

**Scheme of Examinations of B.A./B.Sc. (Semester System)  
Three Years Degree Course w.e.f. 2010-11\***

Semester	Paper Code	Nomenclature	Marks		Time in hours
			In the Exam.	Internal Assessment	
I	ST-101	Statistical Methods-I	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-102	Probability Theory	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
II **	ST-201	Statistical Methods-II	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-202	Probability Distributions	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-203	Practical	B.Sc.-100 B.A.-60	-	3
III	ST-301	Elementary Inference	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-302	Sample Surveys	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
IV **	ST-401	Parametric and Non-Parametric Tests	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-402	Design of Experiments	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-403	Practical	B.Sc.-100 B.A.-60	-	3
V	ST-501	Applied Statistics	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-502	Numerical Methods & Fundamentals of Computers	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
VI **	ST-601	Statistical Quality Control	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-602	Operations Research	B.Sc.-45 B.A.-32	B.Sc.-5 B.A.-3	3
	ST-603	Practical	B.Sc.-100 B.A.-60	-	3

\* Scheme of Examinations for B.Sc. I & II (Semesters I, II, III & IV) will be applicable w.e.f. the session 2010-11 and B.Sc. III (Semesters V & VI) will be applicable from the session 2011-12.

\*\* The Practical classes will be held in both the semesters (even and odd). However, practical examination will be conducted only at the end of the even semesters and will be based on the syllabi of even and odd semesters.

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

Statistical Methods-I

B.Sc.- 45+05 (I.A.)

B.A.- 32+03 (I.A.)

Time Allowed: 3 hours

Section-I (Two Questions)

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

**Types of Data:** Qualitative and quantitative data, nominal and ordinal data, cross sectional and 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.

Section-II (Three Questions)

**Presentation of Data:** Diagrammatic and graphical presentation of grouped data; Graphing the data constructing histograms, frequency polygon, frequency curve and ogives.

**Measures of Central Tendency and Location:** Mean, median, mode, geometric mean, harmonic mean; partition values-quartiles, deciles, percentiles and their graphical location.

**Measures of Dispersion:** Absolute and relative measures of range, quartile deviation, Mean deviation, standard deviation ( $\sigma$ ), root mean square deviation(s), relation between  $\sigma$  and s, variance of the combined series, Coefficient of variation.

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; concepts of Skewness and Kurtosis and their measures/coefficients including those based on quartiles and moments.

**Theory of Attributes:** Symbolic notation, 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.

**Note:** The examiner is requested to set 8 (eight) questions in all. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

Books Suggested

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I.

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

**Probability Theory**

**B.Sc.- 45+05 (I.A.)**

**B.A.- 32+03 (I.A.)**

**Time Allowed: 3 hours**

**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: 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 and properties of random variable, discrete and continuous random variable, probability mass and density functions, distribution functions.

**Mathematical Expectation:** Definition and its properties-moments, measures of location, dispersion, skewness and kurtosis. Addition and multiplication theorem of expectation.

**Section-III (Two Questions)**

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

**Note:** The examiner is requested to set 8 (eight) questions in all. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Meyer, P.L.: Introductory Probability and Statistical Applications (Addison Wesley)
2. Freund, J.E.: Mathematical Statistics (Prentice Hall)

**Section-I (Two Questions)**

**Correlation for Bivariate Data:** Concept and types of correlation, Scatter diagram; Karl Pearson Coefficient ( $r$ ) of correlation for non-frequency and frequency distributions, assumptions and properties for  $r$ , derivation of limits of  $r$ ; Rank correlation coefficient with derivation of its formula, its merit and demerits. Derivation of 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)**

**Correlation and Regression for Trivariate data:** Concept of multiple and partial correlation and regression, derivation of plane of regression, properties of residuals, derivation of the formula for variance of the residual, coefficient of multiple correlation and its properties, coefficient of partial correlation and its properties, multiple correlation in terms of total and partial correlations.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I.
2. Mukhopadhyaya, P.: Mathematical Statistics.

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

Probability Distributions

B.Sc.- 45+05 (I.A.)

B.A.- 32+03 (I.A.)

Time Allowed: 3 hours

Section-I (Three Questions)

**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, characteristic function (c.f.), cumulants, recurrence relation for cumulants, probability generating function (p.g.f.) and recurrence relation for the probabilities of Binominal distribution.

**Poisson 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 Binominal distribution: m.g.f. cumulants and p.g.f. of negative binominal distribution, deduction of moments of negative binominal distribution from those of binominal distribution.

Numerical problems based on Binominal and Poisson distributions.

Section-II (Two Questions)

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

Section-III (Three Questions)

Normal distribution as a limiting form of binominal 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 and related numerical problems, importance and fitting of normal distribution.

**Gamma distribution:** m.g.f. properties of Gamma distribution, Beta distribution of first and second kind, Exponential Distribution.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-I.
2. Freund, J.E.: Mathematical Statistics (Prentice Hall)
3. Hogg, R.V. & A.T. Craig: Introduction to Mathematical Statistics.

### 203: Practical

(Based on the syllabi of Semesters I & II)

**Time: 3 hours**

**Maximum Marks: B.Sc.100  
B.A.-60**

It will consist of three experiments and the record of practical work and oral test.

The allotment of marks will be as follows:

- i) Experiments (80 marks)
  - ii) Record of practical work and oral test (20 marks)
1. To collect, classify and tabulate some primary data using questionnaire and charts.
  2. To construct frequency distribution using exclusive and inclusive methods and representation of data using Histogram, frequency curve and Ogives, stem and leaf chart, Box plot.
  3. To represent data diagrammatically using bars, rectangles, circles and pie diagrams.
  4. To toss a coin at least 100 times and plot a graph of proportion of heads with respect to number of tosses.
  5. To compute various measures of central tendency and dispersion.
  6. To obtain moments and apply Charlier's checks.
  7. To find moments applying Sheppard's correction.
  8. To obtain coefficients of skewness and kurtosis.
  9. To discuss the association of attributes for 2x2 contingency table using Yule's coefficients of association and colligation.
  10. To compute Karl-Pearson's coefficients of correlation for a Bivariate frequency distributions.
  11. To find Spearman rank coefficient for the given data on two or three variables.
  12. to fit straight line and second degree parabola. 1<sup>st</sup>
  13. To fit the curve of the types (i)  $Y = a^{xb}$  (ii)  $Y = a^{bx}$  (iii)  $Y = ae^{bx}$
  14. To obtain regression of a Bivariate frequency distribution.
  15. To compute partial and multiple correlation coefficients.
  16. To obtain variance of residuals and plane of regression for the given trivariate data.
  17. To fit binomial distribution to the given data.
  18. To fit Poisson distribution to the given frequency distribution using area under the normal curve.
  19. To fit Poisson distribution to the given frequency distribution using method of ordinates.

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

Elementary Inference

B.Sc.- 45+05 (I.A.)

B.A.- 32+03 (I.A.)

Time Allowed: 3 hours

Section-I (Three Questions)

**Statistical Estimation:** Parameter and statistic, sampling distribution of statistic. Point estimate of a parameter, concept of bias and standard error of an estimate. Standard errors of sample mean, sample proportion, standard deviation, Unbiasedness, Efficiency, Consistency and Sufficiency.

Section-II (Three Questions)

**Methods of Estimation:** Method of moments and maximum likelihood

**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 (Two Questions)

**Large Sample Test:** Testing and interval estimation of a single mean and a single proportion and difference of two means of two proportions. Fisher's Z transformation.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Hogg, R.V. & A.T. Craig: Introduction to Mathematical Statistics.
2. Mood, A.M. and Graybill, F.A.: Introduction to the theory of Statistics

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

**Sample Surveys**

**B.Sc.- 45+05 (I.A.)**

**B.A.- 32+03 (I.A.)**

**Time Allowed: 3 hours**

**Section-I (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 and mean squared errors.

**Section-II (Three Questions)**

Some basic sampling methods-simple random sampling (SRS) with and without replacement. Use of random number tables, estimator of mean and its variance in case of simple random sampling. Estimators of proportions and ratios.

**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.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-II.
2. Daroga Singh & F.S. Chaudhary: Theory & Analysis of Sample Surveys



**B.A./B.Sc.II Semester-IV**  
**Parametric and Non-Parametric Tests**

**B.Sc.- 45+05 (I.A.)**  
**B.A.- 32+03 (I.A.)**  
**Time Allowed: 3 hours**

**Section-I (Two Questions)**

Chi-square distribution: Definition, derivation of  $y^2$  distribution, moment generating function, Cumulant generating function, mean mode, skewness, additive property, conditions for the validity of chi-square, Pearson's 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 of Student's 't' and Fisher's 't', derivation of Student's 't' distribution, distribution of Fisher's 't', constant of t-distribution, limiting form & graph of t-distribution. Definition & derivation of Snedcor's F-distribution, constants of F-distribution, mode of F-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 (Three Questions)**

Nonparametric Tests: Definition of order statistics and their distributions, Non-parametric test: Sign test for univariate & bivariate distribution, run test and median test.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-II.
2. Mood, A.M. and Graybill, F.A.: Introduction to the theory of Statistics
3. Hogg, R.V. & A.T. Craig: Introduction to Mathematical Statistics.

**Section-I (Three Questions)**

Analysis of variance (ANOVA), definition, assumptions of ANOVA test, one-way and two-way classifications for fixed effect model with one observation per cell. Introduction to design of 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 and dis-advantages and efficiency or 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 design-  $2^2$  and  $2^3$  designs, illustrations, main effects and interaction effects, Yate's method for computing main and interaction effects.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-II.

### 403: Practical

(Based on the syllabi of Semesters III & IV)

**Time: 3 hours**

**Maximum Marks: B.Sc.-100  
B.A.-60**

It will consist of three experiments and the record of practical work and oral test.

The allotment of marks will be as follows:

- i) Experiments (80 marks)
  - ii) Record of practical work and oral test (20 marks)
1. To apply large sample test of significance for single proportion and difference of two proportions and obtain their confidence intervals.
  2. To apply large sample test of significance for single mean and to obtain confidence interval.
  3. To apply large sample test of significance for difference between two means and standard deviations.
  4. To apply t-test or 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 the given data.
  11. To apply Run test for the given data.
  12. To apply Median test for the given data.
  13. To apply Mann – Whitney test for the given data.
  14. To estimate population total from the given sampled data and obtain confidence interval for population total.
  15. To find standard error of estimate of population total for a given grouped frequency distribution for the population by:
    - (a) Selecting a sample random sample of some specified size n (say).
    - (b) Selecting a sample of size n (say) that include some particular number of observations k (say) of the population and which is a simple random sample of size n-k from the remaining observation of population.
  16. To estimate the total number of words in a dictionary using simple random sampling.
  17. To divide the given population into two/three strata and then selecting sample of given size, find the S.E. of estimate of population total for:
    - (a) Stratified sampling with proportional allocation
    - (b) Stratified sampling with given number of units drawn from each stratum.
  18. To estimate the total number of words in a dictionary using stratified random sampling. Also find S.E. of the estimate.
  19. To perform ANOVA in case of CRD and test whether the treatments/verities are equally effective.
  20. For an RBD, construct an ANOVA table and test:
    - (a) Whether row effects are equal.
    - (b) Whether column effects are equal.
  21. Perform ANOVA for an LSD and test whether the treatments/rows/columns effects are equal.
  22. To analyse  $2^2$  and  $2^3$  factorial designs.

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

**Applied Statistics**

**B.Sc.- 45+05 (I.A.)**

**B.A.- 32+03 (I.A.)**

**Time Allowed: 3 hours**

**Section-I (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, illustration, 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, Abridged life table using King's method, 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.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-II.
2. Kapoor, V.K. and Gupta, S.C.: Applied Statistics

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

Numerical Methods & Fundamentals of Computers

B.Sc.- 45+05 (I.A.)

B.A.- 32+03 (I.A.)

Time Allowed: 3 hours

Section-I (Three Questions)

**Numerical Methods:** 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 one-third and three-eighth 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  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rules.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Sastry, S.S.: Introduction to Methods of Numerical Analysis
2. Ram Kumar: Introduction to Fortran – 77
3. V Raja Raman: Fortran – 77

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

**Statistical Quality Control**

**B.Sc.- 45+05 (I.A.)**

**B.A.- 32+03 (I.A.)**

**Time Allowed: 3 hours**

**Section-I (Three Questions)**

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

**Section-II (Two 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, rectifying inspection plans. Sampling inspection plans.

**Section-III (Three Questions)**

**Demand Analysis:** Laws of supply and demand, price elasticity of demand, demand function with constant price elasticity, price 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.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. Goon, A.M., Gupta, M.K., and B. Das Gupta: Fundamentals of Statistics, Vol-II.
2. Kapoor, V.K. and Gupta, S.C.: Applied Statistics

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

**Operations Research**

**B.Sc.- 45+05 (I.A.)**

**B.A.- 32+03 (I.A.)**

**Time Allowed: 3 hours**

**Section-I (Two Questions)**

Objectives 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., limitation of graphical method, simplex method to solve L.P.P., concept of initial basic feasible solution computation procedure for simplex method. (Not included the case of degeneracy) unrestricted variables.

**Section-III (Three Questions)**

Transportation Problem, Formulation of T.P., BFS to TP, Determination of initial feasible solution North-West corner rules Row minima method, column minima method, Matrix minima method (Least cost entry method), Vogel's Approximation method (or Unit cost penalty method). Assignment problem and its solution.

**Note:** The examiner is requested to set 8 (eight) questions in all, as mentioned above for each section. The candidate is required to attempt 5 (five) questions in all, selecting at least one question from each unit.

**Books Suggested:**

1. J.K. Sharma: An Introduction to Operations Research
2. Kanti Swaroop, P.K. Gupta and Manmohan: Operations Research

### 603: Practical

(Based on the syllabi of Semester V & VI)

**Time: 3 hours**

**Maximum Marks: B.Sc.-100  
B.A.-60**

It will consist of three experiments and the record of practical work and oral test.

The allotment of marks will be as follows:

- i) Experiments (80 marks)
  - ii) Record of practical work and oral test (20 marks)
1. To construct X chart 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 the 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 number for the given data using:
    - Aggregate Expenditure Method
    - Family Budget Method
  6. To test for the given data whether the formulae given by Laspyre, Paasche, Marchal – Edgeworth and Fisher satisfy reversal tests.
  7. To work out trends using moving average method for the given data estimating the mostly appropriate period of moving averages.
  8. To obtain seasonal variation indices using ratio to moving average method for quarterly data.
  9. To obtain seasonal variation indices using ratio to trend method.
  10. To obtain seasonal variation indices using method of link relatives.
  11. To calculate the crude and standardized death rates of the population using Direct Method and Indirect Method regarding one of the population and 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 unequal intervals using Newton's/Lagrange's interpolation formulae.
  - 16-17. To evaluate the integral of the type  $\int f(x) dx$  using
    - (i) Trapezoidal rule
    - (ii) Simpson's one-third rule
    - (iii) Simpson's three-eight ruleWhere the function  $f(x)$  and the values of  $a$  and  $b$  may be taken as follows:
    - $f(x) = \sin x - \log x + e^x$  ;  $a = 0.2, b = 1.4$
    - $f(x) = e^{x^2}$  ;  $a = 0, b = 1$
    - $f(x) = \frac{1}{1+x^2}$  ;  $a = 0, b = 1$
  18. To use computer software SPSS for computing/constructing the following:  
Correlation coefficient, Regression line, ANOVA.
  19. Test of significance applying,  $t$ ,  $F$  and  $\chi^2$  tests.
  20. To solve the problems on Linear Programming by simplex method
  21. To solve the transportation and assignment problems.