SCHEME OF EXAMINATION FOR M.PHIL (STATISTICS) 2009-10

The duration of the course of instruction of M.Phil (Statistics) Degree shall be one year (Two Semesters) there will be three theory papers each of 100 Marks in 1st semester and two theory papers each of 100 marks in 2nd Semester. There will be dissertation of 200 marks to be submitted by the candidate during the course of Study. The detailed Scheme of the course is given below.

In each semester, the departmental committee will assign three courses to each student on the basis of preferences indicated by the candidate out of the following courses:-

M.Phil-1st Semester

PAPER-1, II, III

Name of Paper	Theory	Internal Assessment	Time allowed	teaching hrs per week
Paper I,II, III				
Opt. (i) Stochastic Processes	80	20	3hrs.	04
Opt. (ii) Advanced Theory of Sample Surveys	80	20	3hrs.	04
Opt. (iii) Regression Analysis and Bayesian Inference	80	20	3hrs.	04
Opt. (iv) Information Theory	80	20	3hrs.	04
Opt. (v) Non-Parametric Inference				

M.Phil 2nd Semester

Paper-1V, V

Opt. (i) Reliability Theory and Modeling	80	20	3hrs.	04
Opt. (ii) Statistical Genetics	80	20	3hrs.	04
Opt. (iii) Actuarial Statistics*				

The dissertation work will start in the 1st Semester under the approved supervisor from amongst the members of the staff. The evaluation will be done by external examiner out of 150 marks. The viva- voce will be of 50 marks will be conducted and evaluated by external examiner and supervisor. There will be internal assessment of 20 marks in each theory paper.

*The scheme will be framed later on.

M.Phil- 1st Semester

Paper I, II, III
Opt. (i) Stochastic Processes

Max Marks- 80
Time- Three Hours

Section I

Stochastic Processes, Random Walk model, Gambler's Ruin problem, Ballot Problem, Applications of Ballot problem, Generalized Random Walk.

Section II

Continuous time Discrete State Markov Process, Population Models, Poison Process, Continuous Time and Continuous State Markov Process, Differention process, Kolmograow backward and forward difference equation, Wiener Process, First passage Time distribution

Section III

Renewal theory, renewal equation, renewal theorems, Central limit theorem for renewal theory, Delayed and equilibrium renewal process, residual and excess life times renewal, renewal process.

Section IV

Applications to population growth, Queuing models, Epidemic processes, simple epidemic, General epidemic, application in ecology, biology and sociology.

Books:

1	Baily, NTJ	the Elements of Stochast6ic Processes
2	Cox, DR & Miller, HD	The Theory of Stochastic Processes
3	Basu AK	Introductions to Stochastic Processes
4	Medhi, J.	Stochastic Processes
5	Bhatt, B.R.	Stochastic Models, Analysis and Application

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.

M.Phil-1st Semester

Paper I, II, III
Opt. (ii)   Advanced Theory of Sample Surveys

Max Marks- 80
Time- Three Hours

Section –I
Types of Sampling: Simple Random, Stratified Random and systematic sampling, Estimation in Ratio and Regression estimators, (For One and two variables), Double sampling for ration and regression estimators, double Sampling for stratification.

Section-II
Sampling with varying probabilities, ordered and unordered estimators, Sampling Strategies due to Horvitz Thomson, Yales and Grundy Form Midzuno Sen, Brewerand Durbin Scheme (Sample size two only) Rao-Hartley, cochran Scheme for sample size n with random grouping and PPS systematic sampling, Double sampling for PPS estimation.

Section-III
Single stage cluster sampling: multi-stage sampling, selection of PSU's with unequal probabilities, Selection of PSU with replacement, stratified multi-stage sampling, Estimation of ratios, choice of sampling and sdub-sampling fraction, Repetitive Surveys, sampling on more than two occasions.

Section-IV
Non-sampling errors, response errors, response bias, the analysis of data, Estimation of variance components uncorrelated response error, response and sampling variance, the problem of non-response, some example of sources of error. Variance estimation, method Estimation of random groups sub population. The best linear estimator two way stratification with small sample, variance estimation in multistage sampling, sampling inspections.

Books suggested

1.	Chochran, W.G.	Sample Techniques
2	Desrjv and Chandok	Sampling Theory
3	Singh & Chaudhary F.S.	Theory and analysis of sample Survey designs.
4	Mukhopadhyay, Primal	Inter Problems in survey sampling

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.

M.Phil-1st Semester

Paper: I, II, III
 (Opt.iii)   Regression Analysis and Bayesian Inference

Max Marks- 80
Time- Three Hours

Section I
Simple Linear Regression, Estimation of parameters, Matrix Approach to Linear Regression, R^2 and adjusted R^2, Weighted Least Squares. Model Adequacy Checking – Residual Analysis, methods of scaling residuals- Standardized and studentized residuals Press Residual, Residual Plots, PRESS Statistic

Section II
Diagnostics for Leverage and Influence, Variable Selection and Model Building, Computational Techniques for Model Selection- Mallow's C_p, Stepwise Regression, Forward Selection, Backward Elimination. Elementary Ideas of Logistic and Poisson regression

Section III
Mixture Distributions, Exponential Family of distributions, Prior and Posterior distributions, Baye's theorem and computation of posterior distribution, Natural conjugate family of priors for a model, Conjugate families for exponential family models

Section IV
Non – Informative and Improper priors, Jeffrey's Prior, Asymptotically Locally invariant prior. Maximum entropy priors, Bayes estimation.

Books Recommended

Montgomery, D.C, Peck and Vining, G.G. (2002). Introduction to Linear Regression
            Analysis (John Wiley & Sons.)
Draper, N.R. and Smith, H. (1981) Applied Regression Analysis (John Wiley & Sons)
Robert, C.P. (2001): The Bayesian Choice: A Decision Theoretic Motivation (Springer
            Verlag New York)
Sinha , S.K. (2004) Bayesian Estimation
Berger, J.O. (1985) Statistical Decision Theory and Bayesian Analysis (Springer)

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.

Paper 1.II, III
Opt. (IV)   Information Theory

Max Marks- 80
Time- Three Hours

Section-1
Basic concepts of Information Theory, Measure of uncertainty and its properties, Measure of Information for two dimensional discrete and continuous finite probability scheme, Uniqueness of Entropy function, Joint and Conditional measure of uncertainty, Interpretation of uncertainty measure , Measure of mutual information.

Section-2
Noiseless Coding, Uniquely decipherable codes, instantaneous codes, condition for uniquely decipherable and instantaneous codes, Noiseless coding Theorem, Optimal Codes, Block Coding,
Construction of Optimal Codes, Shannon Fanon encoding, Huffman procedure.

Section-3
Discrete Memoryless Channel, Channel matrix, Channel Capacity, Classification of Channels, Channel capacity for different types of channel, Fundamental theorem of Information Theory(without proof), Efficiency and Reduancy, decoding schemes ,the ideal observer, Exponential error bound, Fano inequality.

Section- 4
Inequalities of Information Theory, Kullback-Leibler measure of information, Mean information for discrimination and divergence and their properties, Fisher information, Information and sufficiency, Minimum discrimination information-sufficient statistics.
Books suggested:

1. Robert Ash   Information Theory
2. Reza, F.M   An Introduction To Information Theory.
3. Mathai,A.M and Rathie, P.N.   Basic Concepts in Information
                                  Theory and Statistics.
4. Kullback, S.   Information Theory and Statistics.

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.

Paper IV & V
Opt. (i)   Reliability Theory And Modeling

Maximum Marks-80
Time:-03 Hours

Section –1
Reliability and Quality. Types of Reliability. Failures Data Analysis: Failure, Types of Failures, Causes of Failures, Failure Rate, Mean Time To Failure (MTTF),Mean Time Between Failures (MTBF), MTTF interms of failure density. Hazard rate reliability Interms of hazard rate and failure density. Reliability Models: Constant Hazard Model, Linear and Non-Linear Hazard Model, The Weibul Model, Gamma Model, Normal Failure Model and Markov Model. Determination of Distribution functions and reliability of hazard models and Markov model.
Section-11
System structures. Evaluation of mean time to system failure (MTSF) and reliability for various structures such as series, parallel, series parallel, parallel series, non –series parallel, mixed-mode and k-out-of-n structures. Methods of reliability improvement: Redundancy And Maintenance. Reliability analysis using redundancy and maintenance. Availability function.
Section- III
Repairable Systems: Instantaneous repair Rate and Mean Time to Repair. Reliability and Availability Analysis of a Two-Unit parallel system with repair using markov model. Economics of Reliability Engineering: Manufactures cost, Customers cost, Reliability Achievement and utility cost Models, Depreciation cost models and Availability cost Model for parallel system. Availability Analysis of a system using reneval theoretic approach.
Section-1V
Reliability and availability analysis of single-unit and two –unit cold standby systems with constant failure rate and repair using Regenerative Point and Supplementary Variable Techniques. Evaluation of reliability by the Methods-Decomposition method, Cut-set method, Event space method and Boolean function technique.
            Parameters Estimation of Exponential, Gamma, Weibule, Normal and Lognormal Distributions (Two and Three Parameters) with Complete, Truncated and Censored Samples. Estimation by Components of order Statistics: k-Out of- n reliability estimation.
 Books Suggested:-
1.   Balagurusamy,E.   :   Reliability Engineering
2.   Srinath, L.S.   :   Reliability Engineering.
3.   Elsayed A. Elsayed   :   Reliability Engineering (Addison Wesley
                                          Longman. Inc. Publication
4.   Sinha,S.K.   Reliability and Life Testing.
5.   Birolini,A   :   Reliability Engg.(Theory And Practice)
6.   Gurjar, Jai Singh   :   Reliability Technology (I.K. International
                                       Publishing House Pvt. Ltd., New Delhi-
                                        110016)

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.

Paper IV &V

Opt. (ii)   Statistical Genetics

                                    Max Marks- 80
                                    Time- Three Hours

Section-I

Basic terms and definition in genetics, Concepts of gene frequencies and their estimation, Mendal's Laws Linkage and crossing over. Statistical analysis for segregation: single factor segregation, two factors segregation, Heterogeneity chi-square, Detection and estimation of linkage for qualitative characters, Sex linked inheritance, gene action interaction, Multiple alleles, Pleiotropic action, lethal action, Mutation.

Section-II

Random mating: Hardy- Weinberg equilibrium, Panmixia Population, Single locus, sex linked genes, Fisher's fundamental theorem of natural selection, forces affecting gene frequencies, selection, mutation and migration, equilibrium between forces in large population.

Section-III

Polygenic system for quantitative characters: Polygenes, Major genes, Characterization of phenotypic value, Additive and genetic effects, Characterization of genotypic value, breeding value and dominance deviation, Determination of parameters of additive – dominance model.

Section-IV

Components of variance and Genotypic variance, Components of Covariance, Correlations between relatives, Genetic parameters; Heritability, Repeatability and Genetic correlation, Relationship between them.

Books suggested:
Falconer, D.S.   Introduction to quantitative Genetics (Longman Group Ltd.)
Kempthorne, O (1953)   An Introduction to Genetical Statistics, Wiley Eastern
Prem Narain   Statistical Genetics, Wiley Eastern
Li, C.C.   Population Genetics, University of Chicago Press Cchieage & London
Jain, J.P.   Statistical Technique in Quantitative Genetics (Tata Mc Graw, Hill Publication Co. Ltd., New Delhi.

Note: The examiner will set two questions from each section. The students are required to attempt five questions in all, selecting at least one question from each section.