DEPARTMENT OF STATISTICS

Ph.D. (Statistics)

Program Specific Outcomes

PSO1: Provided a platform for job prospects to the students in Private/ Govt. sectors.

PSO2: Able to achieve expertise knowledge for giving consultancy to the researchers of Medical Sciences, Banking Sector and Industries.

PSO3: Acquired proficiency in teaching and research at higher level in the subject Statistics and related areas.

PSO4: Able to expertise in Data Analysis using Statistical Software.

PSO5: Acquired knowledge to help the State/ Central Govt. of India in formulation of the welfare policies.

PSO6: Established a base for further research in the field of Statistics and its Applications.

Scheme of Examination for Ph.D. Course Work

Paper Code	Name of Paper	Theory Marks	Internal Assessment Marks	Time (per week)	Credits
17STAMP11	Research Methodology	80	20	4 hrs.	04
Optional Papers (**Any two of the following**)					
17STAMP12	Stochastic Processes	80	20	4 hrs.	04
17STAMP13	Advanced Theory of Sample Surveys	80	20	3 hrs.	04
17STAMP14	Regression Analysis and Bayesian Inference	80	20	3 hrs.	04

Ph.D. Coursework (Statistics)
17STAMP11 (Research Methodology)

Maximum Marks: 80
Internal Assessment Marks: 20
Total Marks: 100
Time: 3 Hours
Credits: 4

Paper Code: 17STAMP11
Paper: Research Methodology
Course Outcomes:

CO1: Able to understand basic concepts of research and its methodologies.
CO2: Ability to find the scores located on the scale of measurements, validity and reliability.
CO3: Able to understand the methodology for writing a research project proposal.
CO4: Able to understand review of literature.
CO5: Able to use the technique for Random Numbers Generation.

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.

17STAMP12 Opt. (i) (Stochastic Processes)

Maximum Marks: 80
Internal Assessment Marks: 20
Total Marks: 100
Time: 3 Hours
Credits: 4

Paper Code: 17STAMP12
Paper: Stochastic Processes
Course Outcomes:
CO1: Able to understand the applications of Markov Chain in research.
CO2: Able to develop Stochastic Models for carrying out research in reliability theory.
CO3: Obtained understanding for the solution of stochastic differential equations.
CO4: Able to understand the use of probability generating functions.
CO5: Acquired knowledge to apply Stochastic Processes in Bio Medical Sciences.

Unit I

Introduction, Examples and Types of Stochastic Processes. Probability Generating Function of Compound Distributions. Random Walk: Definition and Examples. Gambler's Ruin problem: Probability of Ruin, Duration of Game and Generating Function. Ballot Problem and its Applications.

Unit II

Markov Process: Continuous time Discrete State Markov Process, Limiting Behavior and Stability. Poison Process: Postulates, Methods for Probability Generating Function, Decomposition and Related Distributions, Birth and Death Processes. Diffusion Process: Diffusion Limit of Random Walk and Branching Process, Kolmogorov Backward and Forward Diffusion Equations, Solution of the General Diffusion Equation, Application to Population Growth.

Unit-III

Wiener Process: Definition, Differential Equations, Kolmogorov Equations and First Passage Time Distribution. Renewal Processes: Renewal Process in Discrete & Continuous Time, Forward Renewal Equation, Renewal Function and Density, Renewal Theorems, Central Limit Theorem for Renewal Process, Delayed and Equilibrium Renewal Process, Residual and Excess Life Times Renewal Process, Poison Process as a Renewal Process.

Unit IV

Applications of Stochastic Processes: Population Growth Models, Queuing Models, Epidemic Models, Simple & General Epidemic Models and Stochastic Models in Ecological & Biological Sciences.

Books:

1	Baily, NTJ	The Elements of Stochastic 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.

17STAMP13 Opt. (ii) (Advanced Theory of Sample Surveys)

Maximum Marks: 80
Internal Assessment Marks: 20
Total Marks: 100
Time: 3 Hours
Credit: 4

Paper Code: 17STAMP13
Paper: Advanced Theory of Sample Surveys
Course Outcomes:

CO1: Able to understand appropriate sampling methods.
CO2: Able to propose estimators for population parameters.
CO3: Gained expertise in designing a survey plan.
CO4: Achieved practical knowledge to analyze data from multistage surveys.

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.

17STAMP14 Opt.iii (Regression Analysis and Bayesian Inference)

Maximum Marks: 80
Internal Assessment Marks: 20
Total Marks: 100
Time: 3 Hours
Credit: 4

Paper Code: 17STAMP14
Paper: Regression Analysis and Bayesian Inference
Course Outcomes:

CO1: Able to understand the different types of regression.
CO2: Updated knowledge to explain the Bayesian frame work for data analysis.
CO3: Able to demonstrate the role of prior distribution in Bayesian inference.
CO4: Enhanced knowledge to use Bayesian methods for solving real life world problems.
CO5: Able to improve research skills to from a hypothesis, collect and analyze the data and reach appropriate conclusion

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

1. Montgomery, D.C, Peck and Vining, G.G. (2002). Introduction to Linear Regression Analysis (John Wiley & Sons.)
2. Draper, N.R. and Smith, H. (1981) Applied Regression Analysis (John Wiley & Sons)
3. Robert, C.P. (2001): The Bayesian Choice: A Decision Theoretic Motivation (Springer Verlag New York)
4. Sinha , S.K. (2004) Bayesian Estimation
5. 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.