University of Rajasthan
Jaipur

SYLLABUS

M.A./M.Sc. STATISTICS

(Annual Scheme)

M.Sc. (Previous) Examination 2021

M.Sc. (Final) Examination 2022

Raj Vad
Dy. Registrar (Acad.)
University of Rajasthan

SCHEME OF EXAMINATION

(Annual Scheme)

1. Each Theory Paper — 3 Hrs. duration — 100 Marks
Dissertation Thesis Survey Report Field — 100 Marks
Work in any — 100 Marks

The number of papers and the maximum marks for each paper practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in practical part separately in each of the Previous and the Final Examination.

2. A candidate has 4 (four) attempts at each of the Previous and the Final Examination shall be required to obtain 36% marks in the aggregate of all the papers prescribed for the examination, provided that if a candidate fails to secure at least 36% marks in any individual paper at the examination and also in the viva-voce/practical/survey/ marks wherever prescribed at the examination, provided that if a candidate fails to secure at least 36% marks in any individual paper at the examination and also in the viva-voce/practical/survey/ report fieldwork. Wherever prescribed, he shall be deemed to have failed at the examination not with standing his having obtained the minimum percentage of marks required in the aggregate for the examination. No division will be awarded at the Previous Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the previous and the Final Examination together, as noted below:

First Division 60% of the aggregate marks taken
Second Division 48% together of the Previous and the Final Examination

3. If a candidate clears any Paper(s)/Practical(s)/Dissertation prescribed at the previous and/or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz 25%/36% in the case of practical)shall be taken into account in respect of such papers/Practicals/Dissertation are cleared after the expiry of the aforesaid period of three years provided that in case where a candidate required more than 25% marks in order to reach the minimum aggregate of minimum marks out of those actually secured by him will be taken into account as would make good (make up the deficiency), in the requisite minimum aggregate.

4. The Thesis/Practical/Survey Report Field Work shall be typewritten and submitted in triplicate so as to reach the office of the Registrar at least 3 weeks before the commencement of the theory examinations (Only such candidates shall be permitted to offer Dissertation /Field Work Survey Report Thesis (if provided in the scheme of examination) in lieu of a paper as have secured at least 45% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme irrespective of the number of papers in which a candidate actually appeared at examination.

M.A. /M.Sc. STATISTICS

Previous

Paper Number	Nomenclature	Max. Marks	Duration of Exam
Paper I	Mathematical Analysis	100	3 Hours
Paper II	Probability and Measure Theory	100	3 Hours
Paper III	Distribution Theory	100	3 Hours
Paper IV	Sample Surveys & Design of Experiment	100	3 Hours
Paper V	Statistical Inference	100	3 Hours
Paper VI	Computer Programming	100	3 Hours
Paper VII	Practical based of paper III and VI	50	3 Hours
Paper VIII	Practical based of Paper I, II and V	50	4 Hours
		100	4 Hours
	Total	700	

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M.A. /M.Sc. STATISTICS
Final

Compulsory Papers

Paper VIII	Multivariate Analysis and Statistical Inference	100	3 Hours
Paper IX	Advanced Design of experiments and Sample Theory	100	3 Hours
Paper X	S.Q.C. and O.R	100	3 Hours
Paper XI	Practical based on Paper IX	100	4 Hours
Paper XII	Paper VIII & X	100	4 Hours

OPTIONAL PAPERS

Any two papers of the following with the permission of the institution concerned

Paper XIII	Economic Statistics and Demography	Marks 100	3 Hours
Paper XIV	Stochastic Process	100	3 Hours
Paper XV	Reliability and Survival Analysis	100	3 Hours
Paper XVI	Advance Multivariate Analysis and Bayesian Inference	100	3 Hours
Paper XVII	Econometrics & Investment System	100	3 Hours
Paper XVIII	Project Work	100	3 Hours

Notes: (1) The project work shall be based on either primary data involving field work or secondary data. The candidates will be required to prepare comprehensive and Critical reports on the same. 1 Hours per week

(2) The teacher supervising the Projects work/Dissertation of a candidate shall be provided one hour per week towards his/her supervision.

(3) In all theory papers of M.A. /M.Sc. (Previous and Final)Statistics except PaperXIV the candidates will be required to answer five question in all taking at least two questions from each section.

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Syllabus
M.Sc. (Previous)
PAPER I
(MATHEMATICAL ANALYSIS)
SECTION-A
(Unit-I)

Real Analysis: Real Valued Function, Continuous Function, Uniform Continuity, Sequences of Functions, Uniform Convergence

Differentiation, maxima-minima of function, functions of several variables, constrained maxima-minima of functions, Multiple integrals and their evaluation by repeated integration, change of variables in multiple integration, differentiation under the sign of integral-Leibnitz rule, Beta & Gamma integrals.

(Unit-II) (24L+12T)

Linear Algebra: Inverse and rank of a matrix, Linear equations, Orthogonal matrix, Orthogonal reduction of a real symmetric matrix to a diagonal form, Hermite canonical form, generalized inverse and its simple properties, Idempotent matrices, Solutions of matrix equations, Kronecker Product.

SECTION-B
(Unit-I)

Bilinear and quadratic forms, reduction to canonical forms, definite and indefinite forms, index and signature, triangular reduction of a positive definite matrix, Characteristic equation, its roots and vectors, Cayley-Hamilton theorem.

(24L+12T)

(Unit-II)

Numerical Analysis: Interpolation formulae (with remainder terms) due to Lagrange's, Newton-Gregory, Newton divided difference, Gauss and Stirling formulae, Inverse interpolation, Numerical differentiation end integration. Trapezoidal, Simpson's 1/3rd and 3/8 rules, Waddle's rules, EulerMaclaurin's Summation Formula. Difference equations of the first order (homogeneous linear difference), homogeneous linear difference equation with constant coefficients.

(24L+12T)

References:

1. Apostol, T.M. (1985): Mathematical Analysis, Narosa Publishing House.
2. Burkil, J.C. (1980): A first course in Mathematical Analysis, Vikas publishing House.
3. Cournat, R. and John, F. (1965): Introduction to calculus and analysis, Wiley.
4. Khuri, A.I. (1983): Advanced Calculus with Applications in Statistics, Wiley.
5. Miller, K.S. (1957): Advanced Real Calculus, Harper, New York
6. Miller, K.S. (1957): Introductory Methods of Numerical Analysis, Prentice Hall.
7. Saxena, H.C.: Calculus of Finite Difference.
8. Searle, S.R.(1982): Matrix Algebra Useful for Statistics, Wiley
9. Shanti Narayan, (1998): Matrix Algebra, S.Chand & co

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Paper II
Probability and Measure theory
SECTION-A
(Unit-I)

General probability space, various definitions of probability, axiomatic definition of probability, combinations of events, laws of total and compound probability, Conditional probability, Baye's theorem and its applications, Concept of random variables, cumulative distribution function and probability density function, joint, marginal and conditional distribution.

(24L+12T)

(Unit-II)

Mathematical Expectation, moments, conditional expectation, moment generating functions, cumulative generating functions and their applications, Characteristic function, uniqueness theorem, Levy's continuity theorem(statement only)Probability inequalities: Chebyshev, Markov and Johnson, Convergence in probability and in distribution, weak law of large numbers and central limit theorem for a sequence of independent random variable under Landenberg's condition central limit theorem for identical independent and identically distributed, random variables: Zero one laws of Borel and Kolmogorov, almost sure convergence in mean square, Kintchin's weak law of large numbers: Kolmogorov inequality, strong law of large numbers.

(24L+12T)

SECTION-B
(Unit-I)

Classes of sets: semi ring, ring, field, sigma field, monotone classes Sequence of sets, limit supremum and limit infimum of a sequence of sets. Additive set functions, measure, outer measure and their properties Cartheodry extension theorem (Statement only) definition of complete measure. Lebsegue and Lebsegue Stieltjes measure (one dimension only). POrobability measure, distribution function and its correspondence with lebsegue Stiltjes.

(24L+12T)

(Unit-II)

Measurable sets and space, measurable space. Simple, elementary and measurable functions. Sequence of measurable functions. Integrability of measurable function, properties of integrals Lebsegue monotone convergence theorems, Fatuous lemma, dominant convergence theorem, Absolute continuity, Random Nikody m theorem, product measure, fubinies theorem.

(24L+12T)

Reference:

1. Kingman J.F. & Taylor. SJ. : Introduction to Measure an Probability.
2. Loeve : Probability Theory.
3. Bhatt. B.R. Probability
4. Feller. W. Introduction to Probability Theory and its Applications Vol. I and II
5. Rohatgi. V.K. An Introduction to Probability theory Mathematical Statistics. Wiley Eastern.
6. Billingsley. P Probability and measure Wiley
7. Dudley. R.M real Analysis and Probability

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Paper III
Distribution Theory
SECTION A
(Unit-I)

[illegible] variables and their distributions using Jacobian of transformation Bernoulli, Binomial(compound and truncated also), Negative Binomial distributions.

(24L+12T)

(Unit-II)

Geometric, Hyper-geometric and Multinomial distributions. Rectangular, Normal (truncated also), Exponential, Cauchy (truncated also), Lognormal and Triangular distributions.

(24L+12T)

SECTION B
(Unit-I)

Sampling distributions-Chi-square, t and F distributions (Central and non-central) & their applications. Bivariate normal (including marginal & conditional distribution), Beta and Gamma distributions.

(24L+12T)

(Unit-II)

Linear regression and correlation; intra-class correlation & correlation ratio, null & non-null distributions of sample correlation coefficient, standard errors of functions of moments. Order statistics their distributions and properties; joint & marginal distributions of order statistics; Sampling Distributions of range & median

(24L+12T)

References:

1. Arnold B C Balakrishnan N. and Nagaraja.H.N (1992): A First Course in Order statistics. Wiley
2. Goon, Gupta & Das Gupta (1991): Outline of statistical Theory. Vol. I World Press, Calcutta.
3. Hogg, R.V and Craig, A.T.(1971): Introduction to Mathematical Statistics. McMillan.
4. Jonson, S. and Kotz(1972)Distribution in Statistics. Vol. I, II. And III. Houghton and Muffin.
5. Kendall, M.G and Stuart. An Advanced theory of Statistics Vol. I, II.
6. Mood, A.M., graybill, F.A. and Boes, D.C (1974): Introduction to the theory of Statistics, McGraw Hill.
7. Mukhopadhyay, P. (1996): Mathematical Statistics. New central book Agency (P) Ltd. Calcutta.
8. Rao, C.R. (1973): Linear Statistical Inference and its Applications, 2/e, Wiley Eastern.
9. Rohatgi, V.K (1984): An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.

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Paper-IV

Sample Surveys & Design of Experiment

SECTION-A

(UNIT-I)

Planning, Execution and analysis of large, small sample surveys with illustrative examples. Non sampling errors and biased reponses, randomized responses for variables, errors in survey, modeling observational errors, estimation of variance components, application to longitudinal studies (repetitive surveys) Basic finite population sampling techniques: SRSWOR, Stratified sampling schemes, Allocation problem in stratified sampling. (24L+12T)

(Unit-II)

Systematic sampling schemes and related results on estimator of mean/total. Cluster sampling, double sampling, two-stage sampling with equal and unequal number of second stage units. Ratio, Product and regression method estimation: Estimators based on SRSWOR method of sampling (24L+12T)

SETCTION-B

(Unit-I)

Analysis of Experimental model by least square, Cochran's Theorem and Regression Analysis (Case of Full rank). Analysis of variance and covariance Transformations. Principles of Experimentation, Uniformity Trails, Randomized experiments, Randomized Blocks, Latin Squares, Balanced Incomplete Block Design(Intra-Block Analysis), Missing Plot Technique (24L+12T)

(Unit-II)

Factorial Experiment 2^n and 3^2, total and partial confounding, split-plot designs, Construction of confounded factorial experiments belonging to 2^n series (24L+12T)

References:

1. Cochran W.G. (1984): Sampling-Techniques (3rd Ed.)Wiley
2. Desraj & Chandak (1998): Sampling Theory, Narosa Publishing House.
3. Murthy M.N. (1977): Sampling Theory and Methods, Statistical Publishing Society, Calcutta.
4. Sampath S. (2000) Sampling theory and Methods, Narosa Publishing House.
5. Singh, D. and Chaudhary, F.S (1986). Theory and Analysis of Sample Survey Designs. New Age International Publishers.
6. Sukhatme B.V. (1984): Sample Survey methods and its Applications Indian Society of Agricultural Statistics.
7. Fedrer, W.T. (1975): Experimental Desogn-Theory and Application, Oxford & IBH.
8. Das, M.N.& Giri, N.C. (1979): Design and Analysis of Experiments, Wiley Eastern.
9. Goon, Gupta & Das Gupta (1991): Fundamentals of Statistics Vol. II, world Press, Kolkata
10. Sukhatme, P.V., Sukhatme, B.V., Sukhatme, S. & Ashok, C: Sampling Theory and Surveys ith Applications

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Paper-V

Statistical Inference

SECTION-A

(Unit-I)

Point estimation, Criteria of good estimator, unbiased estimators uniformly minimum variance unbiased estimator (UMVUE), Cramer Rao Inequality, Consistent estimator, Suffecient estimator, Fisher Neyman factorization theorem, Non uniqueness theorem, Exponential theorem (without proof) Davi's theorems (without proof), Rao- Blackwell efficient estimator, Completeness and Lehmann- Scheffe theorem minimal sufficient statistic, maximum likelihood estimator and its properties (without proof) and the method of estimation (moments, minimum Chi-square and modified minimum Chi-square)

(24L+12T)

(Unit-II)

Confidence intervals, Determination of confidence intervals based on large samples, confidence interval based on small samples. Hypothesis- simple and composite, Critical region, error of Ist and IInd kind, power of test, most powerful test, Neyman-Pearson lemma. Derivations of some Common tests of a simple hypothesis against a simple alternative, uniformly most powerful test.

(24L+12T)

(SECTION B)

(Unit-I)

Likelihood ratio-method of test construction. Asymptotic distribution of the logarithm of LRT statistic. Definition of S.P.R.T. Fundamental relation among α, β, A and B.Determination of A and B in practice Wald's fundamental identity and the derivation of O.C. and A.S.N. functions

(24L12T)

(Unit-II)

Non-Parametric tests. Sign Tests, Singed rank test, Kolmogorov- Smirnov one sample test, General two sample Problem. Wattowitz runs test, Kolmogorov Smirnov two sample test for sample of equal size, Median test, Wilcoxon-Mann-Whitney test. Test of randomness based on runs test based on the total number of runs, test based on the length of longest run.

(24L+12T)

Reference:

1. Cramer, H.: Mathematical methods of Statistics.
2. Goon and others. Outline of Statistical theory, Vol.I.
3. Gibbons: Non-Parametric Statistical Inference.
4. Kendall, M.G. and Stuart, A.: Advanced Theory of Statistic Vol.I and II.
5. Mood, Graybill and Boes: Introduction to the theory of Statistics 3rded.
6. Rohtagi, V.K. Introduction to Probability theory and mathematical statistics.
7. Hogg and Craig Introduction to Mathematical Statistics.
8. Wald, A.: Sequential Analysis.

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Paper VI (a)
Computer Programming (Theory)

SECTION-A

Programming Fundamentals: Computer based Problem solving techniques. Flow charts and Algorithm. Structured Programming Techniques. Statistical Computations using MS-Excel.

Programming through C-Language: Introduction, Structure & Execution of a C Program. Character Set. Keywords. Constants & Variables. Data Types. Types of Operators & Precedence. Input & Output Statements. Assignment Expression. Decision making structure. Looping Structures and Branching Structures and related C-Programs.

(24L+12T)

SECTION-B

Arrays, Character Strings. Standard Library Functions. Header Files Modular programming-User defined Functions, Returning values, Parameter passing Mechanism, Structures, Pointers Defining a Pointer. Array Vs Pointers, Dynamic Memory allocation C-Preprocessors, Related Programs. (24L+12T)

Reference:

1. Ram B., Computer Fundamentals- Architecture and Organization New Age International (P) Ltd 3rd Edition.
2. Pelosi M.K. et. al., Doing Statistics for Business with Excel Data, Inference and Decision Making. John Wiley & Sons.
3. Venugopal et. al Mastering C. Tata Mc Graw Hill.
4. Gottfried B.S., Theory and Problems of programming withTMH.

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