Scheme of Examination for M. Phil (Statistics) 2015-16

The duration of the course of instruction of M.Phil (Statistics) Degree shall be one and half year (Three semesters). There will be three theory papers each in 1st Semester and 2nd Semester of 100 marks (including Internal Assessment of 20 Marks). The detailed Scheme of the course is given below:

M. Phil Semester-I (Common with Ph.D Course Work)

Paper Code	Name of Paper	Theory Marks	Internal Assessment	Time Allowed	Teaching Hrs. Per week
MPHE 101	Research Methodology	80	20	3 hrs.	04
Any Two of the following:					
MPHE 102	Stochastic Processes	80	20	3 hrs.	04
MPHE 103	Advanced Theory of Sample Surveys	80	20	3 hrs.	04
MPHE 104	Regression Analysis and Bayesian Inference	80	20	3 hrs.	04

M. Phil Semester-II

Paper Code	Name of Paper	Theory Marks	Internal Assessment	Time Allowed	Teaching Hrs. Per week
MPHE 201	Reliability Theory and Modeling	80	20	3 hrs.	04
MPHE 202	Statistical Genetics	80	20	3 hrs.	04
MPHE 203	Information Theory	80	20	3 hrs.	04
*MPHE 204	Bio-Statistical Methods	80	20	3 hrs.	04

* Syllabi will be framed later.

M. Phil Semester-III

This semester will be devoted to the Dissertation work. The dissertation work for M. Phil will be carried out under the approved supervisor from amongst the faculty members of the department. The whole dissertation work will be of 200 marks including marks of evaluation and viva-voce. The evaluation will be done by external examiner out of 150 marks. The viva-voce will be of 50 marks which will be conducted jointly by the external examiner and the supervisor.

M. Phil (Statistics) Semester-I

Paper-I
MPHE-101 (Research Methodology)

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit – I

Introduction to Research Methodology. Types and Significance of Research. Research Approaches. Research and Scientific Methods. Research Process and Criteria of Good Research. Research Problem and its Necessity. Features of a Good Research Design. Sampling Design. Characteristics of a Good Sample Design. Random Samples and Determination of Sample Size.

Unit – II

Data Collection. Methods of Data Collection. Case Study Method. Questionnaires and Schedules. Guidelines for Successful Interviewing. Measurement and Scaling Techniques: Measurement Scales, Meaning of Scaling, Test of Second Measurements. Meaning of Scaling, Scale Classification Bases, Important Scaling and Scale Construction Techniques. Reliability and Validity of Measurements.

Unit – III

Data Analysis using Tools like SPSS, Minitab, SAS & MS Excel. Generating Data from Standard Discrete and Continuous Distributions. Exploring Univariate and Multivariate Data Using Tables and Plots (Stem and Leaf Display, Box Plot, Spider Plot, Q-Q Plot and Probability Plot). Graphical Methods of Clustering (Chernoff Faces).

Unit - IV

Documentation and Scientific Writing: Meaning & Techniques of Interpretation, Precautions in Interpretation, Preparation & Presentation of Manuscript of a Research Paper and Thesis Writing. Research Report: Presentation, Structure, Components, Types-Research Papers, Thesis, Research Project Report, Pictures & Graphs, Citation Styles and Bibliography.

Books Suggested:

1. C.R. Kothari : Research Methodology (Methods and Techniques), New Age International Publishers
2. R. Panneerselvam : Research Methodology, Prentice Hall of India, New Delhi
3. J.A. Khan : Research Methodology, APH Publications, New Delhi
4. V.V. Khanzode : Research Methodology (Techniques and Trends), APH Publications, New Delhi
5. B.H. Dursten & : Thesis and Assignment Writing, Wiley Eastern, 1977 M. Poole
6. Sheldon Ross : Probability and Statistics for Engineers and Scientists, Elsevier Academic Press
7. A.M. Goon, M.K. : Fundamentals of Statistics (Vol. I & Vol. II)Gupta and B. Das Gupta
8. J. Tukey : Exploratory Data Analysis. Addison-Wesley Pub Co., USA, 1977.

Note: The examiner is to set the question paper into four units. In each unit, he/she has to set two questions of 16 marks each from sections I, II, III, & IV respectively. The candidate will attempt five questions in all, selecting at least one question from each unit.

M.Phil- Ist Semester
MPHE- 102 Opt. (i) Stochastic Processes

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit I

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

Unit 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

Unit-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.

Unit 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-Ist Semester
MPHE-103 Opt. (ii) Advanced Theory of Sample Surveys

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit –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.

Unit-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.

Unit-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.

Unit-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-Ist Semester
MPHE- 104 (Opt.iii) Regression Analysis and Bayesian Inference

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit I

Matrix Approach to Linear Regression, R^2 and adjusted R^2 , Model Adequacy Checking – Residual Analysis, methods of scaling residuals- Standardized and studentized residuals Press Residual, Residual Plots, PRESS Statistic, Variance Stabilizing Tranformation, Analytical methods for selecting a transformation.

Unit II

Generalized and Weighted Least Squares. 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

Unit III

Concepts of Prior and Posterior distributions and Non – Informative and Improper priors. Baye's theorem and computation of posterior distributions, Standard Loss functions, and concept of Baye's estimation,Mixture Distributions, Sufficient Statistics, Exponential Family of distributions.

Unit IV

Natural conjugate family of priors for a model, Conjugate families for exponential family models, Jeffrey's Prior, Asymptotically Locally invariant prior. Maximum entropy priors and associated 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.

M.Phil. Semester-II
MPHE-201 Reliability Theory and Modeling

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit- I

Reliability: Types and Its Importance. Failures and Failure Modes. Causes of Failures. Failure Rate. Hazard Function. Reliability in Terms of Hazard Rate and Failure Density Functions. Hazard Models: Constant, Linear & Non-Linear, Weibull, Gamma and Normal Models. Markov Model. Estimation of Reliability and Failure Density Functions of Hazard and Markov Models. Mean Time to System Failure (MTSF).Relation Between MTSF and Reliability.

Unit- II

System and System Structures. Evaluation of MTSF and Reliability of The Systems: Series, Parallel, Series-Parallel, Parallel-Series, Non-Series- Parallel, Mixed Mode and K-out-of-n. Reliability Evaluation of Systems by Decomposition, Cut-Set, Event Space, Path Tracing and Boolean Function Methods.

Unit- III

Reliability Estimation Using Redundancy and Maintenance Techniques. Repairable and Non-Repairable Systems. Availability Function and its types. Parametric and Non- Parametric Renewal Function Estimation. Renewal Theoretical Approach for Availability Evaluation of a System. Economics of Reliability Engineering: Manufactures & Customers Costs, Reliability Achievement, Utility and Depreciation Cost Models. Availability Cost Model for a Parallel System.

Unit- IV

Evaluation of Reliability and Availability of Parallel-Unit System with Repair Using Markovian Approach. Reliability and Availability Analysis of Single Unit, Two-Unit Cold Standby and Parallel-Unit Systems with Constant Failure Rate, Arbitrary Repair Rates and a Single Server using Semi-Markov Process and Regenerative Point Technique. Idea of Supplementary Variable 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).

Note: The examiner is to set the question paper into four units. In each unit, he/she has to set two questions of 16 marks each from sections I, II, III, & IV respectively. The candidate will attempt five questions in all, selecting at least one question from each unit.

M.Phil-2nd Semester
MPHE- 202 Statistical Genetics

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit-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.

Unit-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.

Unit-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.

Unit-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.

M.Phil-2nd Semester
MPHE- 203 Information Theory

Time: 3 Hours | Maximum Marks: 80
Teaching Hours: 4 Hours per week | Internal Assessment Marks: 20
Total Marks: 100

Unit-I

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.

Unit-II

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.

Unit-III

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.

Unit-IV

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.