STATISTICS

Scheme of Examination of B.A/B. Sc three year degree course w.e.f. 2012-2013

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 the constituent semesters).

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

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

(Semester-II)

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

B.A /B. Sc Part-II

(Semester-III)

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

(Semester-IV)

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

B.A /B. Sc Part-III

(Semester-V)

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

(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 will be based on the following criteria:

(i)	Two Handwritten Assignments (1st Assignment after one month & 2nd 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
(2) 81% to 90%	:	4 Marks
(3) 75% to 80%	:	3 Marks
(4) 70% to 75%	:	2 Marks***
(5) 65% to 70%	:	1 Mark***

**Practical Examinations will be held annually in the even semesters i.e. IInd, IVth & VIth semesters. The distribution of marks will be as under:

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

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

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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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

Types of Data: Qualitative and quantitative data, nominal and ordinal data, time series data, discrete and continuous data, frequency and non-frequency data.

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.

UNIT-II

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 and 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.

UNIT-III

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.

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.

UNIT-IV

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

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

Conditional probability. Addition and multiplication laws of probability and their extension to n events. Boole's inequality; Baye's theorem and its applications.

UNIT-III

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.

UNIT-IV

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

Books recommended

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

Curve Fitting: Principle of least squares, fitting of straight line, second degree parabola, power curves of the type $Y=aX^b$, exponential curves of the types $Y=ab^X$ and $Y=ae^{bX}$.

UNIT-III

Linear Regression: Two lines of regression, regression coefficients, properties of regression coefficients, angle between two regression lines, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values, distinction between correlation and regression.

UNIT-IV

Multiple Regressions for Three variables: 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 coefficient of determination.

Books recommended

S. 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.	Lowa 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

Bernoulli distribution and its moments, Binominal distribution: Moments, recurrence relation for the moments, mean deviation about mean, mode, moment generating function (m.g.f), additive property and recurrence relation for the probabilities of Binominal distribution.

UNIT-II

Poisson distribution: Poisson distribution as a limiting case of Binomial distribution, moments, mode, recurrence relation for moments, m.g.f., additive property of independent Poisson variates. Negative Binominal distribution: m.g.f., deduction of moments of negative binominal distribution from those of binominal distribution. Geometric distribution: moments and m.g.f.

UNIT-III

Continuous uniform distribution: Moments, m.g.f., and mean deviation. Gamma distribution: m.g.f., and additive property. Exponential distribution: m.g.f., moments and lack of memory.

UNIT-IV

Normal distribution as a limiting form of binominal distribution, chief characteristics of Normal distribution; mode, median, m.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.

Books recommended

S. 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-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 at least 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 Poisson 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**
Practical:	**80**	**48**

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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

Statistical Estimation: Parameter and statistic, Basic concept of sampling distribution. 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).

UNIT-II

Methods of Estimation: Method of moments, method of maximum likelihood and its properties (without proof). Estimation of parameters of Binomial, Poisson and Normal distributions

UNIT-III

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, BCR, Neyman-Pearson Lemma, Test of simple hypothesis against a simple alternative in case of Binomial, Poisson and Normal distributions.

UNIT-IV

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

Books recommended

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

Basic sampling methods: Simple random sampling (SRS) with and without replacement, use of random number tables, estimation of mean and variance in case of SRS. Simple random sampling of attributes, size of simple random sample.

UNIT-III

Stratified random sampling, estimation of population mean, variance of the estimate of population mean in stratified random sampling, allocation of sample size, proportional allocation, optimum allocation. Comparison of Stratified random sampling with SRS.

UNIT-IV
Systematic random sampling, estimation of mean and variance. Comparison of **S**ystematic random sampling with SRS and Stratified random sampling.

Books recommended

S. 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	Lowa 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 Hours 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

Student's 't' and Snedecor's '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.

UNIT-III

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. Testing for the significance of sample correlation coefficient in sampling from bivariate normal distribution.

UNIT-IV

Nonparametric Tests: Definition of order statistics. Sign test for univariate and bivariate distribution, run test, median test, Kolmogorov-Smirnov one sample test, Kolmogorov-Smirnov two sample test, Mann Whitney U-test (only applications without derivation).

Books recommended

S. 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 Experiments

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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

Analysis of variance (ANOVA): Definition and assumptions for ANOVA. Analysis of variance for one-way classification and two-way classifications for fixed effect models with one observation per cell.

UNIT-II

Introduction to design of experiments, 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. Fundamental principles of design: randomization, replication and local control.

UNIT-III

Completely randomized design (CRD), Randomized Block Design (RBD), their layout, statistical analysis, applications, advantages and disadvantages. Efficiency of RBD relative to CRD.

UNIT-IV

Latin square design (LSD): Layout, statistical analysis, applications, merits and de-merits of LSD. Factorial designs: Definition, advantages and disadvantages.

Books recommended

S. 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-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.

Distribution of marks:

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

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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

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.

UNIT-III

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, moving average method. Analysis of seasonal fluctuations, construction of seasonal indices using method of simple averages, ratio to trend method and ratio to moving average method.

UNIT-IV

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

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

Numerical Methods: Concept of interpolation 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.

UNIT-II

Numerical integration, General quadrature formula for equidistant ordinates, Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ formulae.

UNIT-III

Basics 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).

UNIT-IV

Flow charts and Algorithms: 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 $3/8^{th}$ rules.

Books recommended

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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-$\overline{X}$ and R chart, criteria for detection of lack of control in $\overline{X}$ & R Charts, Interpretation of $\overline{X}$ & R charts.

UNIT-II

Control chart for standard deviation (σ chart), control charts for attributes: 'p' chart and 'c' chart, Concept of 6-σ limits.

UNIT-III

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.

UNIT-IV

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

Books recommended

S. 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 four units uniformly i.e. two from each unit. The candidate will be required to attempt five questions in all selecting one question from each unit and 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.

UNIT-I

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.

UNIT-II

Linear programming problem (LPP): 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.

UNIT-III

Artificial variable techniques: Big-M method, Two-phase method. Duality in Linear Programming; Concept of duality, Fundamental properties of duality.

UNIT-IV

Transportation Problem (T.P.): Formulation, Basic feasible solution. 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's method) for finding the optimum solution of T.P.

Books recommended

S. 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-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 $\overline{X}$ 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 populations 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 life 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) Trapezoidal 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**
Practical:	**80**	**48**