Syllabus for Pre Ph. D.
Course Work in Statistics

There are THREE Courses, two compulsory and one elective, each of 3 credits.

Compulsory Courses:

Ph.D. CSTA01 Research Methodology

- Meaning and Definition of Research, Types of Research, Research Process and Steps in it
- Search for existing literature, Review of literature on selected topic, writing up the review
- Review of research articles, Formulation of research problem, Presentation and Discussion of Research Problems
- Research Proposal and Report

Ph.D.CSTA02 Computer Applications and Use of Statistical Software

- Elements of R Language
- Basic of MINITAB and SPSS

Elective Course: Any ONE of the following (as per the suggestion of the guide)

Ph.D.ESTA01 Advanced Statistical Inference

Decision Theory: Decision function, Risk function Utility and subjective probability, Randomization, Optimal Decision Rules, The forms of Bayes rules for estimation.

Main Theorems on: Admissibility and completeness, Decision Theory, Admissibility of Bayes rules. Existence on Bayes Decision rules under some basic assumptions. Existence of minimal complete class. The separating Hyper plane Theorem Essential completeness of class of non-randomized decision rules. The minimax theorem. The complete class theorem.

Invariant Statistical Decisions Problems: Invariant decision problems and invariant decision rules. Admissible and minimax invariant decision rules. Minimax estimate of location parameters (Application of this method to normal and multivatiate normal distribution). The Pitman Estimate of Distribution function.

Prior Distribution: Subjective determination and approximations. Conjugate priors for exponential families. Non-informative prior distributions.

Bayes Point Estimation: Normal model-estimation of variance. Linear Models and g-priors. Ranking and Selection. Sampling Models-Laplace Successive rule. The Tramcar Problem. Capture Recapture Models.

Robust Statistics: Introduction and Motivation: The role of parametric models. The type of deviation from parametric models. The effect of mild deviation from parametric models.

Estimation: Huber's minimax approach for Robust estimation. The approach based on influence functions. Relation between these two approaches. Classes of estimator L-estimator and R-estimator. Other types of estimators.

Bayes estimation in exponential distribution: failure rate estimation under (i) uniform prior (ii) Non-informative prior (iii) Gamma prior a~d (iv) other prior distributions. System Reliability Assessment: Introduction. Coherent systems. Basic system configuration Assignment of prior distributions; component level priors, system level priors. Bayesian estimations in series system, parallel system r-out-of-k systems.

Empirical Bayes Reliability Estimation.'

BOOKS:

1. Ferguson, T. P. (1967) Mathematical Statistics: A decision Theoretic approach, Academic Press.
2. James O. Burger (1980): Statistical Decision Theory and Bayesian Analysis: Second Edition Springer- Verlag.
3. Hampel, F. R. Ronchetti E. M., Roussew, P. J., Stahel, W. A. (1986) Robust Statistics, Join Wiley and Sons.
4. Robert P. C. (1994) The Bayesian choice, Springer-Verlag.
5. Martz, M. F. and Waller, R. A. (1982) Bayesian Retiablity Analysis. John Wiley and Sons.
6. Tiku M. c., Tan W. Y. and Balkrishnan, N. (1986) Robust Inference, Marcel Dekker Inc.

Ph.D.ESTA02 Survey Sampling Inference

Inference Under a Fixed population set-up: Basic ideas and principles, RaoBlackwellization. UMVU estimation, admissibility.
Inference under a Superpopulation set-up: Superpopulation concept, various superpopulation models, design-unbiased and model-unbiased predictions under different models.
Bayesian Prediction: Basic theory, multivariate normal model, Bayes linear predictors, minimax and admissible predictors.
Nonresponse: Characteristic of nonresponse, measuring nonresponse, dealing with nonresponse-planning of the survey-call backs-sub sampling of nonrespondents.
Randomized response: Estimation in the presence of unit responseImputation.
Measurement Errors: Nature of measurement errors, measurement models, Deterministic and random assignment of interviewers.
Domain Estimation: Background for domain estimation, basic estimation methods, model-based estimation, regression estimators for domains.

BOOKS:

1. Bolfarine, H & Zacks, S (1992) Prediction theory for finite population, Springer- Verlag, NY
2. Classel, C.M., Samdal, C.E. and Wretman, J. (1977) Foundations of inference in survey

sampling. John Wily: NY
3. Hedayet, A.S. and Sinha, B. K. (1991) Design and inference in finite population sampling, John Wiley: NY
4. Mukhopadhyay, P. (1998), Small area estimation in survey sampling, Narosa, LOIldon.
5. Mukhopadhyay, P. (1998), Theory and methods of survey sampling. Prentice ?Hall India, New Delhi.
6. Samdal, C. E., Swensson, B. and Wertman, J. (1992) Model assisted survey sampling, Springer - Verlag, NY.

Ph.D.ESTA03 Advanced Design of Experiments

PBIBD(2): Classification with properties and construction
Optiomal and robust design: Concepts, criteria, construction for block designs.
Weighing designs (Non-singular and Singular): Concept, estimation of weights, construction. Optimality.
Fractional factorials with and without confounding: Concept, analysis and construction
Orthogonal arrays and Orthogonal fractional factorial plans: Introduction, construction and applications.
Response Surface Methodology: First and Second order Response Surface models, method of estimation of response surfaces, Determination of optimum conditions.

BOOKS:

1. Raghavarao, D. (1971) Construction and combinatorial problems in Design of Experiments, John Wiley.
2. Khuri, A. I.; Cornell, J. A. (1987), Response surfaces (Design and Analysis), Marcel Dekker.
3. Dey, A. (1985), Orthogonal fractional factorial Designs, Wiley Eastern Ltd.
4. Das, M. N.; Giri, N. C. (1986) Design and analysis of experiments. Wiley Estern (2nd edition)
5. Ghosh S.; Rao, C. R. (1996) (Editors), Design and Analysis of Experiments. Elsevier
6. Pukelsheim, F. (1993), Optimal Design of Experiments, John Wiley.
7. Shah, K.R.; Sinha, B.K.(1989) Theory of Optimal designs, Springer Verlag.