Maharshi Dayanand University

Rohtak

Ordinances, Syllabus and Courses of Reading for

Msc. Statistics (Final)

Examination

Session - 2008-2009

Available from :

Deputy Registrar (Publication)
Maharshi Dayanand University
Rohtak -124001 (Haryana)

Price :
At the Counter : Rs. 50/
By Regd. Parcel : Rs. 75/
By Ordinary Post : Rs.60/

MAHARSHI DAYANAND UNIVERSITY ROHTAK
DEPARTMENT OF STATISTICS

Scheme of the examination for M.Sc. (Mathematical Statistics) w.e.f. 2008-2009. The duration of the course of instruction for M.Sc. (Mathematical Statistics) degree shall be of two years. There will be ten papers, five in M.Sc. (Previous) and five in M.Sc (Final). In addition, students will have to submit a project work. The detailed scheme of examination for M.Sc. (Mathematical Statistics) (Previous & Final) is as given below :

M.Sc. (Previous)		Max Marks	I.A.	Time allowed	Teaching Hrs.per week
Paper-I	Analysis and Laplace transform	80	20	3hrs.	05
Paper-II Part (A) :	Probability and Statistical Methods	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-III Part (A) :	Statistical Inference	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-IV Part (A) :	Sampling Techniques Linear Estimation and Design of Experiments	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-V Part (A) :	Applied Statistics	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
M.Sc. (Final)					
Paper-VI Part (A) :	Multivariate Analysis and Econometrics	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-VII Part (A) :	Numericals Methods, and Computer programming	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-VIII Part (A) :	Linear & Non Linear programming	75		3hrs.	05
	Part (B) : Practicals	25		3hrs.	04
Paper-IX and X	Any two of the following				
Opt. (i)	Stochastic processes, Queueing and Reliability Theory	100	20	3hrs.	05
(ii)	Methods of Operations Research	100	20	3hrs.	05
(iii)	Design of experiments and Genetical Statistics	100	20	3hrs.	05
(iv)	Official Statistics and Clinical Trails	100	20	3hrs.	05
(v)	Advance Sample Survey	100	20	3hrs.	05
(iv)	*Computer Programming	100	20	3hrs.	05
(vi)	*Bayesian Inference	100	20	3hrs.	05

The project work : The project work will start in the beginning of M.Sc.(Final) under approved supervisors from amongst the members of the staff. The last date for the submission of project work will be two months after the theory papers. However the result may be communicated to the students.The evaluation will be done by single external examiner on the basis of project work and Viva-voce on five point grading system.

* Syllabi of these papers will be framed later on.

PAPER-VI PART A MULTIVARIATE ANALYSIS AND ECONOMETRICS

Max. Marks : 75
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Three questions)

The Multivariate normal distribution Marginal and Conditional distributions Characteristics function. Distribution of Linear combinations of normal vector, Distributions of Quardratic forms.

Random sampling from a multivaraite normal distribution, Maximum likelihood estimates of mean vector and covariance matrix. Distribution of sample mean vector.

Wishart matrix its distribution (without proof) and its properties. Distribution of sample genealized variance, Null distribution of simple, partial and multiple correlation coefficient.

SECTION-II (Two questions)

Hotelling's T^2 Statistic, Null distribution and its applications. Tests on mean vector for one and two multivariate normal populations. Beheran - Fisher's Problem Multivaraite Linear Regression : estimation of parameters, tests of linear hypotheses about regression coefficient.

Wilk's Lambda, Multivaraite Analysis of Variance (MANOVA) for one way classified data. Fisher's discriminant function (For two popultaion only), Mahalanobis D^2 statistic. Principal components. Canonical correlations.

SECTION-III (Three questions)

The general linear regression models. Estimation of parameters by least squares and maximum likelihood methods. Inference in the OLS Model. Generalized least squares estimation. Use of extraneous information in the

form of exact and stochastic linear restriction : Restricted regresion and mixed regression methods and their properties Tests for restriction. Heteroscedasticity, Auto correlation : its consequences. Durbin Watson Test Multicollinearity its implications and remedies.

SECTION-IV (Two questions)

Specification error analysis related to explanatory varaibles. Errors in varaibles. Instrumental variables. Simultaneous equation models. Structural and Reduced forms. Rank and order conditions of Identification. estimation of simultaneous equation Models : Indirect least squares. Two stage least squares, limited information maximum likelihood, K-Class Estimators. Elementary ideas of full information methods.

BOOKS SUGGESTED

1.	Anderson, T.W.	An Introduction to Multivariate Analysis
2.	Rao, C.R.	Linear Statistical Inference and its Applications
3.	Johnston, J	Econometric Methods
4.	Koutsoyiannis, A	Theory of Econometrics
5.	Kendall M. G.	Multivariate Analysis
6.	Maddala G. S.	Econometrics

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-VI PART B (PRACTICAL) **Max. Marks : 25**
Time : 3 hrs.
Teaching hours : 4 per week

The question paper will consist of 5 questions and the students will be required to attempt any three questions. the question paper will be set on the spot jointly by the

internal and external examiners.

Distribution of marks will be as follows :

Marks for question paper	:	15
Marks for practical record book and viva-voce	:	05
Marks for Viva-Voce	:	05
Total	:	25

PAPER-VII PART A NUMERICAL METHODS AND COMPUTER PROGRAMMING

Max. Marks : 75
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Three questions)

Numerical differention and Integration : Trapezodial, Simpsons's 1/3rd, Simpson's 3/8th Rule. Cote's formula, Error estimation, Simpson's 1/3rd rule with end corection, Richardson extrapolation, Romberg integraton, Evaluation of eigenvalues and eigen vectors of matrics by Power and Jacobi's method, Solution of Ordinary differential equation : Taylor's series, Euler's, Modified Euler's, Picard and Runge Kutta Method, Predictor - Corrector Methods, Boundary value problem.

SECTION-II (Three questions)

Computer Orgnaization, Problem analysis, Algorithem development, Flow chart Introduction to Fortran 77, Data type, Oprators and expressions, Asssignment statements, Arithmetric and logical operation, List directed and Format - directed Input/ Output statement, Arrays, Dimensions statement, Sub-programming and subroutine functions, Double precision type, Complex type.

SECTION-III (Two questions)

Overview of C programming language, Constants, Variables, data types, Operators and expressions, Standard Input output data, Formatted and Unformatted

Input/ Output data, decision making and looping statements, Jumping statements.

SECTION-IV (Two questions)

C-Preprocessors, User's defined function, Arrays string processing, Arrays of structure, Unions, Pointers, Pointers to Array, Array of pointers, Pointers and structure File handling.

BOOKS SUGGESTED

1.Sastry, S.S.	Introduction to Methods of Numerical Analysis
2. Nielson, K.L.,V.K.	Methods of Numerical Analysis Mec Mohan
3. E. Balaguruswamy	Programming in C
4. Ram Kumar	Introduction to Fortran 77
5. R.S. Salaria	A beginner's Guide to Computer programing with C
6. Yashwant Kanetkar	Let us C
7. Raja Raman	Fortran 77

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-VI PART B (PRACTICAL) **Max. Marks : 25**
Time : 3 hrs.
Teaching hours : 4 per week

The question paper will consist of 5 questions and the students will be required to attempt any three questions. the question paper will be set on the spot jointly by the internal and external examiners.

Distribution of marks will be as follows :

Marks for question paper	:	15
Marks for practical record book and viva-voce	:	05
Marks for Viva-Voce	:	05
Total	:	25

PAPER - VIII PART A Linear and Non-Linear Programming

Max. Marks : 75
Time : 3 hrs.
Teaching hours : 04 per week

SECTION-I (Two questions)

Covex sets, convex functions and their properties. general linear programming problems : Formulation and their properties of solutions. Generations of extreme point soultion. Graphical and simplex methods for solving LPP. Artificial varaible techniques : Big - M-Method and two phase simplex method. Problem of degeneracy in LPP and its resolution. Solution of simultaneous equations by simplex method. revised simpex method & bounded varables technique.

SECTION-II (Three questions)

Duality in linear programing : symmetric and un-symmetric dual problems, economic interpretation of primal and dual problems, Fundamental dualtiy theorem and dual simplex method. Complementary slackness theorem. Sensitivity analysis. Parametric linear programming. Interger Linear programming : Gomory's cutting plane and Branch and Bound methods. Applications of Integer programming.

Assignment problems and their solution by Hungarian asignment method. Reduction theorem. Unbalanced assignment problem. Senstivity analysis in asignement problem. Balanced and un-balanced transportation problems and their optimal solution.

SECTION-III (Two questions)

Theory of games : charateristics of games, minimax (maximin) criterion and optimal starategy. Solution of games with saddle point. Rectangular games without saddle point. Equivalence of rectangular game and linear programing. Fundamental theorem of game theory.

Solution of m x n games by linear programming. (2x2) games without saddle point. Principle of dominance. Graphical soultion of (2x2) games without saddle point. Principle of dominance. Graphical soultion of (2xn) & (mx2) games.

SECTION-IV (Three questions)

Non- Linear Programming problems (NLPP) : Kuhn-Tucker necessary and sufficient conditions of optimality, saddle points. Formulation of NLPP and its graphical solution. Quadratic programming : Wolfe's and Beale's mehods of solutions. Separable programing and its reduction to LPP, separable programmming algorithem. Geometric programming : Constrained, unconstrained and complementary Geometric programming Problems.

Fractional programming and its computation procedure. Dynamic programming : Ballman's principle of optimality, applications of dynamic programming in production linear programming and reliability problems. Goal programming and its formulation. Stochastic Programming.

BOOKS SUGGESTED

1.	Gass, S.I.	Linear Programming
2.	Kambo, N.S.	Mathematical Programming
3.	R. Bellman	Dynamic Programming, Princeton University Press, Princeton, N.J. 1957

Additional Readings

4.	Hadley, G	Linear Programming
5.	Bellman, R and Dreyfus. S.	Applied Dynamic Programing, Princeton University Press, Princeton, N.J. 1963.
6.	Sharma, S.D.,	Linear and Non- Linear programming.

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-VIII PART B (PRACTICAL) **Max. Marks : 25**
Time : 3 hrs.
Teaching hours : 4 per week

The question paper will consist of 5 questions and the students will be required to attempt any three questions. the question paper will be set on the spot jointly by the internal and external examiners.

Distribution of marks will be as follows :

Marks for question paper	:	15
Marks for practical record book and viva-voce	:	05
Marks for Viva-Voce	:	05
Total	:	25

PAPER-IX & X Opt. (i) Stochastic Processes, Queueing and Reliability Theory.

Max. Marks :100
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Two questions)

Probabilty generating function, Covolution. genral process, definition, classification and examples. compound distribution, Branching process, extinction probabilities, distribution of total number of progency. random walk, Classical Gambler's ruin problem, Probability of ruin, expected duration of the game. Generating functions for the first passage times. Probabilities generating functions. Compound distributions. branching process, exitinction probabilities, total progency.

SECTION-II (Three questions)

Markov chains, higher transition probabilities. Classifications of sates and chains, determination of higher transition probablities. Statbility of Markov systems, limiting behaviour. Poisson process and related

distribution. Generalization of Poisson process. Birth Process, Yule- Furry process, Genaralized Birth and Death process, Linear Birth and Death Process.

SECTION-III (Three questions)

The Stochastic Processe in queues, general concept, waiting time distribution and transtion solution of M/ M/ I, Steady state soultion of M/M/I/R, M/M/C, M/M/ , M/M/ C/C/ models. Machine interference problem. Bulk queues, $M^{(x)}$/M/I,M/M/$^{(a,b)}$/I Models. Non Makovian queues. Phase technique, M/E_k/I System. Imbedded Makov Chain technique, limiting probablities of M/G/I, M/G $^{(a,b)}$/ I and GI/ M/I models, Suppplementary variable techniques, M/ G/I model.

SECTION-IV (Two questions)

General Introduction to reliability theory, reliability models : series, Parallel and mixed mode failure systems. redundant system. Standby Redundancy. Maintainability and availability functions. Two unit redundant systems with repair, Preventive maintenance.

BOOKS SUGGESTED

1. Medhi, J — Stochastic Processes.
2. Gross and Hariss. — Fundamental of Queueing Theory.
3. Kashyap, B.R.K and Chaudhary, M.L. — An Introduction to Queueing Theory
4. Balaguruswamy — Reliability Engineering
5. Sri Nath L.S. — Concept in Reliability
6. Bailey, N. T.J. — Elements of Stochastic Process
7. Srinivasan and Mehta — Stochastic process

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-IX & X Opt. (ii) Methods of Operations Research

Max. Marks :100
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Two questions)

Measure of Information, an Introduction, Axioms for uncertainty measure, Interpretation of uncertainty measure. Joint and conditional Entropy Noiseless Coding, Uniquely decipherable codes, Instantantaneous code.

SECTION-II (Two questions)

Noiseless Coding Theorem. optimal Codes, Construction of Optimal Codes. Huffmman Procedure. Discrete Memoryless Channels. CLASSIFICATION of Channels, Efficiency and Redunancy, Decoding schemes; the ideal observer, Exponential error bound, Fano inequality.

SECTION-III (Three questions)

Definition and scope of Opeartions Research, its characteristics and phases. modeling in Operations Reserach and general methods for Operations research Deterministic inventory : Development, Classification, concepts of average inventory and economic ordering quantity (EOQ) mathod for solving EOQ models, EOQ production models and its solution, ECQ control system, Purcahse inventory models with one & two price break. Probabillistic inventory models determination of safety stop under normal distribution of demand instantiations demand and uniform demad order level system lead time. Selected control technique replacement models, replacement policy for items, Mortality theorem on individual replacement policy and group replacement policy. Recruitmnet and promotion problems.

SECTION-IV (Three questions)

Sequencing Problems ; Introduction and Assumption, solution for processing of n jobs through two/three, m

machines Maintenance crew scheduling PERT/ CPM : development uses and advantages, development & applications of PERT/ CPM techniques, Network diagram representation Fulkesons I-J rule for labling, Time estimate and determination of critical path on network analysis, PERT techniques Simulation Definition, types uses and limitation of simulation Phases of simulation models, Montecarlo simulation , application of simulation.

BOOKS SUGGESTED

1. Robbert Ash — Information Theory
2. Churchman — Methods of Operations research
3. J.H. Taha — Methods of Opeartions Research : an Introduction

Additional Book

1. S.D. Sharma — Operations Research.

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-IX & X Opt. (iii) Design of Experiments and Genetical Statistics

Max. Marks :100
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Three questions)

Response curves, Response Surface Designs, fitting and optimization, Experiments with Mixtures Repeated Measurement Designs, Group of Experiments, transformtaion of data, Mutually Orthogonal Latin Squares (MOLS). Construction of complete sets of MOLS. Connection between complete sets of MOLs and PG (2,s), Non-existence of complete sets of pairwise balanced designs and construction of Mols using pairwise balanced design. Use of methods of difference

in the construction of Mols. Designs for two -way elimination of heterogeneity including Lattice Square Designs, augmented designs.

SECTION-II (Two questions)

Block designs, C-matrix and its properties. Balancing in connected desings Kronecker- product designs, resolvability and parametric relations. repeated measurement designs. Construction of BIB desings through the methods of finite geometries and symmetrically repeated difference.

SECTION-III (Three questions)

Basic terms and definitions in genetics. Concept of gene frequencies and its estimates. Mendel's Laws, statistical analysis for segregation, detection and estimation of linage. Sex linked inheritance, gene action interaction. Random mating, Hardy- Weinberg equilibrium, application and extension of the equilibrium law, Fisher's fundamental theorem of natural selection. Forces affecting gene frequency. selction, mutation and migration, equilibrium between forces in large population System of human blood groups : Inheritance of bloood antigens, estimation off gene frequencies, Bernstien and maximum likelihood method of estimation of gene frequencies, MNS's blood group system.

SECTION-IV (Two questions)

Polygenic system for quantative characteristics, concepts of breeding value and dominance deviations, components of phenotypic varaition. Genetic parameters, Correlations betwen relatives, Heritability, Genetic- correlation and Repeatability. Response due to selection, selection index, Methods of estimation of heritability, genetic correlation and repeatability.

BOOKS SUGGESTED

1. Falconer, D.S. Introduction to Quantitative Genetics (Longamn Group Ltd.)
2. Joshi, D.D. Linear Estimation and Design of

		Experiments (Wiley Esatern Ltd.)
3.	Kempthorne, O	An Introduction to Genetical Statistics. (Wiley Eastern Ltd.)
4.	Narian P.	Statistical Genetics (Wiley Eastern Ltd.)
5.	Li,C.C.	Population Genetics, University of Chicago Press, Chicago & London)
6.	Jain, J.P.	Statistical Techniques in Quantitative Genetics (Tata Mc Graw Hill Publication)
7.	Mather, K and Jinks, J.L.	Introduction of Biometric Genetics (Chapman & Hall Ltd.)
8.	Mather, K and Jinks, J.L.	Biometrical Genetics (Chapman & Hall Ltd.)

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.

PAPER-IX & X Opt. (iv) Official Statistics and Clinical Trials

Max. Marks :100
Time : 3 hrs.
Teaching hours : 5 per week

SECTION-I (Three questions)

Introduction to Indian and International Statistical Systems. Present Official Statistical Systems in India, role, functions and activities of central and state organizations. Organizations of large- scale sample surveys, methods of collection of official statistics, their reliability and limitations. Role of National Sample Survey Organizations. General and special data dissemination systems, population growth in developed and developing countries. Evaluation of performance of family welfare programs, projection of labour force and manpower. Scope and content of population of census of India.

SECTION-II (Two questions)

System of collection of agricultural statistics. Crop forecasting and estimation, productivity fragmentation of holdings, support prices, buffer stocks, impact of irrigation projects. Statistics realted to industries, balance of payment, cost of living, inflation, educational and other social statistics.

SECTION-III (Three questions)

Introduction to clinical trials : the need and ethics of trials, bias and random error in clinical studies, conduct of clinical trials, overview of phase I-IV trials, multi center trials Data management data definition, case report forms, database design, data collection systems for good clinical practice.

Design of clinical trails : parallel vs cross over designs, cross sectional vs longitudinal designs sreview of factorial design, objectives and endpoints of clinical trial, design pf phase I trials, design of single stage and multi stage phase II trials, design and monitoring of phase III trials with sequential stopping.

SECTION-IV (Two questions)

Reporting and analysis : analysis of categorical out comes from phase I-III trials, analysis of survival data form clinical trial Introduction to Meta- analysis of clinical trials.

Books for References :

1. Piantadosi, S (1997) Clinical Trails : A methodological Persceptive, Wiley & Sons.
2. Friedman, L.M. FurBurg, C. and Demets, D.L. (1998) Fundamentals of Clinical trails Springer Verlag
3. Fleiss, J.L.(1989) The Design and Analysis of Clinical Experiments, Wiley and Sons.
4. Marubeni, E and Valsecchi, M. G. (1994) Analyzing Survival Data from Clinical Trials and Observational Studies, Wiley and Sons.

Note: The question paper will consist of ten questions as indicated and the students will be required to attempt any five questions selecting atleast one from each section.