Shri Vile Parle Kelavani Mandal's
MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)
NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India,
Best College (2016-17), University of Mumbai

Affiliated to the
UNIVERSITY OF MUMBAI

Program: M.Sc.

STATISTICS

Semester I

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Test	15 marks
Component 2 (CA-2)	Test	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be THREE HOURS.

Question Number	Description	Marks (with option)	Total Marks
Q1	Based on Unit 1: Any Two out of three (7 * 2 =14) Compulsory 1 mark question.	21 +1 = 22	15
Q2	Based on Unit 2: Any Two out of three (7 * 2 =14) Compulsory 1 mark question.	21 +1 = 22	15
Q3	Based on Unit 3: Any Two out of three (7 * 2 = 14) Compulsory 1 mark question	21 +1 = 22	15
Q4	Based on Unit 3: Any Two out of three (7 * 2 = 14) Compulsory 1 mark question.	21 +1 = 22	15
Q5	Mixed bag question Any Three out of four (5 * 3 = 21) Compulsory 1 mark question.	21 +1 = 22	15
		Total Marks	**75**

Signature Signature Signature

HOD Approved by Vice –Principal Approved by Principal

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Affiliated to the
UNIVERSITY OF MUMBAI

Program: M.Sc. Statistics

Semester 1

Course: Probability Theory

PSMAST101

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Course: Probability Theory				**Course Code: PSMAST101**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4	-	6	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Mathematical Analysis (Proof is not expected) Sequence and series, limit, limit inferior, limit superior, monotone sequence, convergence of sequence, infinite series, Power series. Function, limit of a function, left and right hand limit, continuity, uniform continuity, derivative, mean values theorems, Taylor series expansion, intermediate forms, partial derivatives, extreme values, implicit, explicit function. Introduction to Riemann integration, integrable functions, integration under differentiation, fundamental theorem on calculus, mean value theorems of integral calculus, integration by parts. Change of limits of integration. Improper integrals: limit of integration, convergence, absolute convergence, uniform convergence.	**15**
Module 2	Sets, classes of sets, algebra of sets, limits of sequence of sets, field, sigma-field, Borel field, minimal field, definitions: random experiment, sample space, event. Measure, measureable sets, non-measurable sets, Probability space, probability definitions, Bonferroni's inequality, Booles' inequality, continuity theorem.	**15**

Module 3	Conditional probability, independence, Borel zero-one law, Borel-Cantelli lemma, Kolmogorov zero-one law. Random variable, Expectation and moments, some moment inequalities, Convolution. Characteristic function, continuity theorem of characteristic function.	**15**
Module 4	Convergence of sequence of random variables, various types of convergence and their interrelations, Monotone convergence theorem, dominated convergence theorem. Law of large numbers: weak, strong. Central limit theorem: Lindberg's central limit theorem, Liapounov's central limit theorem.	**15**

Reference Books:

1. Apostol, T. M. (1974): Mathematical Analysis. 2nd edition, Narosa Publishing house.
2. Bartle G. and Sherbet, D. R. (2000): Introduction to Real Analysis. 3rd edition. Wiley
3. Bhat B.R. (1999): Modern Probability Theory: An Introductory test book. 3rd edition. New Age International.
4. Chandra, T. and Gangopadhyay, S. (2017): Fundamentals of Probability Theory. Narosa Publishing House.
5. Gut, A. (2005): Probability: A Graduate Course. Springer.
6. Kumar, A and Kumaresan S. (2015): A Basic course in Real analysis. CRC Press.
7. Malik, S. C. and Arora, S. (2017): Mathematical Analysis. 5th edition. New age International Publishers.
8. Rohatgi V.K. & Saleh A.K. Md. Ehasanes (2001) - An Introduction to Probability and Statistics. Wiley.
9. Rudin, W. (1976): Principles of Mathematical Analysis. 3rd edition. McGraw-Hill.

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Program: M.Sc. Statistics

Semester I

Course: Linear Models

PSMAST102

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Linear Models				**Course Code: PSMAST102**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in** Question Paper)
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Basic operations, Vector Spaces, Linear dependence and independence, Determinants of Matrices: Definition, Properties and applications of determinants for 3rd and Higher order, Inverse of matrix, Trace of matrix, Partition of matrix, Rank of matrix, echelon forms, canonical form, generalized inverse, Solving linear equations, Characteristic roots and characteristic vectors, properties of characteristics roots , Idempotent matrix, Quadratic forms, positive and Positive semi definite matrix.	**15**
Module 2	Linear parametric function and its estimability, Gauss Markoff theorem, Interval estimates and test of hypothesis, fundamental theorems on conditional error ss, Test of β=d, generalized least squares	**15**
Module 3	Analysis of variance, fixed effect models: (i) One –way classification model. (ii) Checking assumptions of ANOVA Model. (iii) Simultaneous Confidence Intervals: Scheffe's, Bonferroni and Turkey's interval.	**15**

	(iv) Two – way classification model with and without interaction effect, one observation per cell and r observations per cell. Tukey's test for non additivity. (v) Two – way classification model with and without interaction effect with unequal number of observations per cell.	
Module 4	(i) Analysis of variance with random and Mixed effect models: Estimation and testing of variance components in one-way, two-way and multiway classification models. ANOVA method. (ii) Analysis of Covariance: Model, BLUE, ANOCOVA table, testing of hypothesis, use of ANOCOVA for missing observation.	**15**

Reference Books: Linear Models

1. Hohn Franz E : Elementary Matrix Algebra
2. Searle S.R. : Matrix Algebra useful for Statistics
3. Kshirsagar A.M. : A course in Linear Models
4. Wang S. GUI and Chow S.C. : Advanced Linear Models.
5. Healy M. J. R. : Matrices for Statistics
6. Shantinarayan : Textbook of Matrices
7. Bishop: discrete data analysis.
8. Finney D, J :- Statistical methods in biological assays.
9. Graybill F.A :- An introduction to linear statistical models Vol. I.
10. Rao C.R :- Linear statistical inference and its applications.
11. Searle S.R :- Linear models.
12. Sen A & Srivastava M. :- Regression analysis. Springer.
13. Scheffe H :- Analysis of variance. .

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Program: M.Sc.

Semester I

Course: Theory of Estimation

PSMAST103

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Theory of Estimation				**Course Code: PSMAST103**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in** Question Paper)
4	4	-	6	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Problem of point Estimation, sufficiency, Neymann factorization theorem, minimal sufficiency, completeness, Ancillarity. Unbiasedness, Uniformly minimum Variance Unbiased Estimator, Rao-Blackwell theorem, Lehmann-Scheffe theorem	**15**
Module 2	Methods of estimation: Method of moments, method of maximum Likelihood estimation (M.L.E.), properties of M.L.E, Scoring method, Large sample properties of MLE.	**15**
Module 3	Bounds for the variance: Cramer-Rao lower bound, Bhattacharya bound, Chapman-Robbins-Keifer bound for the variance of an Estimator. Consistency, properties of consistent estimators.	**15**
Module 4	Bayes estimator, Loss function, risk functions, Minimaxity and Admissibility, Non-parametric Estimation, Jacknife and Bootstrap Estimator.	**15**

Reference Books:

01 Casella, G. and Berger, R. L. (2002): Statistical Inference. Duxbury.

02 Cox, D. R. and Hinkley, D. V. (1996): Theoretical Statistics. Chapman and Hall.

03 Dixit, U. J. (2016): Examples in Parametric Inference with R. Springer.

04 Jun Shao (2005): Mathematical Statistics. Springer.

05 Kale, B. K. (2005): A First Course on Parametric Inference. Narosa Publishing.

06 Lehmann, E.L.and George Casella(1998) :- Theory of point estimation. Springer.

07 Rohatgi V.K. & Saleh A.K. Md. Ehasanes (2001) - An Introduction to Probability and Statistics. Wiley. .

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Program: M.Sc.

Semester I

Course: Sampling Techniques

PSMAST104

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: SAMPLING TECHNIQUES				**Course Code: PSMAST104**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit I	15
3	Unit I	15
4	Unit I	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Complete enumeration, need of sampling, types of sampling: probability sampling and non probability sampling. Some concepts: unit, population, population parameter, sampling unit, sampling frame, sample. Simple random sampling, stratified random sampling, need for stratification, allocation requiring more than 100% sampling, effects of deviations from optimum allocation, Post stratification, method of collapsed strata, allocation of more than one unit. Determination of sample size Ratio estimator, Unbiased type ratio estimator. Ratio method for stratified random sampling, combined and separate ratio, regression estimators. Regression estimator, Regression method for stratified random sampling, combined and separate regression estimators.	**15**
Module 2	Systematic sampling when N = nk and N ≠ nk, estimation of variance of estimated mean, Comparison of systematic random sampling with simple random sampling and without replacement and stratified random sampling.	**15**

	Varying Probability Sampling: Probability Proportional to Size sampling with replacement (PPSWR): Methods of obtaining a sample i. Cumulative Total Method. ii. Lahiri's method Properties of the estimator Hansen-Hurwitz estimator. Comparison of PPSWR with simple random sampling with replacement. Probability Proportional to Size sampling without replacement: Sen-Midzuno method, Des Raj's ordered estimator, Horvitz-Thompson estimator, Yates Grundy form of variance.	
Module 3	Cluster Sampling: Cluster sampling of uniform cluster size, efficiency of cluster sampling with respect to simple random sampling. Optimum cluster size, Cluster sampling of unequal cluster size Two-stage sampling: with equal first-stage units, optimum values of n and m, with unequal first-stage units. Two-phase sampling (Double sampling): Double sampling for stratification, optimum allocation.	
Module 4	Network sampling: multiplicity estimator, Horvitz-Thompson estimator, stratification in network sampling. Adaptive sampling: adaptive cluster sampling, systematic and strip adaptive cluster sampling, stratified adaptive cluster sampling. Non-sampling errors: response and non-response error, methods of imputation.	

Reference Books:

01 Bansal A, (2017): survey Sampling. Narosa.

02 Chaudhari, A and Stenger, H (1992): Survey Sampling, Marcel Dekker.

03 Chaudhari, A (2014): Modern Survey Sampling, CRC Press.

04 Cochran W.G. (1999): Sampling techniques. Wiley series.

05 Singh Daroga and Chaudhary, F. S. (1986): Theory and Analysis of Sample Survey Designs. New Age International Publishers.

06 Mukhopadhyay, P. (2009): Theory and Methods of Survey Sampling. Eastern Economy Edition, 2nd Edition.

07 Murthy M.N.(1967): Sampling theory and Methods. Statistical Publishing Society, Calcutta.

08 Sukhatme,P.V.and Sukhatme B.V.(1970) : Sampling theory of Surveys with applications. Food and Agriculture organization.

09 Thompson, S. K. (2002): Sampling. Willey. 2nd edition.

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Program: M.Sc. Statistics

Course:

PSMAST P1A (Practical)

Semester I

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Statistics Practical I				**Course Code: PSMAST P1A**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in** Question Paper)
-	4	-	4	--	100

Course Code	**STATISTICS PRACTICALS - I**	
PSMAST P1A	Sr. No.	Title of Practical
	Practicals based on Estimation Theory & Matrix theory	
	01	Matrix Theory-I(Determinant, Rank of Matrix , Inverse of matrix)
	02	Matrix Theory-II-(Generalized Inverse, Simultaneous Linear Equations ,Characteristics roots & Characteristics
	03	Methods of estimation.
	03	Uniform Minimum variance unbiased estimation – II
	04	Lower bounds for variance
	05	Consistency
	06	Bayes' Estimation
	Sr. No.	Title of Practical
	Practicals based on Sampling Techniques	
	07	Simple random sampling and Stratified random sampling.
	08	Ratio and Regression methods of Estimation.
	09	Systematic random sampling and Varying Probability Sampling
	10	Cluster sampling.
	11	Two-stage and Two-phase sampling.

AC ITEM No.

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Program: M.Sc. Statistics

Semester I

Course:

PSMAST P1B (Practical)

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Statistics Practical II				**Course Code: PSMAST P1B**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (per week)**	**Tutorial (Hours per week)**	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
-	4	-	4	--	100
Outline of Syllabus: (per session plan)					

Course Code	**STATISTICS PRACTICAL - II**		
PSMAST P1B			
	Sr. No.		
	01	Introduction to R Language, SAS and SPSS softwares	
	02	Elementary calculation	
	03	Data processing and Manipulation	
	04	Matrix operations using R language & SAS language	
	Practical's based on Linear Models.		
	Sr.No.		
	01	Matrix Theory-I (Determinant, Rank of Matrix , Inverse of matrix)	
	02	Matrix Theory-II(Generalized Inverse, Simultaneous Linear Equations, Characteristics roots & Characteristics Vectors)	
	03	Linear Model-I	
	04	Linear Model-II	
	05	Techniques for Checking Assumptions of ANOVA	
	06	One way classification model	
	07	Two way classification model -I	
	08	Two way Classification Model-II	
	09	Random Effect Models	
	10	Analysis of Covariance	

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Program: M.Sc.

Semester II

STATISTICS

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

SVKM's Mithibai College of Arts, Chauhan Institute of Science & Amrutben Jivanlal College of Commerce & Economics (AUTONOMOUS)

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester end Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester end Examinations is as shown below:

a) Details of Continuous Assessment (CA)

25% of the total marks per course:

Continuous Assessment	Details	Marks
Component 1 (CA-1)	Test	15 marks
Component 2 (CA-2)	Test	10 marks

b) Details of Semester End Examination

75% of the total marks per course. Duration of examination will be THREE HOURS.

Question Number	Description	Marks (with option)	Total Marks
Q1	Based on Unit 1: Any Two out of three (7 * 2 =14) Compulsory 1 mark question.	21 +1 = 22	15
Q2	Based on Unit 2: Any Two out of three (7 * 2 =14) Compulsory 1 mark question.	21 +1 = 22	15
Q3	Based on Unit 3: Any Two out of three (7 * 2 = 14) Compulsory 1 mark question	21 +1 = 22	15
Q4	Based on Unit 3: Any Two out of three (7 * 2 = 14) Compulsory 1 mark question.	21 +1 = 22	15
Q5	Mixed bag question Any Three out of four (5 * 3 = 21) Compulsory 1 mark question.	21 +1 = 22	15
		Total Marks	**75**

Signature HOD

Signature Approved by Vice –Principal

Signature Approved by Principal

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Program: M.Sc.

Semester II

Course: Distribution Theory

PSMAST201

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)	**Semester: I**
Course: Distribution Theory	**Course Code: PSMAST201**
Teaching Scheme	**Evaluation Scheme**

Lecture (per week)	Practical (per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) (Marks - 25)	Semester End Examinations (SEE) (Marks- 75 in Question Paper)
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	Description	No of Hours
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	Topic	No. of Lectures /Credits
Module 1	Distribution function, quantile function, empirical distribution function, Properties of distributions, Jordan decomposition theorem, functions of random variables. Generating functions: probability generating function, moment generating function.	**15**
Module 2	Multiple random variables, joint cumulative distribution function, joint probability function, joint moment generating function, conditional probability distribution, conditional expectation, functions of several random variables. Moments, covariance, correlation. Truncated distributions. Mixture of distributions.	**15**
Module 3	Some special statistical univariate discrete distributions: degenerate distribution, two-point distribution, discrete uniform distribution, hypergeometric distribution, negative hypergeometric distribution, negative binomial distribution. Special properties of binomial distribution, Poisson distribution, geometric distribution. Compound distributions. Some special statistical bivariate distributions: negative binomial distribution, hypergeometric distribution, Multinomial distribution.	**15**
Module 4	Some special statistical univariate continuous distributions: uniform distribution, Probability integral transform, gamma distribution, beta distribution, Cauchy distribution, Pareto distribution,	**15**

	Order statistics.	

Reference Books:

01 Bhat B.R. (1999): Modern Probability Theory: An Introductory test book. 3rd edition. New Age International.

02 David, H.A and Nagaraja, H. N. (2005): Order Statistics. Wiley.

03 Johnson, N. L., Kotz S. and Balakrishnan, N (2005): Univariate Discrete Distributions. Wiley.

04 Johnson, N. L., Kotz S. and Balakrishnan, N (2004): Continuous Univariate Distributions. Volume-I. Wiley.

05 Johnson, N. L., Kotz S. and Balakrishnan, N (2004): Continuous Univariate Distributions. Volume-II. Wiley.

06 Rao, C. R. (2002): Linear statistical Inference and its Applications. Wiley.

07 Rohatgi V.K. & Saleh A.K. Md. Ehasanes (2001) - An Introduction to Probability and Statistics. Wiley.

08 Ross, S. M. (2014): Introduction to Probability Models. 11th edition. Elsevier.

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Program: M.Sc.

Semester II

Course: Regression Analysis

PSMAST202

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Regression Analysis				**Course Code: PSMAST202**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in** Question Paper)
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Multiple Linear regression models: Assumptions of Linear regression model and checking their assumptions, Box-Cox Power transformation, Diagnostics of Multicollinearity, Regression on Dummy variable, Variable Selection methods: Subset selection, Forward selection, backward elimination and stepwise.	**15**
Module 2	Regression diagnostics: Analysis of residuals, definition of ordinary and Studentized residuals, their properties and use in regression diagnostics, Autocorrelation, Influence Analysis, Cook's distance, PRESS Statistics, covariance ratio , Orthogonal polynomials.	**15**
Module 3	Generalized Linear regression models: Logistic regression: Example, model, MLE of parameters, Iterative procedure to solve likelihood equations, multiple regressors. Multinomial and Ordinal Logistic Regression. Poisson Regression. Analysis of Categorical data: Log linear models, Contingency tables.	**15**

Module 4	Ridge regression: Ill conditioned matrix, need of ridge regression, biased estimator, Mean square error. Bias and MSE of ridge estimator, ridge trace method. Sensitivity Analysis: Properties of Hat matrix, Role of variables in regression model.	**15**

Reference Books:

1. Kshirsagar A.M. : A course in Linear Models
2. Draper N.R & Smith H : Applied Regression Analysis.
3. Song GUI Wang and S.C Chow: Advanced Linear Models.
4. Agresthi: Categorical data analysis.
5. Chattterjee and Haddi: Sensitivity Analysis
6. David W Hosmer and Stanley Lemeshow: Applied Logistic regression.
7. Healy M. J. R. : Matrices for Statistics
8. Shantinarayan : Textbook of Matrices
9. Bishop: discrete data analysis.
10. Cox, D. R. : Analysis of binary data.
11. Chaterjee and Price: Regression Analysis with examples
12. Finney D, J :- Statistical methods in biological assays.
13. Graybill F.A :- An introduction to linear statistical models Vol. I.
14. Montgomery D.C. & Peck B.A. :- Introduction to linear regression analysis.
15. Rao C.R :- Linear statistical inference and its applications.
16. Searle S.R :- Linear models.
17. Seber G.A.F :- Linear regression analysis.
18. Sen A & Srivastava M. :- Regression analysis. Springer.
19. Scheffe H :- Analysis of variance.

AC ITEM No.

Shri Vile Parle Kelavani Mandal's
MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF COMMERCE AND ECONOMICS (AUTONOMOUS)
NAAC Reaccredited 'A' grade, CGPA: 3.57 (February 2016),
Granted under RUSA, FIST-DST & -Star College Scheme of DBT, Government of India
Best College (2016-17), University of Mumbai

Affiliated to the
UNIVERSITY OF MUMBAI

Program: M.Sc.

Course: Planning and Analysis of Experiments I

PSMAST203

Semester II

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Planning and Analysis of Experiments I				**Course Code: PSMAST203**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in** Question Paper)
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Brief History of Statistical Design. Basic principles of design. Contrast, orthogonal contrast and mutual orthogonality of contrasts. General block design (GBD) - an example. C- matrix and its properties. Properties of design – Connectedness, Balance and orthogonal. Statistical analysis of GBD. Randomized Block Design as a particular case of GBD.	**15**
Module 2	Balanced incomplete block design (BIBD). C-matrix, properties, statistical analysis of BIBD. Resolvable BIBD, Affine resolvable BIBD Optimality of block design. : A,D,E – optimality.	**15**
Module 3	Factorial design – an example. Basic definitions and principles .	**15**

	The advantage of factorial designs. The 2^2 factorial design. The general 2^k factorial design. Fitting response curves and response surfaces. A single replicate of 2^k design. NPP method, half NPP method, hidden replication method, Lenth's method and Bisgaard's conditional inference chart method for detecting significant effects. The addition of centre points to the design.	
Module 4	Blocking and confounding of a replicated 2^k factorial design. Das method, contrast method and sign method to obtain principal block. Total and partial confounding. Two level fractional factorial designs . The one half fraction and one quarter fraction of the 2^k design. General $2^{(k-p)}$ fractional factorial design. Alias structure. Complete defining relation. Resolution – III designs. Resolution -IV and Resolution - V designs. Statistical analysis of all these designs.	**15**

Reference Books:

01 Chakraborti, M. C. (1962): Mathematics of Design and analysis of Experiments. Asia Publishing House.

02 Cochran, W. G. and cox, G. M. (1959): Experimental Design. 2nd Edition, Asia Publishing House

03 Davies, O. L. (1954): The Design and analysis of Industrial Experiments. Oliver and Boyd.

04 Das, M. N. and Giri, N. C. (2015): Design and analysis of Experiments. 2nd edition. New Age International Publishers.

05 Fisher, R. A. (1935): The Design of Experiments. Oliver and Boyd.

06 Montgomery, D. C. (2016): Design and analysis of Experiments. 8th edition, Wiley..

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Program: M.Sc.

Semester II

Course: Multivariate Analysis I

PSMAST204

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: I**	
Course: Multivariate Analysis I				**Course Code: PSMAST204**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical (** per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
4	4	-	4	25	75

Outline of Syllabus: (per session plan)

Module	**Description**	**No of Hours**
1	Unit I	15
2	Unit II	15
3	Unit III	15
4	Unit IV	15
	Total	**60**

PRACTICALS

Unit	**Topic**	**No. of Lectures /Credits**
Module 1	Multivariate data and Multivariate graphical display. Multivariate normal distribution, Wishart distribution,	**15**
Module 2	Hotelling' s T^2 and its applications. Regression and correlation coefficients among several variables and their testing.	**15**
Module 3	Likelihood Ratio Tests, Multivariate Analysis of variance.	**15**
Module 4	Discriminant analysis, classification of the observations into one of the two populations. Extension to more than two populations	**15**

Reference Books:

1. Johnson Richard A and Wichern D.W.(1998) : Applied Multivariate Statistical Analysis (4th Edition)
2. Anderson T.W.(1958) : An Introduction to Multivariate Statistical Analysis.John Wiley & Sons
3. Dillon William R & Goldstein Mathew (1984) : Multivariate Analysis : Methods and Applications.
4. Giri Narayan C. (1995) : Multivariate Statistical Analysis.
5. Kshirsagar A. M. (1979) : Multivariate Analysis ,Marcel Dekker Inc. New York.
6. Hardle Wolfgang & Hlavka : Multivarite Statistics : Exercise & Solutions
7. Parimal Mukhopadhyay.: Mathematical Statistics.

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Program: M.Sc. Statistics

Semester II

Course:

PSMAST P2B (Practical)

Choice Based Credit System (CBCS) with effect from the Academic Year 2018-19

Program: M.Sc. (2018-19)				**Semester: II**	
Course: Statistics Practical IV				**Course Code: PSMAST P2B**	
Teaching Scheme				**Evaluation Scheme**	
Lecture (per week)	**Practical** (per week)	**Tutorial** (Hours per week)	**Credit**	**Continuous Assessment (CA) (Marks - 25)**	**Semester End Examinations (SEE) (Marks- 75 in Question Paper)**
-	4	-	2	--	100

Course Code	STATISTICS PRACTICALS - IV
PSMAST P2B	Practicals based on Planning and Analysis of Experiments. Sr. No. Title of Practical 01 Completely Randomized design 02 General block design 03 Randomized block design 04 Balanced Incomplete block design 05 2^2 factorial design. 06 Single replicate 2^k design 07 Confounding in 2^k factorial design 08 Two level fractional factorial design
	Practicals based on Multivariate analysis Sr. No. Title of Practical 01 Multivariate Normal Distribution. 02 Hoteling T^2 03 Multivariate Regression 04 Likelihood Ratio Test 05 Multivariate Analysis of Variance (MANOVA) 06 Discriminant Analysis