BHAGWANT UNIVERSITY
Sikar Road, Ajmer
Rajasthan

Syllabus

Institute of Life Sciences & Applied Sciences
M. Phil
(STATISTICS)

ANNUAL SCHEME OF EXAMINATION:

1. Every candidate shall be required to offer three written papers and one dissertation (equivalent to one paper). Within this frame work the Board of Studies shall recommend the course of study for the M. Phil examination.
2. The course of study for the M. Phil degree shall extend over a period of one academic year. There shall be a continuous internal assessment and as external assessment. The proportion of internal and external assessment shall be 30:70. There will be no internal assessment in the dissertation. Total marks for M. Phil will be 400. Dissertation may be written by the candidates under the supervision of any teacher who is registered as M. Phil Supervisor. Supervisor can guide normally five dissertations. However, the maximum limit may be relaxed by the permission of Vice-Chancellor on the recommendation of Head. The internal Supervisor can guide five candidates and workload of six hours is admissible for each M. Phil course for dissertation. The Supervisor will sign and issue a certificate counter signed by the Head of department concerned.
3. The internal assessment may be evaluated on the basis of:
   (a) Mid Terms : 15 Marks
   (b) Assignments /Seminar Presentation /Group Discussion: 15 Marks
4. Each theory paper shall consist of 100 marks. The dissertation shall also consist of 100 marks. For a pass, a candidate shall be required to obtain (a) at least 40% marks in each paper separately (b) a minimum of 50% marks in the aggregate of all the papers prescribed for the examination. In the mark sheet, successful candidates shall be classified as under

First Division	65% or more.
Second Division	50-65%

6- A candidate will have to pass individually both in the Internal as well as external examination and it should be shown separately in the marks sheet.

7- The placement of every candidate under a Supervisor/Guide shall be decided within two months from the last date for admission.

8- A candidate who fails at the examination even in one paper/dissertation shall be required to reappear at the examination in a subsequent year in all the papers/dissertation prescribed for the examination, provided that a candidate who obtains at least 50% marks in dissertation shall be exempted from the submitting a fresh dissertation and the marks obtained by him shall be carried forward for working out his result.

9- For each theory paper 10 questions will be set for the final examination and the candidate will have to attempt at least five questions. All the questions will carry equal marks.

10- Workload distribution: There will be a teaching of four periods of one hour duration per week for each theory paper and six hours for dissertation.
i.e. 4X3 = 12 hours for theory papers and six hours for dissertation per week.

Papers Number	Paper Code	Papers Name	TEACHING PERIOD L	T	P	External Marks	Internal (Mid Terms+assignment) carrying 30 marks	G. Total
Paper I	01MPL22101	**RESEARCH METHODOLOGY**	3	1	0	70	30	100
		ANY TWO						
Paper II	01MPL22102	**ADVANCED STATISTICAL INFERENCE**	3	1	0	70	30	100
Paper III	01MPL22103	**ADVANCED APPLIED MULTIVARIATE ANALYSIS**	3	1	0	70	30	100
Paper IV	01MPL22104	**MARKOV CHAINS AND TIME SERIES**				70	30	100
	01MPL22201	**DESSERTATION**			6	100		100
		TOTAL	9	3	6	210	90	400

Paper I : RESEARCH METHODOLOGY

Paper code 01MPL22101

Unit 1 Matrices
Introduction to Linear models – Quadratic forms in random variables - Canonical reduction – generalized inverse and it 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 01MPL22102

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 01MPL22103

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 01MPL22104

Unit 1

Introduction of Stochastic Process: Definition – Examples - Classification of Stochastic process awarding to state space, index set and dependence among the random variablessome

common stochastic processes (Bernoulli, Poisson Gaussion and wiener - concept only). Marko chain (MC): Chapman kolmogorov's equation - classification of states. A canonical representation of the transition probability matrix. Classification of the states using graph algorithms - Morkov 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 Makov 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 Cyclic 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.

Dissertation (Compulsory)

Paper Code: 01MPL22201

A dissertation of about 80-100 typed pages on a topic of the candidate's choice. The topic for the dissertation is to be selected in consultation with the supervisor and with the approval of the Research Degree Committee. An External Examiner appointed by the University will evaluate the dissertation.