DEPARTMENT OF STATISTICS
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhana Magdalla Road, Surat-395 007.

Ph.D. (Full Time / Part Time) COURSE in Statistics

SYLLABUS

FOR POSSIBLE IMPLIMENTATION FROM: 2021-2022

Paper	Title	Marks			Credits	Passing	Yearly Work Load
		Int.	Ext.	Total			
1	Research Methodology	30	70	100	4	50	60
Optional papers (Opt any two)							
2	Advanced Survey Sampling	30	70	100	4	50	60
3	Advanced Operations Research	30	70	100	4	50	60
4	Advanced Statistical Quality Control and Reliability	30	70	100	4	50	60
5	Applied Regression Analysis	30	70	100	4	50	60
Total		**300**				150	
Thesis	Evaluation of Thesis by Internal Examiner	100			9	50	
	Evaluation of Thesis by First External Examiner	100				50	
	Evaluation of Thesis by Second External Examiner	100				50	
Thesis		**300**				150	
Viva-		**200**			4	100	
		Total: 800			**25**	**400**	

Grand Total: 800 Marks

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PAPER-1

RESEARCH METHODOLOGY

FOUNDATION OF STATISTICAL INFERENCE:

The sufficiency Principles, Likelihood Principles, Conditional Principles, their inter-relations, Birnbaums' results. The likelihood principles and the Law of likelihood. Critical study of various classical inference procedures in the light of the law of likelihood.

STAITISTICAL METHODS AND SCIENTIFIC INFERENCE:

Basu's results about ancillary statistics. Fisher's theory of Fiducial Inference.

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.

BAYESIAN THEORY OF INFERENCE:

Use of prior information. Jeffrey's invariant prior. Consistency of Bayesian theory with Likelihood principles. Conjugate families of

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distributions. Principles of indifference in Bayesian theory and difficulties arising therefrom.

Bayesian interval estimation: Credible intervals. Highest posterior density regions. Interpretation of the confidence coefficient of an interval and its comparison with the interpretation of the confidence coefficient for a classical confidence interval.

Bayesian testing of Hypothesis: Specification of the appropriate form of the prior distribution for a Bayesian testing of hypothesis problem. Prior odds, Posterior odds, Bayes factor for various types of testing hypothesis problems depending upon whether the null hypothesis and the alternative hypothesis are simple or composite. Specification of the Bayes tests in the above cases. Discussion of Lindley's paradox for testing a point hypothesis for normal mean against the two sided alternative hypothesis.

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2. Bansal A. K.: Bayesian Parametric inference, Narosa publishing
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4. Basu, D.: The family of ancillary Statistics; Sankhya A.
5. Basu, D.: On Statistical independent of complete sufficient Statistics; Sankhya, Vol.15.
6. Berger, J. O. Statistical Decision Theory and Bayesian Analysis, Springer Verlag.
7. Bernando J. M. and Smith, A. F. M. Bayesian Theory, John Wiley and Sons.
8. Birnbaum, A.: On the Foundations of Statistical Inference; Journal of the American Statistical Association, Vol.57.
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12. Ferguson, T. P. Mathematical Statistics: A decision Theoretic approach, Academic Press,
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14. Fisher, R.A.: Statistical methods and Scientific Inference; Edinburgh: Oliver and Boyd.
15. Gemerman, D. Markov Chain Monte Carlo: Stochastic Simulation for Bayesian Inference, Chapman Hall.
16. Hacking I.: Logic of Statistical Inference; Cambridge Univ. Press.
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18. Hampel, F. R. Ronchetti F.M., Roussew, P. J. Stahel, W. A, Robust Statistics, Join Wiley and Sons.
19. James 0. Burger: Statistical Decision Theory and Bayesian Analysis: Second
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PAPER-2

ADVANCED SURVEY SAMPLING

IPPS schemes of sampling due to Midzuno-Sen, Brewer, Durbin and JNK Rao (sample size 2 only), Rao-Hartley-Cochran sampling scheme for sample size n with random grouping

Issues in small area estimation - synthetic and generalized regression estimators.

Non-sampling errors and biased responses, randomized responses for variables, errors in surveys, Nature of measurement errors, measurement models,modeling observational errors, estimation of variance components, application to longitudinal studies (repetitive surveys).

Randomized response: Estimation in the presence of unit response imputation.

Unified theory of finite population sampling, the basic model and non-existence of BLUE in the general class of estimators.

Criteria for judging estimators: Admissibility and Hyper admissibility, Minimax and invariant estimators.

Concepts of likelihood and sufficiency and short comings of the conventional theory of sampling, some alternative approaches: Royall's prediction approach and Erichson's Bayesian approach.

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Inference under a Super population set-up: Super population concept, various super population models, design-unbiased and model-unbiased predictions under different models.

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1. Bolfarine, H & Zacks. S Prcdiction theory for finite population. Springer- Verlag, NY
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3. Hedayet, A. S. and Sinha, B. K. Design and inference in finite population sampling, John Wiley: NY
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8. Chaudhuri, A. and R. Mukerjee: Randomized Response: Theory and Techniques, New York: Marcel Dekker Inc.
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PAPER-3

ADVANCED OPERATIONS RESEARCH

1. Parametric Programming: Changes in requirement and cost vector.
2. Nonlinear Programming: General nonlinear programming problem, constrained optimization with equality and inequality constraints. Necessary and sufficient conditions (Kuhn-Tucker conditions) for solving a nonlinear programming problem.
3. Quadratic programming : Wolf's method and Beal's method
4. Non- Poisson Queues: Study of the systems $M/E^k/1$, M/G/1, GI/M/1, GI/M/C.
5. EOQ models with price change, EOQ model with varying demand, EOQ models with uncertain demand. Dynamic version of Economic Lot –size model.

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1. Kanti Swarup, P.K.Gupta Mohan: Operations Research
2. K.G. Murthy: Nonlinear programming.
3. Donald Waters: Inventory Control and Management; Wiley.
4. Rao, S.S.: Optimization: Theory and Applications

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PAPER-4

ADVANCED STATISTICAL QUALITY CONTROL AND RELIABILITY

Continuous sampling plans of Dodge type and Wald-Wolfiwitz type and their properties. Bayesian sampling plans.

Capability indices Cp, Cpk and Cpm; estimation, confidence intervals and tests of hypotheses relating to capability indices for Normally distributed characteristics.

Use of Design of Experiments in SPC; factorial experiments, fractional factorial designs, construction of such designs and analysis of data.

Multivariate quality control; use of control ellipsoid and of utility functions.

Reliability estimation based on failure times in variously censored life tests and in tests with replacement of failed items; stress-strength reliability and its estimation.

Maintenance and replacement policies; availability of repairable systems; modeling of a repairable system by a non-homogeneous Poisson process.

Reliability growth models; probability plotting techniques; Hollander-Proschan and Deshpande tests for exponentiality; tests for HPP vs. NHPP with repairable systems.

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10. Nelson, W: Applied Life Data analysis; John Wiley.
11. Zacks S. : Reliability Theory, Springer
12. Martz. M. F. and Wailer. R. A. Bayesian Reliability Analysis. John Wiley and Sons.

PAPER-5

APPLIED REGRESSION ANALYSIS

Selection of variables: Formulation of the problem, All possible regressions and "Best Subset" regression, stepwise regression, Backward Elimination, Stepwise Method, Consequences of variable deletion, use of regression equations, Significance levels for selection procedures, Multicollinearity and Variable selection, Variable Selection Using Ridge Regression

Residuals and their analysis, Influential observations, Power transformations for dependent and independent variables.

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Non-linear regression models, Different methods of estimation (Least squares, Maximum Likelihood), Asymptotic properties of estimators.

Generalized linear models, Analysis of binary and grouped data by using logistic models, Log-linear models.

Random and mixed effect models, Maximum likelihood, MINQUE and restricted maximum likelihood estimators of variance components, Best linear unbiased predictors (BLUP), Growth curves.

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1. Bates, D. M. and Watts, D. G.: Nonlinear Regression Analysis and its Application, Wiley, New York.
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