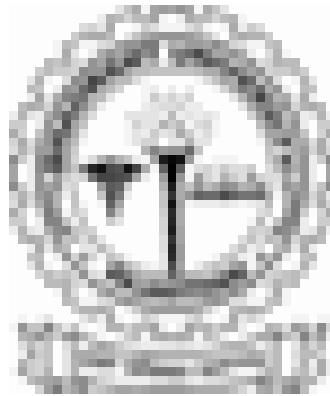


BHAGWANT UNIVERSITY

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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SEMESTER II

Subject code	Subject Name	Teaching hours			Marks		
		L	T	P	External	Internal	Total
02MSta101	ADVANCED RESEARCH METHODOLOGY	3	0	0	70	30	100
02MSta102	ADVANCED OPERATIONS RESEARCH	3	0	0	70	30	100
02MSta103	ADVANCED STATISTICAL QUALITY CONTROL AND RELIABILITY	3	0	0	70	30	100
02MSta201	Dissertation	3	0	0	50	50	100
Total		12	0	0	260	140	400

Paper I : RESEARCH METHODOLOGY

Paper code 01MSta101

Unit - 01

Research - definition - importance and meaning of research - characteristics of research - types of research - steps in research - identification, selection and formulation of research problem – research questions - research design - formulation of hypothesis - review of literature

Unit - 02

Sampling techniques: sampling theory - types of sampling - steps in sampling - sampling and non-sampling error - sample size - advantages and limitations of sampling. Collection of data : primary data - meaning - data collection methods - secondary data - meaning - relevances, limitations and cautions.

Unit - 03

Statistics in research - measure of central tendency - dispersion - skewness and kurtosis in research. Hypothesis - fundamentals of hypothesis testing - standard error - point and interval estimates - important non-parametric tests : sign, run, kruskal - wallis tests and mann-whitney test.

Unit - 04

Para metric tests: testing of significance - mean, proportion, variance and correlation - testing for significance of difference between means, proportions, variances and correlation co-efficient. Chi-square tests - anova - one-way and two-way.

Unit - 05

Research report: types of reports - contents - styles of reporting - steps in drafting reports - editing the final draft - evaluating the final draft.

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 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.

SEMESTER II

PAPER I –ADVANCED RESEARCH METHODOLOGY (02MSta101)

UNIT I

Basic concepts: Research process, problem identification, research designs, informal experimental designs. Completing randomised design, randomized block design, latinsquare design, factorial designs

UNIT II

Sampling and testing of hypothesis: Concept of probability, probability distribution, Normal, Poisson, χ -square, t-test. Sampling distribution, central limit theorem, Sandler's A-test, standard error, population mean, population proportion, sample size, confidence intervals, null hypothesis and alternative hypothesis, level of significance, two tailed and one tailed tests, Z-test, t-test, χ^2 -test, F-test, testing of correlation coefficients, ANOVA one way ANOVA, two way ANOVA Tukey's HSD.

UNIT III

Non-parametric tests: Sign test, Fisher-Irwin test, Mc Nemer test, Wilcoxon Mali test, Wilcoxon, Mann-Whitney test, Kruskal-Wallis test, one sample runs test. Spearman's rank correlation, Kendall's coefficient of concordance.

UNIT IV

Multivariate analysis: Multiple regression, multiple discriminant analysis, multiple analysis of variance, canonical correlation analysis, Factor analysis cluster analysis, path analysis. Computational techniques.

UNIT V

Computer Application, Basic of computer, System Software & application Software. Computer as a tool of Research: Application in Data Analysis, related software. MS Office, SPSS, Data Communication, LAN & WAN Data Exploration using internet tools, e-journal, e-books, basic concept of tele-conferencing & related configuration.

References:

1. Kothari, C.R.(2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.
2. Arya., P.P. and Pal, Y.(2001) Research Methodology in Management: Theory and Case Studies. Deep and Deep Publishers Pvt. Ltd., New Delhi.

PAPER II ADVANCED OPERATIONS RESEARCH

UNIT I

Parametric Programming: Changes in requirement and cost vector.

UNIT II

. Nonlinear Programming: General nonlinear programming problem, constrained optimization with equality and inequality constraints. Necessary and sufficient conditions (Kuhn-Tucker conditions) for solving a nonlinear programming problem.

UNIT III

Quadratic programming : Wolf's method and Beal's method

UNIT IV

Non- Poisson Queues: Study of the systems M/Ek/1, M/G/1, GI/M/1, GI/M/C.

UNIT V

EOQ models with price change, EOQ model with varying demand, EOQ models with uncertain demand. Dynamic version of Economic Lot –size model.

REFERENCES:

1. Kanti Swarup, P.K.Gupta Mohan: Operations Research
2. K.G. Murthy: Nonlinear programming.
3. Donald Waters: Inventory Control and Management; Wiley.
4. Rao, S.S.: Optimization: Theory and Applications

PAPER-III

ADVANCED STATISTICAL QUALITY CONTROL AND RELIABILITY

UNIT I

Continuous sampling plans of Dodge type and Wald-Wolfiwitz type and their properties. Bayesian sampling plans.

UNIT II

Capability indices Cp, Cpk and Cpm; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics.

UNIT III

Use of Design of Experiments in SPC; factorial experiments, fractional factorial designs, construction of such designs and analysis of data. (10L)
Multivariate quality control; use of control ellipsoid and of utility functions.

UNIT IV

Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items; stress-strength reliability and its estimation.

UNIT V

Maintenance and replacement policies; availability of repairable systems; modeling of a repairable system by a non-homogeneous Poisson process. (5L)
Reliability growth models; probability plotting techniques; Hollander-Proschan and Deshpande tests for exponentiality; tests for HPP vs. NHPP with repairable systems.

REFERENCES:

1. Montgomery, D.C. Introduction to Statistical Quality Control; Wiley
2. Montgomery, D.C. Design and Analysis of Experiments; Wiley
3. Ott, E.R. Process Quality Control; McGraw Hill

4. Phadke, M.S. Quality Engineering through Robust Design; Prentice Hall
 5. Wetherill, G.B. Sampling Inspection and Quality Control; Halsted Press
 6. Wetherill, G.B. and Brown, D.W. Statistical Process Control, Theory and Practice; Chapman and Hall
 7. Barlow R.E. and Proschan F. Statistical Theory of Reliability and Life Testing; Holt, Rinehart and Winston.
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8. Lawless J.F. Statistical Models and Methods of Life Time Data; John Wiley.
 9. Bain L.J. and Engelhardt Statistical Analysis of Reliability and Life Testing Models; Marcel Dekker.
 10. Nelson, W: Applied Life Data analysis; John Wiley.
 11. Zacks S. : Reliability Theory, Springer
 12. Martz. M. F. and Wailer. R. A. Bayesian Reliability Analysis. John Wiley and Sons.