

**Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce,
Baramati**

Autonomous

Course Structure for M.Sc. I Semester- I (STATISTICS)

Semester	Paper Code	Title of Paper	No. of Credits
I	STAT-4101	Mathematical Analysis	4
	STAT-4102	Linear Algebra	4
	STAT-4103	Probability Distributions	4
	STAT-4104	Sampling Theory	4
	STAT-4105	Practical-I	4
	STAT-4106	Practical-II	4

SYLLABUS(CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code: STAT-4101

Paper : I

Title of Paper : Mathematical Analysis

Credit : 4 credits

No. of lectures: 60

A) Learning Objectives: Students should:

- 1 Apply mathematical concepts and principles to perform numerical and symbolic computations.
- 2 Use technology appropriately to investigate and solve mathematical and statistical problems.
- 3 Use calculus to analyze and evaluate properties of real valued functions.
- 4 Have a deeper understanding of mathematical theory.
- 5 Be familiar with several subfields of mathematics (e.g, numerical analysis, topology, operations research).
- 6 Understand the concepts required for further studies in Probability Theory and Asymptotic Inference.

B) Learning Outcome:

- 1 Understand the fundamentals ideas and applications of calculus.
- 2 Employ technology to investigate mathematical concepts and applications.

TOPICS/CONTENTS:

Unit-1

Set of real numbers, supremum and infimum of sets of real numbers, real field, Euclidean spaces, Finite, Countable and uncountable sets, metric spaces, interior points and limit points of a set, open set, closed set. (These concepts will be introduced through metric spaces and \mathbb{R}^n will be considered as a special case) Compactness, Heine-Borel theorem.

(15L)

Unit-2

Sequence of real numbers, convergence and divergence of sequence, subsequences of a sequence, Cauchy sequences, Bolzano-Weierstrass theorem, completeness of \mathbb{R} , limit inferior, limit superior of the sequences, some special sequences. (15L)

Unit-3

Series of real numbers, convergence of series, tests for convergence of series (ratio test, root test), alternative series, conditional and absolute convergence, power series and radius of convergence, examples and problems on these concepts. (15L)

Unit-4

Concept and examples on Derivative of real function, mean value theorem, L' Hospital rule, Taylor's theorem, Inverse function theorem (without proof), implicit function theorem (without proof), definitions and existence of Riemann integral, refinement of partitions, condition of integrability, Riemann sums, fundamental theorem of calculus, definition and existence of Riemann-Stieltjes integral, a condition of integrability (15L)

References:

1. Apostol T.M. (1975). Mathematical Analysis: A modern approach to advanced calculus. Addison-Wesley
2. Rudin, W. (1985). Principles of Mathematical Analysis, McGraw-Hill
3. Goldberg R.R.(1964): Methods of Real Analysis-Blaisell Publishing company, New York, U.S.A.
4. Bartle R.G. & Sherbert D.R. (2000): Introduction to Real Analysis-John Wiley & Sons Inc.
5. Bartle R. G. (1976). Elements of Real Analysis, John Wiley
6. Mapa S. K. (2018) Introduction to Real Analysis, Sarat Book Distributors, Kolkata
7. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer
8. Ajit Kumar (2019), A Basic Course in Real Analysis, A Chapman & Hall Book

**SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020**

Class : M. Sc. (Semester- I)

Paper Code: STAT-4102

Paper : II

Title of Paper : Linear Algebra

Credit : 4 credits

No. of lectures: 60

A) Learning Objectives:

- 1 Use the basic concepts of vector and matrix algebra
- 2 Understand real vector spaces and subspaces and apply their properties.
- 3 Solve systems of linear equations using various methods
- 4 Understand basic mathematical concepts required in advanced statistical and machine learning techniques.

B) Learning Outcome:

Students will demonstrate competence with the basic ideas of linear algebra including concepts of linear systems, independence, theory of matrices, linear transformations, bases and dimension, eigenvalues, eigenvectors and diagonalization.

TOPICS/CONTENTS:

Unit-1

Vector space, subspace, linear dependence and independence, basis and dimension of a vector space, orthogonal and orthonormal vectors, null space, Gram-Schmidt Orthogonalization process, orthonormal basis, orthogonal projection of vector, linear transformation, algebra of matrices, row and column spaces of a matrix, elementary operations and elementary matrices, rank of a matrix. (15 L)

Unit-2

Inverse of a matrix null space and nullity, partitioned matrices, permutation matrix, reducible / irreducible matrix, primitive / imprimitive matrix, idempotent matrix, Kronecker product, Generalised inverse, Moore-Penrose generalized inverse, solution of a system of homogenous and non-homogeneous linear equation, theorem related to existence of solution and examples (15 L)

Unit-3

Characteristic roots of a matrix algebraic and geometric multiplicities of a characteristic root, right and left characteristic, vector, orthogonal property of characteristic vector Cayley-Hamilton theorem and its applications. (15 L)

Unit-4

Spectral decomposition of a real symmetric matrix singular value decomposition nth power of a matrix, Choleskey decomposition of real quadratic form, reduction and classification of simultaneous reduction of two quadratic forms, maxima and minima of ratio of quadratic form. (15 L)

References:

- 1 . Graybill, F.A(1961) An Introduction to Linear Statistical Models Vol 1,McGraw-Hill Book Company Inc.
- 2 . Hadely G.(1962) Linear Algebra,Narosa Publishing House.
- 3 . Harville D. (1997) Matrix Algebra From Statistics Perspective,Springer.
- 4 . Rao A.R. and Bhimasankaram P.(2000),Linear Algebra,Second edition,Hindustan Book Agency.
- 5 . Rao C.R. (2001) Linear Statistical Inference and Its Application,Second Edition,Wiley.
- 6 . Schott J. (2016) Matrix Analysis for Statistics,Third edition Wiley.
- 7 . Searl S.B.(2006) Matrix Algebra Useful for Statistics,Wiley.
- 8 . R. B. Bapat Linear Algebra and Linear Models.

**SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020**

Class : M. Sc. (Semester- I)

Paper Code: STAT-4103

Paper : III

Credit : 4 credits

Title of Paper : Probability Distributions

No. of lectures: 60

A) Learning Objectives:

1. Providing students with a formal treatment of probability theory.
2. Understand characteristics about discrete and continuous random variable and their probability distributions.
3. Prepare students for modeling real data using distributions
4. Develop understanding of distribution theory related for further advanced topics in statistical inference.

B) Learning Outcome:

Students should be able to:

1. Develop problem-solving techniques needed to accurately calculate probabilities.
2. Apply problem-solving techniques to solving real-world events.
3. Apply selected probability distributions to solve problems.

TOPICS/CONTENTS:

Unit 1:

Random experiments and its sample space, probability axioms, random variables, probability distribution of random variables, discrete and continuous random variable, functions of random variables and its distribution, mixture of probability distribution, m.g.f, p.g.f of distribution function. (15 L)

Unit 2:

Multiple random variables, joint, marginal and conditional distribution, variance covariance matrix, independence of random variables, marginal and conditional densities using joint densities, conditional expectations and variance, convolution of random variable, compound distribution, multiple and partial correlation coefficient, exponential family of distribution, location and scale families, non-regular family. (15 L)

Unit 3:

Bivariate normal, bivariate Poisson, bivariate exponential, (Olkins method 3 types) Weibull (2 and 3 parameter), multinomial, Dirichlet, sampling distribution of statistics from univariate normal random samples. (15 L)

Unit 4:

Non-central χ^2 , t, F distribution and their properties, distribution of linear and quadratic forms in iid and standard normal variable (technique based on m.g.f.), Independence of two linear forms, Independence of two quadratic forms and independence of linear and quadratic forms, Fisher's Cochran's theorem, order statistic, joint distribution of order statistic, distribution of r^{th} order statistic, joint distribution of (r^{th} and s^{th} order statistic and their function), distribution of range. (15 L)

References:

- 1 Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics, John wiley & Sons (Asia)
- 2 Hogg R. V. and Crag R. G. (1978): Introduction to Mathematical Statistics Ed.4.
- 3 Casella and Berger(2002) Statistical Inference (Duxbury advanced series II edition)
- 4 Johnson N.L. & Kotz S.(1996) Distributions in statistics Vol.I .VolII and Vol III John Wiley and sons Inc.)
- 5 Johnson N.L., Kotz S., Balkrishnan, N. Multivariate Distributions (John Wiley and sons)
- 6 Rohatagi V.K. & Saleh A.K.(2001) Introduction to probability theory and mathematical statistics. (John Wiley and sons)
- 7 Anirban DasGupta, Fundamentals of Probability: A First Course
- 8 Feller, Fundamentals of Probability: A First Course

**SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020**

Class : M. Sc. (Semester- I)

Paper Code: STAT-4104

Paper : IV

Title of Paper: Sampling Theory

Credit : 4 credits

No. of lectures: 60

Learning Objectives:

- 1 To introduce the statistical aspects associated with the design and analysis of sample surveys, and to develop your understanding of the principles and methods used to design survey sampling schemes.
- 2 Distinguish between probability and non-probability sampling.
- 3 Understand the factors to consider when determining sample size.
- 4 Understand the steps in developing a sampling plan.
- 5 Handle the problem of non response or missing data.

Learning Outcomes:

Students are expected to

- 1 Define principal concepts about sampling
- 2 Explains the advantages of sampling.
- 3 Lists the stages of sampling process
- 4 Categorizes and defines the sampling methods
- 5 Apply the Simple Random Sampling (SRS) method
- 6 To analyze and solve problems
- 7 Use statistical softwares.

TOPICS/CONTENTS:

Unit 1:

Objectives of sample survey, planning for sample survey, concept of sampling distribution of statistic, Simple random sampling with replacement, Simple random sampling without replacement, systematic sampling and related results on estimation of population total, mean and proportion, circular systematic sampling, stratified sampling: formation of strata and number of strata, allocation problems and estimation problems, deep stratification and method of collapsed strata.

[15L]

Unit 2:

Inclusion probabilities, Probability Proportional to Size With Replacement (PPSWR) methods, cumulative total method and Lahiri's method for estimation problem, estimation of finite population mean and total, PPSWOR method, Horvitz-Thompson estimator, its variance and properties, Des Raj estimators for a general sample size and Murthy's estimator for a sample of size 2, midzuno sampling design. **[15L]**

Unit 3:

Use of supplementary information for estimation, ratio and regression estimators using separate strata and combined strata, unbiased and almost unbiased ratio type estimators of population mean post stratification, variance of estimator of population mean under it, cluster sampling with clusters of equal sizes and unequal sizes, estimator of population mean and its properties, two stage sampling with equal first stage units, expected value and variance of sample mean, double sampling. **[20L]**

Unit 4:

Sampling and non-sampling errors, Response and non response errors, mathematical model for Response errors, Hansen Hurwitz technique Randomized response technique (RRT), Warner's model; related and unrelated questionnaire methods. **[10L]**

References:

1. Des Raj & Chandhok P.(1998), Sample survey theory (Narosa)
2. Murthy M.N.(1977) Sampling theory and methods (Statistical Publishing Society)
3. Sukhatme P.V. Sukhatme B.V. and C. Ashok Sampling theory of survey and applications (Indian society for Agricultural statistics)
4. W.G.Cochran, (1977) Sampling techniques (John Wiley and sons)

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code: STAT-4105

Paper : V

Title of Paper: Practical-I

Credit : 4 credits

No. of lectures: 60

Sr. No.	Title of Experiments
1.	Introduction to Statistical Software – I (Minitab, R)
2.	Introduction to Statistical Software – II (Matlab, SPSS)
3.	Matrices
4.	G-Inverse
5.	MPG-Inverse
6.	Eigen value, Eigen vectors, Spectral decomposition, Power of matrix- I
7.	Eigen value, Eigen vectors, Spectral decomposition, Power of matrix- II
8.	Solution of system of linear equations using Gauss elimination and Gauss Jordan
9.	Solution of system of linear equations using Gauss Seidal and Gauss Jacobi methods
10.	Application of Calley- Hamilton Theorem
11.	Classification and reduction of quadratic forms
12.	Plotting of density function, distribution functions and Computation of probability of events related to bivariate probability distribution computation of probability of non-central χ^2 , t, F-distributions
13.	Model sampling from Gamma, Chi-square, Weibull, Lognormal probability distribution
14.	Model sampling from discrete, continuous and mixture distribution
15.	Model sampling from bivariate probability distribution

SYLLABUS (CBCS) FOR M.Sc. STATISTICS (w.e.f. June, 2019)
Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code: STAT-4106

Paper : VI

Title of Paper: Practical-II

Credit : 4 credits

No. of lectures: 60

Sr. No.	Title of Experiments
1.	Estimation of parameters in simple random sampling using SRSWR and SRSWOR
2.	Estimation of parameters in Systematic sampling
3.	PPS sampling
4.	Ratio and Regression estimates
5.	Stratified sampling (using ratio and regression)
6.	Cluster sampling with equal and unequal cluster size
7.	Two stage sampling
8.	Double sampling
9.	Simultaneous Transcendental equations (Theory and Procedure)
10.	Simultaneous Transcendental equations (Problems using any Software)
11.	Bivariate Interpolation
12.	Unconstraint Optimization Techniques (Theory and Procedure)
13.	Unconstraint Optimization Techniques (Problems using any Software)
14.	Computation of integral by Riemann and Riemann-Stiltjes integral
15.	Jackknife technique and Bootstrap technique

**Anekant Education Society's
Tuljaram Chaturchand College of Arts, Science and Commerce,
Baramati
(Autonomous)**

Course Structure for M.Sc.- I Semester- II (STATISTICS)

Semester	Paper Code	Title of Paper	No. of Credits
II	STAT-4201	Probability Theory	4
	STAT-4202	Parametric Inference	4
	STAT-4203	Multivariate Analysis	4
	STAT-4204	Regression Analysis	4
	STAT-4205	Practical-III	4
	STAT-4206	Practical-IV	4

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS

(With effect from Academic Year 2019-2020)

Paper Code : STAT-4201

Paper : I

Credit : 4 credits

Title of Paper : Probability Theory

No. of lectures : 60

TOPICS/CONTENTS:

Unit-1

Review of algebra of sets, sequence of sets, limsup, liminf and limit of a sequence of sets, Classes of sets, field, sigma field, minimal sigma field, Borel fields, measurable space, monotone classes, Measurable function, Real and Vector valued random variables, simple r.v., r.v. as a limit of sequence of simple r.v.s, Probability measure on a measurable space, probability space, properties of probability measure: continuity, mixture of probability measures, Lebesgue and Lebesgue-Stieltjes measures. (18L)

Unit 2

Distribution function, decomposition of a distribution function, discrete and continuous type r.v., Correspondence theorem (without proof), Expectation of simple r.v, non-negative r.v. and arbitrary r.v., properties of expectation, moments, moment inequalities. (12L)

Unit 3

Convergence of a sequence of r.v.s, convergence in probability, convergence in distribution, convergence in r^{th} mean, almost sure convergence, their inter-relations, Slutsky's theorem, convergence theorem for expectations, characteristic function and properties, conjugate pairs of distributions, uniqueness theorem (without proof) (15L)

Unit 4

Independence of events, class of independent events, independence of classes, independence of r.v.'s, expectation of the product of independent r.v.'s, equivalent definitions of independence, Kolmogorov 0-1 Law, Borel 0-1 criterion, Borel Cantelli Lemma, Khintchin's WLLN, Strong Law of Large Numbers (SLLN) (Statement only), Central Limit Theorem (CLT), Levy continuity theorem, CLT for i.i.d. r.v.s, Liapounov's form, Lindeberg Feller form and their applications. (15L)

REFERENCES:

- 1) Bhat, B.R. (2007) Modern Probability Theory, Third Edition. New Age International
- 2) Billingsley, P. (1995) Probability and Measure, Wiley Publication.
- 3) Chung, K. L. (2001) A Course in Probability Theory, Third Edition, Academic Press, London
- 4) Basu, A. K. (1999) Measure Theory and Probability (Prentice Hall of India)
- 5) Ash, Robert. (1972) Real Analysis and Probability, (Academic Press)
- 6) Feller, W. (1969) Introduction to Probability and its applications Vol.II, (Wiley Eastern Ltd.)
- 7) Gut A. (2005), Probability: A Graduate Course, Springer-Verlag, New York.
- 8) Dasgupta A. (2008), Asymptotic Theory of Statistics and Probability, Springer-Verlag, New York.

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS

(With effect from Academic Year 2019-2020)

Paper Code : STAT-4202

Paper : II

Credit : 4 credits

Title of Paper : Parametric Inference

No. of lectures : 60

TOPICS/CONTENTS:

Unit-1

Sufficiency, Fisher's concept of sufficiency, Sufficient statistic, Factorization theorem, Joint Sufficiency, Likelihood Equivalence, Minimal Sufficiency, construction of Minimal Sufficient Statistic, Exponential family and Pitman family admitting Minimal Sufficient Statistic. (15L)

Unit 2

Fisher information for one parameter and several parameter models, Unbiasedness, Estimable function, Best Linear Unbiased Estimator, Gauss-Markov theorem, Cramer Rao inequality and its application, Rao-Blackwell theorem, Completeness, Lehman-Scheffee theorem and its application, necessary sufficient condition of MVUE, Ancillary statistic. (15L)

Unit 3

Critical region and test function, Neyman Pearson lemma and Most Powerful test, Uniformly Most Powerful (UMP) test for one sided alternative for one parameter Exponential class of density and extension to the distribution having Monotone Likelihood Ratio property, statement of UMPU test. (15L)

Unit 4

Confidence Interval (C.I.), Shortest Expected Length C.I. Uniformly Most Accurate C.I., introduction to Bayesian estimation: Prior and Posterior distribution, Loss function, Conjugate family of Prior distribution and its example, Principal of Minimum Expected Posterior Loss. (15L)

REFERENCES:

1. Casella G. and Beregar R.L. (2002) Statistical Inference, 2nd Edition (Duxbury Advanced Series)
2. Dudewitz E.J. & Mishra S.N.(1988) Modern Mathematical Statistics (John Wiley)
3. Kale B.K. (1999) A First course on Parametric Inference (Narosa)
4. Lehman E.L (1988) Theory of point estimation (John Wiley)
5. Lehman E.L(1986) Testing of Statistical hypotheses (John Wiley)
6. Rohatagi V.K. (1976) Introduction to theory of probability & mathematical statistics (John Wiley & sons)
7. Dasgupta A. (2008), Asymptotic Theory of Statistics and Probability, Springer-Verlag, New York.

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS

(With effect from Academic Year 2019-2020)

Paper Code : STAT-4203

Paper : III

Credit : 4 credits

Title of Paper : Multivariate Analysis

No. of lectures : 60

TOPICS/CONTENTS:

Unit-1

Exploratory multivariate data analysis, sample mean vector, sample dispersion matrix, correlation matrix, graphical representation, linear transformation and its mean, variance covariance, correlation between linear transformations, principal component analysis, factor analysis, canonical correlation with applications, cluster analysis with applications. (20L)

Unit 2

Multivariate normal distribution, singular and non-singular normal distribution. m.g.f., characteristic function, moments, distribution of a linear form and quadratic form of normal variables, Cochran theorem, marginal and conditional distribution. Test for multivariate normality. (12L)

Unit 3

M.L.E's of parameters of multivariate normal distribution and their sampling distribution, Wishart matrix, Wishart distribution and its properties, Tests of hypothesis about mean vector of a multivariate normal population, Hotelling T^2 statistic and its distribution, its applications. Likelihood ratio test, confidence region for mean vector of multivariate normal distribution. (15L)

Unit 4

Test for equality of dispersion matrices, discriminant analysis, Mahalanobis D^2 statistic, test for significance of the coefficients in discriminant function, misclassification error, methods and applications of MANOVA (without derivation of the distribution of Wilk's lambda). (13L)

REFERENCES

1. Anderson T.W.(1984) Introduction to multivariate analysis (John Wiley)
2. C. R. Rao (1985) Linear Statistical inference and its applications (Wiley Eastern Ltd)
3. Hardle, W. K. & Simar, L. (2012) , Applied Multivariate Statistical analysis (Springer, New York)Johnson R.A. and Wichern D.W.(1988)Applied multivariate statistical analysis (Prentice hall Inc.)
3. Johnson R.A. & Wichern, D.W. (1988). Applied Multivariate Statistical analysis (Prentice Hall Inc.)
4. Kshirsagar A.M. (1983) Multivariate Analysis(Marcel Dekker.)
5. K.C. Bhuyan (2005) Multivariate Analysis and its application, New Central book agency, LTD. Kolkatta
6. Morrison, D.F.(1990). Multivariate Statistical Methods (McGraw Hill Co.) (3rd ed.)

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS

(With effect from Academic Year 2019-2020)

Paper Code : STAT-4204

Paper : IV

Credit : 4 credits

Title of Paper : Regression Analysis

No. of lectures : 60

TOPICS/CONTENTS:

Unit-1

Simple linear regression, assumptions, least square (LS) estimators of parameters, standard error of estimators, testing of hypothesis for coefficient of regression, S.E. of prediction, testing of hypothesis about parallelism (slopes), equality of intercepts, generalized and weighted least squares, congruence, extrapolation, optimal choice of independent variables diagnostics checks and correction: graphical technique, tests for normality, uncorrelatedness, homoscedasticity, lack of fit, transformation on of dependent or independent variables. (15L)

Unit 2

Multiple regression: Standard Gauss-Markov setup, least square estimation, error and estimation spaces, variance and covariance of LS estimators, properties of LS estimators, estimation of error variance, case with correlated observation, LS estimation with restriction on parameters, simultaneous estimation of linear parametric functions, testing of hypothesis for one and more than one linear parametric functions, confidence intervals and regions, generalized and weighted least squares, Mallows Cp, stepwise regression methods – forward, backward, stepwise. (15L)

Unit 3

- a) Multicollinearity: consequences, detection and remedies, autocorrelation consequences, Durbin Watson test, estimation of parameters in autocorrelation.(4L)
- b) Multiple correlation, adjusted multiple correlation coefficient, null distribution of simple correlation and multiple correlation coefficient, partial correlation coefficient and its relation with multiple correlation coefficient, test for significance of simple, multiple and partial correlation coefficients. Residual and residual diagnostics, transformation of variables: Box-Cox power Transformation. (11L)

Unit 4

- a) Polynomial regression, inverse regression, Non-linear regression: Non-linear least squares transformation to a linear model, their uses and limitations, examination of non-linearity, initial estimates, iterative procedure, Newton-Raphson method. **(5L)**
- b) Generalized linear model: Link function: normal, binomial, Poisson, exponential, gamma. **(3L)**
- c) Logistic regression: Logit transform, ML estimation, tests of hypothesis, Wald test, LR test, score test, test for overall regression. **(7L)**

REFERENCES

1. Draper, N. R. and Smith H. (1998) Applied regression analysis 3rd edition (John Wiley)
2. Hosmer, D. W. and Lemeshow, S. (1989) Applied logistic regression (John Wiley)
3. McCullagh, P. and Nelder, J. A.(1989) Generalized linear models (Chapman and Hall)
4. Montgomery D.C.,Elizabeth a. Peck, G.Geoffrey.(2003) Introduction to linear regression analysis (Wiley Eastern)
5. Neter, J.; Wasserman, W. and Kutner, M.H.(1985) Applied linear statistical models
6. Ratkowsky, D. A.(1983) Nonlinear regression modeling (Marcel Dekker)

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS
(With effect from Academic Year 2019-2020)

Paper Code : STAT-4205

Paper : V

Credit : 4 credits

Title of Paper : Practical-III

No. of lectures : 60

Sr. No.	Title of Experiments
1.	Exploratory multivariate data analysis
2.	Principal component analysis
3.	Factor Analysis
4.	Canonical correlation analysis
5.	Cluster Analysis
6.	Visualizations in multivariate data
7.	Model sampling from multivariate normal distribution and computation of M.L.E.'s of parameters
8.	Model sampling from Wishart distribution.
9.	Application of Hotelling T^2 statistics I
10.	Application of Hotelling T^2 statistics II
11.	Likelihood ratio tests (Multivariate Test)
12.	Discriminant analysis
13.	Multivariate Analysis of Variance
14.	Computation of power of the test and level of significance
15.	Computation of confidence coefficient for given confidence interval

SYLLABUS (CBCS) FOR M.Sc.-I Sem.-II STATISTICS
(With effect from Academic Year 2019-2020)

Paper Code : STAT-4206

Paper : VI

Credit : 4 credits

Title of Paper : Practical-IV

No. of lectures : 60

Sr. No.	Title of Experiments
1.	Simple regression and regression diagnostic I
2.	Multiple regression
3.	Lack of fit of the regression model
4.	Multiple regression (selection of variable)
5.	Multicollinearity and diagnosis I
6.	Multicollinearity and diagnosis II
7.	Polynomial regression
8.	Nonlinear regression
9.	Generalized Linear Model
10.	Logistic regression
11.	Modes of convergence
12.	Application and verification of Weak Law of Large Number
13.	Application and verification of Central Limit Theorem
14.	Comparison of lengths of CI
15.	MP test and UMP test