

BHAGWANT UNIVERSITY

Sikar Road, Ajmer

Rajasthan



Syllabus

Institute of Applied Sciences & Life Sciences

M. Phil I Semester

Statistics

Course Category

MSta : M.Phil in Statistics

CCC: Compulsory Core Course

ECC: Elective Core Course

Contact Hours:

L: Lecture

T: Tutorial

P: Practical or Other

Marks Distribution :

IA: Internal Assessment (Test/Classroom Participation/Quiz/Presentation/Assignment etc.)

EoSE: End of Semester Examination

M. Phil (Statistics)

(Course Structure)

Subject code	Subject Name	Teaching hours			Marks		
		L	T	P	External	Internal	Total
01MSta101	Research Methods	3	0	0	70	30	100
01MSta102	ADVANCED STATISTICAL INFERENCE	3	0	0	70	30	100
01MSta103	ADVANCED APPLIED MULTIVARIATE ANALYSIS	3	0	0	70	30	100
01MSta104	Paper-IV: MARKOV CHAINS AND TIME SERIES Reforms	3	0	0	100		100

Total	12	0	0	280	120	400
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Paper I : RESEARCH METHODOLOGY

Paper code 01MSta101

Unit 1 Matrices

Introduction to Linear models – Quadratic forms in random variables - Canonical reduction – generalized inverse and its properties– Moore Penrose inverse .

Unit 2 Probability Theory:

Convergence in sequence - Almost uniform convergence – Convergence in probability - Convergence in Measure – Convergence in Mean.

Law of large numbers: Weak and Strong Law of large numbers – various forms of Central limit theorems: Lindeberg – Liapounov and Lindeberg – Feller CLT.

Unit 3 Sampling Theory

Ratio and Regression methods of estimators – Bias of these estimators – Two stage sampling - Probability proportion sampling methods (PPS).

Unit 4 Data Analysis

Types of Data: Qualitative and Quantitative data: Cross sectional and time series data:

Different types of scales nominal, ordinal, ratio and interval.

Basics of Statistical methods such as regression, principal component analysis, Discriminant analysis, cluster analysis (no derivations – applications understanding of procedures, concepts interpretation and assumptions) – Implementation of about techniques through statistical packages – Interpretation of computer outputs.

Unit 5 Research Methodology

Definition of Research – Stages in Research – Types of research – Research design and planning ,Thesis writing.

Writing a project proposal to a funding agency.

Books for Study:

1. Pauline V Young Research Methodology
2. Burrill C. W Measure theory and Probability, McGraw Hill, New York.
3. Billingsley : Probability and Measure, Wiley Interscience, 1984.
4. Rao, C.R. : Linear statistical inference and its applications, John Wiley & sons, 1983.
5. Biswas S: Topics in Algebra of Matrices, Academic Publication, 1984.
6. Bhat B.R. : Modern probability theory 3rd ed., New Age International, 1999.
7. Graybill, F.A.: An Introduction in to Linear Models, McGraw Hill, New York, 1961.
8. Rohatgi & Saleh (2002) – Introduction to probability and statistics – Asia Publications
9. Ash R.B : Real Analysis and Probability – Academic press, New York, 1972.
10. Sukhatme, P.V., Sukhatme, B.V. and others: Sampling theory of Surveys with applications, 3rd ed, ISAS Publication, 1997.
11. Johnson & - Applied Multivariate Techniques.

Paper II : ADVANCED STATISTICAL INFERENCE

Paper code 01MSta102

Unit I

Sufficient statistics – existence and construction of Minimal sufficient statistics – sufficiency and completeness – sufficiency and invariance – Minimum variance unbiased estimation – Unbiased estimation of location and scale parameters.

Unit II

Maximum likelihood estimators – properties – Strong consistency – asymptotic efficiency of maximum likelihood estimators – best asymptotically normal estimators – Inference based on Censored data (concept only).

Unit III

Neymann – Pearson fundamental lemma – distributions with monotone likelihood ratio confidence bounds, UMP tests for the two sided hypothesis – tests for parameters in a normal distribution.

Unit IV

Unbiased tests: Concept of unbiasedness – application to one parameter exponential family – similarly and completeness – UMP unbiased tests for multi parameter exponential families – comparison of two Poisson and Binomial population - Application of unbiasedness.

Unit V

Invariant tests: Symmetry and invariance – maximal invariance - most powerful invariant tests – unbiasedness and invariance.

Reference:

1. Lehman E.L. and Casella: Theory of Point Estimation, Springer Verlag, 1988.
2. Lehman E.L. : Testing Statistical Hypothesis, John Wiley & Sons, 1986.
3. Rohatgi V.K. : Introduction to mathematical Statistics, Wiley Eastern, 1984.
4. Zacks S.: Theory of Statistical Inference, John Wiley & Sons, 1991
5. Ferguson T.S. : Mathematical Statistics - A decision theoretic approach, Academic Press, 1967.
6. Kale B.k : A first course on parametric inference, Narosa Publication, New Delhi, 1999.

Paper III: ADVANCED APPLIED MULTIVARIATE ANALYSIS

Paper code 01MSta103

Unit I

Introduction to Multivariate analysis – Data Reduction – Principle component analysis – Determination of number of principle components to be retained – component scores.

Unit II

Introduction to Factor analysis – Communalities – Comparison of Extraction procedures – Rotation of factors – Factor scores – Introduction to Multidimensional scaling – Proximities and data collection – Relationship with other data reduction procedures.

Unit III

Introduction to Cluster analysis – Similarity measures – Clustering techniques – Hierarchical and partitioning methods – Graphical methods – Peudograms – guidelines.

Unit IV

Introduction to canonical correlation analysis – Interpretation of canonical correlation results

– Issues in interpretation.

Introduction to Discriminant analysis – Two group problem – variable contribution – Violation of assumptions Logistic discrimination – error rate estimation.

Unit V

Linear structural Relations (LISREL) – Path analysis – Testing casual model – Evaluating LISREL solutions.

Latent Structural analysis – Logic behind Latent structure analysis – Latent class models – Restricted Latent class models.

Books for study:

1. Dillon, W.R. and Goldstein, M.: Multivariate Analysis Methods and Applications, John Wiley & Sons 1984.
2. Hair J.F., Junior Anderson R. E and Tatham R.L, Multivariate Data Analysis with Readings, MacMillan Publications, New York, 1987.

Paper-IV: MARKOV CHAINS AND TIME SERIES

Paper code 01MSta104

Unit 1

Introduction of Stochastic Process: Definition – Examples - Classification of Stochastic process according to state space, index set and dependence among the random variables some common stochastic processes (Bernoulli, Poisson Gaussian and Wiener - concept only). Markov chain (MC): Chapman Kolmogorov's equation - classification of states. A canonical representation of the transition probability matrix. Classification of the states using

graph algorithms - Markov chains as graphs – Martingales - Limiting Probabilities.

Unit 2

Finite Markov chains with recurrent and transient states - irreducible finite Markov chains with ergodic states - First passage times and occupation times - Two states MC (idea only).

Reversed Markov chains - Limit theorems (No proof) - Application only.

Unit 3

Markov Processes (MP) – Detailed Study of Poisson process, Pure Birth process, Yule's process, Birth and death process-Application to queues.

Unit 4

Stochastic models for Time Series - General linear filter model-Autoregressive (AR(p)) models - Moving average model (MA(q)) - Autoregressive - Moving average (ARMA(p,q)) models - Autoregressive integrated moving average model (ARIMA(p,d,q)).

Unit 5

Analysing Time Series Model: Spectral Density of AR models, MA, ARMA, models.

Relationship between Auto covariance and spectral density - Cyclical Behaviour finding Auto covariance, Auto correlation through Spectral Density. Analysing Spectral Graph-Analysing the Cyclical Behaviour of Time Series - Spectral Density and Linear Filters. Relationship between Markov Process and Time Series - Co integrated Time Series.

Books for study:

1. Bhat. U.N: Elements of Applied Stochastic Processes, Wiley 1972.
2. Karlin.S and Taylor: A first course in Stochastic Processes, Academic Press, New York. 1975.
3. Methi.J: Stochastic Processes, Wiley Eastern, 2nd ed, 1994.