

**B.Sc. Part I Examination 2013**  
**Mathematics**

**Paper I : Algebra and Co-ordinate Geometry of Two Dimensions.**

**Paper II : Calculus**

**Paper III: Co-ordinate Geometry of three Dimensions and Vector Calculus.**

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**Paper I**  
**Algebra and Co-ordinate Geometry of Two Dimensions**

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit1: The characteristic equation of a matrix. Eigen values and Eigen vectors. Cayley-Hamilton theorem and its use in finding the inverse of a matrix. Inequalities, continued fractions.

Unit 2: Relations between the roots and coefficients of general polynomial equations in one variable. Symmetric functions of roots Transformation of equations. Descarte's rule of signs. Solution of cubic equations (Cardon method). Biquadratic equations.

Unit 3: Infinite series. Convergent series, tests for convergence of a series, comparison test, D'Alembert's Ratio test, Cauchy's root test, Raabe's test, De Morgen and Bertrand's test, Cauchy's condensation test, Gauss's test. Alternating series, Leibnit'z test (Derivation of above tests not required).

Unit 4 : Polar equation of a conic, polar equations of tangent, normal, asymptotes, chord of contact, auxiliary circle, director circle of a conic and related problems.

Unit 5 : General equation of second degree. Tracing of conics.

**SUGGESTED BOOKS**

M. Ray : A Text Book of Higher Algebra  
Bansal, Bhargva, Agarwal : Algebra (Hindi Ed.)  
Bansal, Bhargava : 2-D Coordinate Geometry (Hindi Ed.)  
Sharma, Varshney : Coordinate Geometry.  
Gokhroo, Saini, Oza : 2-D Geometry (Hindi Ed. )

**Paper – II**  
**Calculus**

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit 1: Polar Co-ordinates. Angle between radius vector and the tangent. Angle between curves in polar form. Length of polar subtangent and polar subnormal, Pedal equation of a curve, Derivatives of an arc, curvature, various formulae, Centre of curvature and chord of curvature and related problems.

Unit 2: Partial differentiation, Euler's theorem on homogeneous functions, chain rule of partial differentiation, Maxima and Minima of functions of two independent variables and of three variables connected by a relation Lagrange's Method of undetermined multipliers.

Unit 3: Asymptotes, double points, curve tracing, Envelopes and evolutes.

Unit 4: Rectification. Volume and Surfaces of solids of revolution. Theory of Beta and Gamma functions, Differentiation and integration under the sign of integration.

Unit 5: Evaluation of double and triple integrals and their applications in finding areas and volumes. Dirichlet's integral. Change of order of integration and changing into polar co-ordinates.

**SUGGESTED BOOKS**

Gorakh Prasad : A Text Book of Differential Calculus

Bansal, Bhargava and Agarwal : A Text Book of Differential Calculus II (Hindi Ed.) and Integral Calculus, Vol. II (Hindi Ed.)

Gokharoo, Saini : Differential Calculus (Hindi Ed.).

Tandon, O.P. and Sharma, K.C. : Integral Calculus

Gupta, Juneja and Tandon : Differential Calculus (English Ed.).

Gorakh Prasad : Integral Calculus

## Paper – III

### Co-ordinate Geometry of 3-Dimensions and Vector Calculus.

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit 1 : Sphere, Cone and Cylinder (Rectangular Coordinates only)

Unit 2 : The Central Conicoids (referred to principal axes). Tangents and tangent planes, Polar planes and polar lines, Section with a given centre, Enveloping cone, Enveloping cylinder and related problems.

Unit 3 : Equations of the normal to an ellipsoid, number of normals from a given point to an ellipsoid, Cone through six normals, Conjugate diameter and diametrical planes and their properties. Cone as a Central surface. Paraboloids.

Unit 4 : Plane Sections of Conicoids, Umbilics, Generating lines of hyperboloid of one sheet and its properties.

Unit 5 : Vector Calculus : Curl, Gradient and Divergence & Identities involving these operators. Theorems of Store's, Green and Gauss (Statement, application and verification only).

### SUGGESTED BOOKS

Gupta, Juneja : Vector Analysis

Gokhroo, Saini, Bhati : Vector Calculus (Hindi Ed.)

Bhargava, Banwari Lall : Vector Calculus (Hindi Ed. )

Bell, R.J.T.: Coordinate Geometry of Three dimensions.

Vasistha, Agarwal : Analytical Solid Geometry

Gokhroo, Saini & Rathi : Analytical 3-D Geometry (Hindi Ed.)

Bansal, Bhargva, Agarwal : 3-D Coordinate Geometry II

**B.Sc. Part II Examination – 2013**  
**MATHEMATICS**

Paper I : **Numerical Analysis and Linear Programming.**  
Paper II : **Differential Equations.**  
Paper III : **Mechanics I (Statics and Dynamics of particle)**

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**Paper I**  
**Numerical Analysis and Linear Programming**

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note: The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit 1: Difference operators and factorial notation, Differences of polynomial, Newton's formulae for forward and backward interpolations. Divided differences, relation between divided differences and Simple difference. Newton's general interpolation formulae, Lagrange interpolation formula.

Unit 2: Central differences, Gauss, Stirling and Bessel interpolation formulae. Numerical Differentiation. Numerical integration, Trapezoidal, Simpsons and Weddles rules.

Unit 3: Solution of linear difference equations with constant and variable coefficients. Solution of Algebraic and Transcendental equations, Iterative, Regula Falsi and Newton Raphson methods.

Unit 4: Convex sets and their properties, introduction to linear programming problems. Mathematical formulation; Graphical method of solution of linear programming problems for two variables.

Unit 5: The simplex technique and its application to simple L.P. problems. Concepts of duality in linear programming. Framing of dual programming. Elementary theorems of duality.

**SUGGESTED BOOKS**

Gokhroo, Saini : Linear Programming (Hindi Ed. )  
Mittal, Sethi : Linear Programming, Pragati Prakashan  
Goyal, Mittal : Numerical Analysis, Prograti Prakashan  
Bansal, Bhargava : Numerical Analysis (Hindi Ed.)  
Saxena, H.C. : Numerical Analysis  
Gokhroo : Numerical Analysis (Hindi Ed.)  
Bhargava, Sharma, Bhati : Linear programming (Hindi Ed.)

## Paper II

### Differential Equations

Duration: 03:00 Hours

Max. Marks: 75

Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

Unit 1: Exact and reducible to exact differential equations of first order and first degree. First order higher degree differential equations solvable for x,y,p. Clairaut's form and singular solutions.

Unit 2: Linear differential equations with constant coefficients, Homogeneous linear differential equations with variable coefficients. Simultaneous differential equations, Total differential equations of the form  $Pdx + Qdy + Rdz = 0$ , by method of inspection and method for homogeneous equations.

Unit 3: Linear differential equations of second order of the form  $\frac{d^2y}{dx^2} + P\frac{dy}{dx} + Qy = R$ .

Exact Linear differential equations of  $n^{\text{th}}$  order. Exact Non-Linear differential equations.

Differential equations of the various forms e.g., (i)  $\frac{d^2y}{dx^2} = f(y)$  (ii) Equations not containing y directly (iii) Equations not containing x directly and other forms. Method of variation of parameters to the solution of second order linear differential equations.

Unit 4: Series solutions of Second Order Linear differential equations, Power series method, Bessel and Legendre equations. Partial differential equations of the first order. Lagrange's solution. Some special types of equations which can be solved easily by methods other than the general method. Charpit's (general) method of solution.

Unit 5: Partial differential equations of second and higher order. Classification of linear partial differential equations of second order. Homogeneous and non-homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients. Monge's method of integrating  $Rr + Ss + Tt = V$ .

### SUGGESTED BOOKS

Sharma, Gupta : Differential Equations.

Ray, Chaturvedi : Differential equations.

Bansal, Dhama : Differential equations (Vol. II).

Gokhroo, Saini, Kumbhat : Differential equations (Hindi Ed.)

Gokhroo, Saini, Oza : Partial differential equations.

**Paper III**  
**Mechanics – I**

**(Statics and Dynamics of a Particle)**

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit 1: Resultant and equilibrium of coplanar forces acting on a rigid body. Friction.

Unit 2: Stable and Unstable equilibrium. Forces in three dimensions, Poinsot's central axis, Wrenches.

Unit 3: Virtual work and common catenary.

Unit 4: Velocities and accelerations along radial and transverse directions and along tangential and normal directions. Simple harmonic motion and motion under inverse square law.

Unit 5: Motion on smooth and rough plane curves, circular and cycloidal motions. Central forces and central orbits (excluding planetary motion).

**SUGGESTED BOOKS**

S.L. Ioney : Statics

R.S. Verma : A Text Book on Statics

S.L. Loney : Dynamics of a particle & Rigid bodies.

Ray, M : A Text book on Dynamics

Gokhroo, Saini & Yadav : Higher Dynamics II (Hindi Ed.).

Bhargava, Agarwal : Dynamics (Hindi Ed. )

Bhargava, Agarwal, Gupta : Statics (Hindi Ed.)

Gokhroo : Statics (Hindi Ed.).

**B.Sc. Part III Examination 2013**  
**MATHEMATICS**

Paper I : Abstract Algebra  
Paper II : Analysis and Laplace Transforms  
Paper III : Mechanics II (Dynamics of Rigid Bodies and Hydrostatics)

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**Paper I**  
**Abstract Algebra**

**Duration: 03:00 Hours**

**Max. Marks: 75**

Note : **The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

Unit 1: Definition and example of groups. General properties of groups, Order of an element of a group. Permutations : Even and Odd permutations. Groups of permutations. Cycle group, Isomorphism, Isomorphism of cyclic groups, Cayley's theorem.

Unit 2: Subgroups, Cosets, Lagrange's theorem, Product Theorem of subgroups, Conjugate elements, conjugate complexes, Central of a groups, Normaliser of an element and of a complex. Normal subgroups, quotient Groups, Commutator subgroup of a group. Homomorphism, Fundamental theorem of homomorphism.

Unit 3: Definition and kinds of rings, Integral domain, Division ring, Field, Subring of a ring, Subfield of a field. Characteristic of a ring and field.

Unit 4: Ideals of a ring, Quotient rings, Prime fields, Prime ideals, Field of quotients of an integral domain, Definition and examples of a vector space, subspace of a vector space, Linear combination and linear space, Linear dependence and independence of vectors. Direct product of vector spaces and internal direct sums of subspaces.

Unit 5: Bases and dimension of a finitely generated spaces, Quotient space, Isomorphism, Linear transformation (Homomorphism), Rank and nullity of linear transformation.

**SUGGESTED BOOKS**

Sharma, G.C. : Modern Algebra  
Bansal & Bhargava : Abstract Algebra (Hindi Ed. )  
Agarwal, R.S. : Text Book on Modern Algebra  
Gokhroo & Saini : Abstract Algebra (Hindi Ed. )

## Paper – II

### Analysis and Laplace Transforms

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note :** The paper is divided into five Units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit

**Unit 1 :** Dedekinds theory of real numbers. Linear sets. Upper and Lower bounds, Limiting points, Weierstrass's theorem. Derived sets, Enumerable Sets, Open and Closed sets.

**Unit 2 :** Theory of Riemann integration, Darboux theorem. Fundamental theorem of integral calculus, Mean value theorem of integral calculus.

**Unit 3 :** Functions, Limits, and continuity. Differentiability, Concept of an analytic function, Cartesian and Polar form of Cauchy-Riemann equations. Harmonic function, Conjugate function, Laplace's differential equations, Orthogonal system, Construction of analytic functions. Power Series: Absolute convergence of power series, circle and radius of convergence of power series, sum function of a power series.

**Unit 4:** Basic definition and Properties of complex integration Complex integration as the sum of two line integrals, Inequality for complex integrals. Curves in complex plane, Cauchy-Goursat theorem, Connected regions, Indefinite integral (or Anti Derivative). Derivative of Single-valued functions  $F(z)$ . Cauchy's integral formula, Extension of Cauchy's integral formula to multiconnected, regions, Cauchy's integral formula for the derivative of an analytic function, Successive derivative of an analytic function, Morera's Theorem. Liouville's Theorem, Poisson's integral formula.

**Unit 5:** Laplace Transforms and Inverse Laplace Transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Convolution theorem. Applications of Laplace Transform to the solution of differential equations.

#### **SUGGESTED BOOKS**

Shanti Narayan: Real Analysis

G.N.Purohit: Real Analysis

Bhargava, Goyal: Real Analysis (Hindi Ed.)

Gokhroo, Saini, Ozgha: Real Analysis (Hindi Ed.)

Shanti Narayan: Theory of Functions of a Complex Variable.

Gupta, K.P. : Complex Analysis

Gokhroo, Saini & Yadav: Complex Analysis (Hindi Ed.)

G.N. Purohit: Complex Analysis

S. Ponnusamy: Foundations of Complex Analysis, Narosa Publishing House, Bombay, New Delhi.

V. Karunakaran: Complex Analysis, Narosa Publishing House. Bombay, New Delhi (2002).

N.Levinson and R.M. Redheffer: Complex Variables, Tata McGraw-Hill Publ. Co. Ltd., New Delhi (1980).



**Paper III**  
**Mechanics – II**

**(Dynamics of Rigid Bodies and Hydrostatics)**

**Duration: 03:00 Hours**

**Max. Marks: 75**

**Note :** The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

**Unit 1:** Moments and Products of inertia. D'Alemberts' principle, the general equations of motion of a rigid body, Motion of the center inertia and motion relative to the center of inertia. Motion about a fixed axis under finite forces.

**Unit 2:** The compound Pendulum. Reaction of the Axis of rotation. Motion of a rigid body in two dimension under finite forces.

**Unit 3:** Fluids and Fluid Pressure, homogeneous and heterogeneous fluids, Surface of equal pressure, fluid at rest under action of gravity, Fluid pressure on Plane surfaces.

**Unit 4:** Centre of pressure, resultant pressure on curved surfaces.

**Unit 5:** Equilibrium of floating bodies, Centre of buoyancy, Surface of buoyancy. Stability of equilibrium of floating bodies, Meta Centre.

**SUGGESTED BOOKS**

Loney, S.L. : Rigid Body Dynamics

Gupta, P.P. : Rigid Body Dynamics, Vol. I

Bansal, J.L. : Rigid Body Dynamics.

Gokhroo, Tak : Rigid Body Dynamics ( Hindi Ed. )

Prasad, B.N. : Hydrostatics

Mathur, S.M. : A Text Book of Hydrostatics.

Sharma, Gokhroo, kSaini, Agarwal.: Elements of Hydrostatics.

**B.Sc. Part I Examination 2013**  
**Statistics**

**Paper I : Statistical Methods**  
**Paper II : Elements of Probability**  
**Paper III: Applied Statistics**  
**Practical**

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**Paper I**

**Statistical Methods**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit.  
The candidates are required to attempt one question from each unit.**

**Unit 1:** Definition, Importance, Scope, Limitations, distrust and functions of statistics, Planning of a statistical enquiry, sources of data, classification and tabulation of statistical data.

**Unit 2:** Diagrammatic and graphical representation of statistical data, graphs of frequency distribution, histogram, frequency polygon and ogives.

**Unit 3:** Measures of central tendency: Mean, Median and Mode, requisites of an ideal average, their merits and demerits, dispersion and its various measures.

**Unit 4:** Moments, raw moments, central moments and interrelationship between them, skewness and its various measures. Kurtosis and its measures.

**Unit 5:** Theory of attributes, class frequency, their order, consistency of data, incomplete data, association and independence of attributes, coefficient of association.

**SUGGESTED BOOKS**

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi.

Gupta, S.P.: Statistical Methods, Sultan Chand & Sons, Delhi.

## Paper II

### Elements of Probability

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit.  
The candidates are required to attempt one question from each unit.**

**Unit 1:** Random experiment. Sample space, events. Union and interaction of events, mutually exclusive, exhaustive, independent and equally likely events. Classical and Statistical definitions of probability and simple problems. Axiomatic approach to probability. Addition law of probability for two or more events.

**Unit 2:** Conditional probability. Multiplication law of probability, Statistical independence of events. Bayes theorem and its simple applications.

**Unit 3:** Random Variable: Discrete and continuous random variables. Probability mass and density functions, joint, marginal and conditional probability function. Distribution functions.

**Unit 4:** Mathematical Expectation: Definition of expectation, Addition and Multiplication laws of expectation. Moments and product moments in terms of expectation, variance and covariance for the linear combination of random variables Elementary idea of conditional expectation. Schwartz's inequality.

**Unit 5:** Moments generating and Cumulant generating functions with properties. Joint Moment generating function. Characteristic function with properties (without proof).

### SUGGESTED BOOKS

Gupta, S.C. and Kapoor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi.

Kapoor, J.N. and Saxena, H.C.: Mathematical Statistics, S.Chand & Co., Delhi

Goon, A.M., Gupta M.K., Dass Gupta.: Fundamentals of Statistics, Vol. 1, World Press, Calcutta, 1991.

Gokharoo, D.C. and Saini, S.R.: Mathematical Statistics (Hindi ed.), Navkar Prakashan, Ajmer.

Bhargava, S.L. and Agarwal, S.M., Mathematical Statistics (Hindi) ed.), Jaipur Publishing House, Jaipur.

David, R.: Elementary Probability, Oxford Press

Bhat, B.R., Srivenkatramana, T. and Rao, Madhava K.S. (1977): A Beginner's Text, Vol, II, New Age International (P) Ltd., 1996.

## **Paper III**

### **Applied Statistics**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

**Unit 1:** Statistical Organizations in India: C.S.O., N.S.S.O., their functions and publications, agricultural Statistics, area and yield statistics, trade statistics.

**Unit 2:** Index Number: Various types of index numbers, construction of index number of prices, fixed base and chain base methods, uses and limitations of these methods.

**Unit 3:** Essential requisites of an ideal index number, cost of living index number and its construction, the notions of splicing, base shifting and deflating.

**Unit 4:** Population Statistics, its nature, vital statistics, measures of mortality and fertility.

**Unit 5:** The growth of population and its measurements, like table, its construction and uses. Indian census, its organization and features.

### **SUGGESTED BOOKS**

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics

Goon, A.M. and others: Fundamentals of Statistics, Vol. II, World Press, Calcutta.

Gupta, B.N.: Statistics: Theory and Practice, Sahitya Bhawan, Agra (The Chapter on Indian Statistics)

Agarwal, B.L. Basic Statistics, Wiley Eastern Ltd.,

## PRACTICAL

**Duration: 04:00 Hours**

**Max. Marks: 75**

The students will be asked to attempt three exercises out of five exercises. The distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
Total	75 Marks	65 Marks*

\*To be converted out of 75 marks.

The following topics are prescribed for practical works:

1. Presentation of raw data.
2. Graphical representation by (i) Histogram (ii) Frequency Polygon (iii) Frequency curve and (iv) Ogives.
3. Diagrammatic representation by (i) Bars (ii) Pie-diagram.
4. Measures of central tendency: Mean, Median and Mode.
5. Measures of dispersion: (i) Range (ii) Inter-quartile range (iii) Mean deviation (iv) Variance and Standard deviation (v) Coefficient of variation.
6. Moments and various measures of skewness and kurtosis.
7. Exercises on determination of class frequencies, consistency of data and association of attributes.
8. Computations of death rates, birth rates, reproduction rates and construction of life tables.
9. Exercises on various types of index numbers.

**B.Sc. Part II Examination 2013**  
**Statistics**

**Paper I : Probability and Probability Distributions**  
**Paper II : Correlation and Numerical Methods**  
**Paper III: Sampling Techniques**

**Practical**

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**Paper I**

**Probability and Probability Distributions**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

**Unit 1:** Discrete probability distributions and their properties: Bernoulli, Binomial, Poisson, negative binomial, geometric, hypergeometric, multinomial and discrete uniform distributions.

**Unit 2:** Continuous probability distributions and their properties: Uniform, Normal, Exponential, Beta type I and type II, Gamma and Cauchy distributions.

**Unit 3:** Distributions of functions of random variables, cumulative distribution, function techniques, distribution of sum, difference, product and quotient of two random variables, the moment generating functions and transformation techniques (Chapter V of Mood, Graybill and Boes Book).

**Unit 4:** Concepts of conditional expectations, the conditional variance, the joint moment generating function and moments, the bi-variate normal distribution and its properties.

**Unit 5:** Stochastic convergence: Chebyshev's inequality and its generalized form, weak and strong law of large numbers, simple form of central limit theorem.

**BOOKS SUGGESTED:**

Mood, A.M. , Graybill, F.A. and Boes, D.C. Introduction to the Theory of Statistics (Third edition), Mc-Graw-Hill.

Hogg, R.V. and Graig, A.T.: Mathematical Statistics, Amerind

Gupta, S.C. and Kapoor; V.K. ; Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Delhi.

## **Paper II**

### **Correlation and Numerical Methods**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

**Unit 1:** Method of least squares, its application in fitting of straightline, Second degree parabola, logarithmic and exponential curves. The bi-variate data marginal and conditional frequency distribution, covariance, variance of a linear function of variates.

**Unit 2:** Correlation and regression, the rank correlation, intraclass correlation, the correlation ratio, probable error.

**Unit 3:** Multivariate data, concept of multiple correlation and regression, partial correlations, multiple regression equation (for three variables).

**Unit 4 :** Time series and its components, method of moving average and curve fitting for determining trend, determination of seasonal indices. Link relative method.

**Unit 5:** Statistical applications of numerical methods: Methods of intra and extra polations due to Newton, Lagrange and Gauss. Divided differences and Newton's formula. Numerical Integrations: Trapezoidal and Simpson's formulae.

### **BOOKS SUGGESTED**

Gupta, S.C. and Kapoor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Delhi.

Kapoor, J.N. and Saxena H.C.: Mathematical Statistics, S.Chand and Co., Delhi.

Scarborough, J.B.: Numerical Mathematical Analysis, Oxford and IBH.

## **Paper III**

### **Sampling Techniques**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note :** The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

**Unit 1:** Sampling surveys vs. complete enumeration, random and purposive sampling. Methods of drawing random sample, the principal steps in sample surveys, sampling and non sampling errors.

**Unit 2:** Simple random sampling with and without replacement, stratified random sampling, comparison of stratified sampling with SRSWOR.

**Unit 3:** Ratio and regression methods of estimation, estimation of population mean and total in large sample size. Comparison with simple estimator.

**Unit 4:** Systematic sampling, cluster sampling with equal cluster size.

**Unit 5:** Two stages sampling in case of equal cluster size at both the stages. Two phase sampling.

#### **BOOKS SUGGESTED**

Cochran, W.G.: Sampling Technique, John Wiley Publication, New York.

Sukhatma, P.V. and others: Sample Surveys and its application, ISAS, Delhi – 12.



## PRACTICAL

**Duration: 04:00 Hours**

**Max. Marks: 75**

The students will be asked to attempt three exercises out of five exercises. The distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
Total	75 Marks	65 Marks*

\*To be converted out of 75 marks.

The following topics are prescribed for practical works:

1. Computation of co-efficient of (i) Simple correlation (ii) Rank correlation.
2. Preparation of correlation table from ungrouped data.
3. Determination of regression lines from (i) Ungrouped data (ii) Correlation table.
4. Fitting of linear regression in case of three variables, computation of partial and multiple correlations coefficient for three variables.
5. Fitting of (i) Straight line (ii) Second degree parabola (iii) Exponential curve by least square method.
6. Fitting of distributions (i) Binomial (ii) Poisson (iii) Normal distributions and testing of goodness fit.
7. Moving average method for determining trend, seasonal indices.
8. Practical on Numerical methods (Covered in Paper II).
9. Practical on sampling techniques (Covered in Paper III).

**B.Sc. Part III Examination 2013**  
**Statistics**

**Paper I : Sampling Distribution, Estimation and Testing of Hypothesis**  
**Paper II : Statistical Quality Control & Operation Research**  
**Paper III: Designs of Experiments and Non-Parametric Tests**

**Practical**

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**Paper I**

**Sampling Distribution, Estimation and Testing of Hypothesis**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

**Unit 1:** Concepts of sampling distribution and standard error, derivation of  $X^2$  (chi-square), t and F distribution, their simple properties.

**Unit 2:** Concepts of point estimation, properties of point estimators such as consistency, unbiasedness, minimum variance. Unbiased estimators, efficiency and simple notion of sufficiency, factorization theorem (without proof).

**Unit 3:** Different methods of finding estimators such as method of moments, method of minimum variance, method of least square and maximum likelihood (without detailed discussion of their properties).

**Unit 4 :** Testing of hypothesis, simple and composite hypotheses, two types of errors, idea of best critical region, power of a test, power curves in simple cases. Neyman- Pearson lemma.

**Unit 5 :** General theory of test of significance, Large sample tests for mean and proportions. Applications of  $X^2$  (chi-square) t and F in testing of hypotheses. The interval estimation.

**SUGGESTED BOOKS**

Gupta, S.C. and Kapoor, V.K.: Fundamental of Mathematical Statistics, Sultan Chand and Sons, Delhi.

Surendran, P.U. and Saxena, H.C.: Statistical Inference, S.Chand & Co., Delhi.

## Paper II

### Statistical Quality Control & Operation Research

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note :** The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.

**Unit 1:** Concept of Statistical quality control, Control charts:  $(\bar{x}, R)$ ,  $(\bar{x}, \sigma)$ ,  $p$ ,  $np$ ,  $c$ -charts, their constructions and uses.

**Unit 2:** Sequential Analysis: Sequential probability ratio test, O.C. and A.S.N. functions and their applications.

**Unit 3:** Sampling Inspection by attributes: Producer's risk, consumer's risk, AOQL, ASN, OC, Single, Double and Sequential Sampling plans and their comparison.

**Unit 4:** Introduction to operation Research, Queuing theory (I): Queuing systems, characteristics of queuing system, Poisson process, exponential distributions of number of arrivals, inter arrival time, service time.

**Unit 5:** Queuing Theory (II): Classification of queues, model I : Model  $(M/M/1): (\infty / \text{FIFO})$  and its characteristics, waiting time distribution. Introduction of Model II  $(M/M/1): (< \infty > / \text{SIRO})$ .

### BOOKS SUGGESTED

Gupta, B.N.: Statistics (Theory and Practical), Sahitya Bhawan, Agra.

Saini, Yashpan and Fiedman: Operation Research Methods and Problems, Hohn Wiley and Sons, New York.

Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II

Grant, E.L.: Statistical Quality Control, Mc-Graw Hill, New York.

## **Paper III**

### **Designs of Experiments and Non-Parametric Tests**

**Duration: 03:00 Hours**

**Max. Marks: 50**

**Note : The paper is divided into five units. Two questions will be set from each unit. The candidates are required to attempt one question from each unit.**

**Unit 1 :** Analysis of variance, one way and two way classification, including multiple but equal number of observations per cell.

**Unit 2 :** The completely randomized design, Randomized block design, comparison of RBD with CRD, Lay-out of RBD.

**Unit 3 :** The latin square design, its layout and analysis. Factorial experiments, the main effects and interactions layout and its analysis (in  $2^2$  and  $2^3$  carried out in a RBD only).

**Unit 4 :** Non-parametric Tests: Order Statistics Cumulative and probability distribution function of a Single Order Statistics, expectation of function of order statistics. Non-parametric methods and advantages and disadvantages, Power efficiency, Sign test (Simple, for paired observations), Run test for randomness.

**Unit 5 :** Wilcoxon signed Rank test, Median Test, Mann-Whitney Wilcoxon U-Test, Wald-wolfowitz Runstest (two sample problem), Kolmogorov-Smirnov Goodness of fittest.

### **BOOKS SUGGESTED**

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, Delhi.  
Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II, World Press, Calcutta.  
Rahatgi, V.: Statistical Inference, Wiley.

## PRACTICAL

**Duration: 04:00 Hours**

**Max. Marks: 75**

The students will be asked to attempt three exercises out of five exercises. The distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
Total	75 Marks	65 Marks*

\*To be converted out of 75 marks.

The following topics are prescribed for practical works:

01. Analysis of variance: One way and two way classifications.
02. Analysis of (i) completely randomized (ii) randomized block and latin square designs, factorial experiments.
03. Practical on SQC (Covered in Paper III).
04. Test of significance based on normal,  $X^2$ , t and F tests, power curve.
05. Practical on Non-Parametric Tests (covered in Paper – III).
06. 'Working knowledge of SPSS Package'.