Age International
2.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan chand & Sons
3.	Introduction to Mathematical Statistics	Kapoor & Sexena.	Schand
4.	Statistics	Johnson R.	Wiley Publishers
5.	Mathematical Statistics With Applications	Freund's J.E.	Prentice Hall

B.A./B.Sc.II Semester-III

Paper-I(ST-301)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Elementary Inference

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-1 (Two questions)

Statistical Estimation: Parameter and statistic, sampling distribution of statistic. Point and interval estimate of a parameter, concept of bias and standard error of an estimate. Standard errors of sample mean, sample proportion, standard deviation, Properties of a good estimator: Unbiasedness, Efficiency, Consistency and Sufficiency (definition and illustrations).

Section-II (Three questions)

Methods of Estimation: Method of moments, method of maximum likelihood and its properties (without proof).

Testing of Hypotheses: Null and alternative hypotheses. Simple and composite hypotheses, critical region, level of significance, one tailed and two tailed testing, Types of errors, Neyman-Pearson Lemma, Test of simple hypothesis against a simple alternative in case of Binomial, Poisson and Normal distribution.

Section-III (Three questions)

Large Sample Test: Testing and interval estimation of a single mean, single proportion, difference of two means and two proportions. Fisher's Z transformation. Determination of confidence interval for mean and variance.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Statistics:A Foundation For Analysis	Hughes A. & Grawoig D.	Addision Wesley
2.	A First Course on Parametric Inference	Kale B.K.	Narosa
3.	Introduction to Theory of Statistics	Mood A.M., Graybill F.A. & Boes D.C.	McGraw Hill
4.	Introduction to Mathematical Statistics	Hoel P.G.	Asia Pub. House
5.	Mathematical Statistics With Applications	Freund's J.E.	Prentice Hall
6.	Introduction to Mathematical Statistics	Hogg and Craig	Prentice Hall

B.A./B.Sc.II Semester-III

Paper-II(ST-302)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Sample Surveys

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-1 (Two questions)

Concepts of census and sample survey, basic concepts in sampling. Sampling and Non-sampling errors. Principal steps involved in a sample survey; bias, precision and accuracy, advantages of sampling over complete census, limitations of sampling, different methods of data collection.

Section-II (Three questions)

Different methods of sampling: probability and non probability sampling, simple random sampling (SRS) with and without replacement, use of random number tables, estimation of mean and variance of estimated mean, merits and limitations, simple random sampling of attributes, size of simple random sample. Probability proportional to sample size(pps): Estimation in with replacement pps sampling, comparison with sampling with equal probabilities, sampling without replacement with unequal probabilities, an alternative expression for variance, comparison of with replacement and without replacement schemes.

Section-III (Three questions)

Stratified random sampling, estimation of population mean, variance of the estimate of population mean of stratified random sampling, allocation of sample size, proportional allocation, optimum allocation, comparison of stratified random sampling with simple random sampling, systematic random sampling and its various results about variance.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Sampling Techniques	Cochran W.G.	Wiley Publishers
2.	Sampling Theory	Des Raj and Chandok	Narosa
3.	Sample Theory of Surveys with Applications	Sukhatme et. all	Low State Uni. Press & IARS
4.	Survey Sampling	Mukhopadhyay P.	Narosa Publishing Society
5.	Sampling Techniques	Daroga Singh & Chaudhry, F.S	New age International

B.A./B.Sc.II Semester-IV

Paper-I(ST-401)

Time:3 Hour

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Parametric and Non-parametric tests

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-1 (Three questions)

Chi-square distribution: Definition, derivation, moment generating function, cumulant generating function, mean, mode, skewness, additive property, conditions for the validity, chi-square test for goodness of fit. Contingency table, coefficient of contingency, test of independence of attributes in a contingency table.

Section-II (Three questions)

t and F statistics: Definition and derivation of Student's 't', constants of t-distribution, limiting form of t-distribution. Definition & derivation of Snedcor's F-distribution, constants of F-distribution, mode of F-distribution. Relationship between t, f and chi-square distribution. Testing for the mean and variance of univariate normal distributions, testing of equality of two means and testing of equality of two variances of two univariate normal distributions. Related confidence intervals. Testing for the significance of sample correlation coefficient in sampling from bivariate normal distribution.

Section-III (Two questions)

Nonparametric Tests: Definition of order statistics and their distributions, sign test for univariate and bivariate distribution, run test, median test, Kolmogorove-Simrnov one sample test, Kolmogorove-Simrnov two sample test, Mann Whitney U-test(only applications without derivation).

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Introduction to Probability and Its Application	Feller W.	Wiley Publisher
2.	Fundamentals of Statistics, Vol. I	Goon A.M., Gupta M.K. & Dasgupta B.	World Press Calcutta
3.	Random Variable and Probability Distribution	Cramer H.	Cambridge Uni. Press
4.	Fundamentals of Mathematical Statistics	Gupta S.C. & Kapoor V.K.	Sultan chand & Sons
5.	Practical Nonparametric	W.J. Conover	Wiley Publisher

B.A./B.Sc.II Semester-IV

Paper-II (ST-402)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Design of Experiment

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-1 (Three questions)

Analysis of variance (ANOVA): Definition, assumptions for ANOVA test, one-way and two-way classifications for fixed effect model with one observation per cell. Introduction to design and experiment, terminology, Experiment, treatment, experimental unit, blocks, experimental error, replication, precision, efficiency of a design, need for design of experiments, size and shape of plots and blocks.

Section-II (Three questions)

Fundamental principles of design, randomization, replication and local control, completely randomized design, randomized Block Design, their layout, statistical analysis, applications, advantages, dis-advantages and efficiency of RBD relative to CRD.

Section-III (Two questions)

Latin square design (LSD) standard Latin square design, layout of LSD, its statistical analysis, applications, merits and de-merits. Factorial designs- 2^2 and 2^3 designs, illustrations, main effects and interaction effects, Yate's method for computing main and interaction effects.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Design and Analysis Of Experiments	Das M.N. & Giri	Springer Verlage
2.	Linear Models	Searle S.R.	John Wiley & Sons
3.	Linear Estimation And Design of Experiments	Joshi D.D.	Wiley Eastern
4.	Fundamentals of Applied Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons

B.A./B.Sc.III Semester-V

Paper-I(ST-501)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Applied Statistics

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-1 (Two questions)

Index Number: Definition, problems involved in the construction of index numbers, calculation of index numbers-simple aggregate method, weighted aggregates method, simple average of price relatives, weighted average of price relatives, link relatives, chain indices, value index numbers, price and quantity index numbers, Laspeyre's, Paasche's, Marshall-Edgeworth and Fisher's index numbers, time and factor reversal tests of index numbers, consumer price index number and its uses. Base shifting, splicing and deflating of index numbers.

Section-II (Three questions)

Time series Analysis : Definition, components of time series-trend, seasonal variations, cyclic variations, irregular component, illustrations, additive and multiplicative models, determination of trend-graphic method, semi-averages method, method of curve fitting by principle of least squares, growth curves and their fitting, moving average method. Analysis of seasonal fluctuations, construction of seasonal indices using method of simple averages, ratio to trend method, ratio to moving average method and link relative method.

Section-III (Three questions)

Demographic methods : sources of demographic data-census, register, adhoc survey, hospital records, measurement of mortality, crude death rate, specific death rate, standardized death rates, complete life tables and its main features, assumptions, descriptions and construction of life tables, uses of life tables, stationary and stable population, measurement of fertility-crude birth rate, general fertility rate, specific fertility rate, total fertility rate, measurement of population growth, gross reproduction rate, net reproduction rate.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Applied General Statistics	Croxton F.E., Cowden D.J. & Kelin S.	Prentice Hall
2.	Demography	Cox P.R.	Cambridge Uni. Press
3.	Technical Demography	Ramakumar R.	New Age International
4.	Fundamentals of Applied Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons

B.A./B.Sc.III Semester-V

Paper-II(ST-502)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Numerical Methods and Fundamentals of Computers

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Three questions)

Numerical Methods: Concept of intrapolation and extrapolation, difference tables, methods of interpolation, Newton's formula for forward and backward interpolation with equal intervals, Lagrange's method of interpolation, Divided differences, numerical integration, General Quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{\text{rd}}$ and $3/8^{\text{th}}$ formula.

Section-II (Two questions)

Basic of Computer: Introduction, origin, development, uses and limitation of computers. Types of computers, computer structure, input-unit, CPU, output unit, secondary storage, High Level and low level languages, compiler and interpreter.

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating point numbers. Number systems- Binary, decimal, octal and hexadecimal number systems and their conversions into each other. Binary arithmetic's, (Addition, subtraction, multiplication & division).

Section-III (Three questions)

Flow charts and Algorithm: Concepts of flow chart, algorithm and programming. Flow charts and algorithms for the following: Mean, Standard Deviation, Coefficient of Correlation, Straight line fitting. Trapezoidal rule, Simpson's $1/3$ and $3/8^{\text{th}}$ rules.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Computer Fundamentals	Sinha P.K.	BPB Publication
2.	Introductory Methods of Numerical Analysis	Sastry S.S.	Prentice Hall
3.	Computer Based Numerical Algorithms	Krishnamurthy E.V. & Sen S.K.	Affiliated East West Press
4.	Computer Oriented Numerical Methods	Rajaraman V.	Prentice Hall

B.A./B.Sc.III Semester-VI

Paper-I(ST-601)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Statistical Quality Control

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Three questions)

Statistical Quality Control : Meaning and uses of SQC, causes of variations in quality, product and process control, control charts, 3- σ control limits, control chart for variables- \bar{X} and R chart, criteria for detection of lack of control in \bar{X} & R Charts, Interpretation of \bar{X} & R charts, control chart for standard deviation (σ charts), control charts for attributes- p and c charts, concept of 6- σ limits.

Section-II (Three questions)

Acceptance sampling : Problem of lot acceptance, stipulation of good and bad lots, producer's and consumers risks, single and double sampling plans, their OC functions, concepts of AQL, LTPD, AOQL, average amount of inspection and ASN function.

Section-III (Two questions)

Demand Analysis : Laws of demand and supply, price elasticity of demand, demand function with constant price elasticity, partial elasticities of demands (income elasticity & cross elasticity), types of data required for estimating elasticities, family budget data, time series data, Leontief's and Pigous's methods (from time series data) to estimate demand functions. Engel's law, Pareto's Law of income distribution, curves of concentration, Lorenz curve and Gini's coefficient.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Statistical Quality Control	Grant E.L.	McGraw Hill
2.	Statistical Methods in Quality Control	Cowden D.J.	Asia Pub. Society
3.	Statistical Theory and Methodology in Science & Engineering	Brownlee K.A.	John Wiley & Sons
4.	Engineering Statistics	Bowker H.A. & Liberman G.T.	Prentice Hall
5.	Fundamentals of Applied Statistics	Gupta S.C. & Kapoor V.K.	Sultan Chand & Sons
6.	Fundamentals of Statistics, Vol. II	Goon A.M., Gupta M.K. & Dasgupta B.	World Press Calcutta

B.A./B.Sc.III Semester-VI

Paper-II(ST-602)

Time:3 Hours

M.M.:B.Sc.:40+10*

B.A.: 28+7*

* Internal Assessment

Operations Research

Note: There will be nine questions in all. Question No.1 will be compulsory covering whole of the syllabus and comprising 5 to 8 short answer type questions. Rest of the eight questions will be set from the three sections. The candidate will be required to attempt five questions in all selecting at least one question from each section including the compulsory one. All the questions will carry equal marks except the compulsory question, the distribution of marks for which will be as follows: B.Sc.8 marks and B.A. 6 marks.

Section-I (Two questions)

Objective of O.R., nature and definitions of O.R., Scope of O.R., Meaning and necessity of O.R. models, classification of O.R. models, Advantages & disadvantages of O.R. models. Steps in model formulation, principles of modeling. Characteristics of a good model, Allocation problems, General linear programming problem, formulation of G.L.P.P., (formulation only for Transportation problem, trim loss problem, product mix problem, Diet problem).

Section-II (Three questions)

Linear programming problem; definition, objective function, constraints, graphical solution of L.P.P., limitations of graphical method, simplex method to solve L.P.P., concept of initial basic feasible solution, computation procedure for Simplex method. Big-M method (Not included the case of degeneracy) unrestricted variables.

Section-III (Three questions)

Transportation Problem(T.P.), Formulation of T.P., B.F.S. of T.P., Different methods to find initial feasible solution, North-West corner rule, Row minima method, column minima method, Matrix minima method (Least cost entry method), Vogel's Approximation method (or Unit cost penalty method). UV-method (Modi-method) for finding the optimum solution of T.P.

Books recommended

Sr.No.	Title of Book	Name of author	Publisher
1.	Operations Research	Hillier F.S. & Lieberman G.J.	Tata McGraw Hill
2.	Linear Programming	Hadley G.	Narosa
3.	Operations Research: An Introduction	Taha H.A.	Macmillan Pub. Co.
4.	Operations Research	Goel B.S. & Mittal S.K.	Pragati Prakashan
5.	Operations Research	Sharma S.D.	KedarNath & Co.
6.	Operations Research	Sharma J.K.	Macmillan Pub.

B.A./B.Sc.-I

Paper-III(Practical ST-203)

Time: 3 Hours

Max. Marks: B.Sc.:100

B.A.: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To construct frequency distributions using exclusive and inclusive methods
2. Representation of data using Bar and pie diagrams
3. Representation of data using Histogram, Frequency Polygon, Frequency Curve and Ogives.
4. To toss a coin atleast 100 times and plot a graph of heads with respect to number of tosses.
5. To compute various measures of central tendency and dispersion.
6. To obtain first four moments for the given grouped frequency distribution.
7. To apply Charlier's checks while computing the moments for a given frequency distribution.
8. To obtain moments applying Sheppard's correction.
9. To obtain various coefficients of skewness and kurtosis.
10. To discuss the association of attributes for a 2x2 contingency table using Yule's coefficient of association and colligation.
11. To compute Karl Pearson's coefficient of correlation for given bivariate frequency distribution.
12. To find Spearman's rank correlation coefficient for given data.
13. To fit the straight line for the given data on pairs of observations.
14. To fit the second degree curve for the given data.
15. To fit the curve of the type $Y = aX^b$ for the given data on pairs of observations.
16. To obtain the regression lines for given data.
19. To compute partial and multiple correlation coefficients for the given trivariate data.
20. To obtain plain of regression for the given trivariate data.
21. To fit binomial distribution to given data.
22. To fit Poissonl distribution to given data.
23. To fit normal distribution to given distribution using area under the normal curve.
24. To fit normal distribution to given distribution using method of ordinates.

Distribution of marks:

	B.Sc.	B.A.
Class Record	: 10	06
Viva Voce	: 10	06
Practicals	: 80	48

B.A./B.Sc.-II

Paper-III (Practical ST-403)

Time: 3 Hours

Max. Marks: B.Sc.:100

B.A.: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To apply large sample test of significance for single proportion and difference of two proportions and obtained their confidence intervals.
2. To apply large sample test of significance for single mean and to obtained confidence interval.
3. To apply large sample test of significance for difference between two means and standard deviations.
4. To apply t-test for testing single mean and difference between means and to obtain their confidence intervals.
5. To apply paired t-test for difference between two means.
- 6 To apply Chi-square test for goodness of fit.
- 7 To apply Chi-square test for independence of attributes.
8. To apply test of significance of sample correlation coefficient.
9. To apply F-test for testing difference of two variances.
10. To apply sign test for given data.
11. To apply Run test for given data.
12. To apply Median test for given data.
13. To apply Mann Whitney U-test for given data.
14. To find standard error of estimate of population mean in case of SRSWR & SRSWOR and comparison of these estimates.
15. To find standard error of estimate of population mean in case of stratified random sampling.
16. To find standard error of estimate of population mean in case of systematic sampling.
- 19 To perform ANOVA in case of CRD and test whether the treatments/varieties are equally effective.
20. To perform ANOVA for an RBD.
21. To perform ANOVA for an LSD.
22. To analyze 2^2 and 2^3 factorial designs.

Distribution of marks:

	B.Sc.	B.A.
Class Record	:10	06
Viva Voce	:10	06
Practicals	:80	48

B.A./B.Sc.-III

Paper-III(Practical ST-603)

Time: 3 Hours

Max. Marks: B.Sc.:100

B.A.: 60

Practical

Note: Five questions will be set. The candidate will be required to attempt any three.

1. To construct \bar{X} and R-chart, and comment on the state of control of the process.
2. To construct p-chart and d-chart, and comment on the state of control of the process.
3. To obtain control limits for number of defects and comment on the state of control plotting the appropriate chart.
4. To calculate price and quantity index numbers using the formulae given by Laspyre, Paasche, Marshal-Edgeworth and Fisher.
5. To obtain cost of living index numbers for the given data using (i)Aggregate Expenditure Method. (ii) Family Budget Method
- 6 To test the given data whether the formulae given by Laspyre, Paasche, Marshal-Edgeworth and Fisher, satisfy reversal tests.
- 7 To work out trends using curve fitting method for given data.
8. To work out trends using moving average method for given data .
9. To obtain seasonal variation indices using simple average method.
10. To obtain seasonal variation indices using ratio to moving average method.
11. To calculate the crude and standardized death rates of the population using Direct Method and Indirect Method regarding one of the population as standard population.
12. To calculate the following for the given data
CDR, CBR, Sex/Age SDR,GFR,TFR,GRR,NRR.
13. To complete the given incomplete life table by computing various elements of l-ife table.
14. To interpolate the required value for the given data using Newton's Forward/backward interpolation formula for equal intervals.
15. To interpolate the required value for the given data of using Newton's divided difference and Lagrange's interpolation formula.
16. To evaluate the integral of the type $\int_a^b f(x) dx$ using
(i) Trapezodial rule, (ii) Simpson's one-third rule
(iii) Simpson's three-eight rule
- 17 Fitting of Paretos curve to income data.
18. Estimation of price-elasticity from time series data.

Distribution of marks:

	B.Sc.	B.A.
Class Record	:10	06
Viva Voce	:10	06
Practicals	:80	48