Department of Statistics

University of Pune

Syllabus for Ph. D. Courses

Paper I: Research Methodology in Statistics

5 credits course: distribution of credits out of 50 is given in brackets against each topic.

1. Importance of research methodology in statistical research: Motivation, objectives and purpose of research. Data collection, information extraction and knowledge discovery as statistical methodology. (2)
2. Types of statistical research: empirical, field experiments, laboratory experiments, and secondary sources of data. Exploratory and confirmatory research. Planned and ad-hoc methods of data collection. Non-response and methods of recovering the missing response. (8)
3. Sampling of non-standard populations: Sampling designs when the population is contiguous or non-stationary or when sampling units are not distinguishable, are not enumerated, are affected by the process of making observation or are evasive. (10)
4. Response surface methodology: Factorial experiments with central and axial points. Optimization of factor levels to maximize the response. (10)
5. Resampling techniques: Bootstrap and Jackknife, bootstrap variance estimation, bootstrap confidence intervals and testing. (5)
6. Simulation methods: Monte Carlo methods, techniques to handle missing data, EM-algorithm, imputation methods. (5)
7. Use of computers in statistical research: Statistical packages like SAS, SYSTAT, MINITAB and other packages like MATLAB, GAUSS, Mathematica, and Maple. R statistical computing environment. (10)

References:

1. Gruijter, J., de Brus, Bierkens, M. F. P. amd Knotters, M. (2006): Sampling for natural resource monitoring. Springer.
2. Thompson, S. K. (2002): Sampling, 2nd Edition. Wiley.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009): Elements of statistical learning, 2nd Edition. Springer.
4. Myers, R. H., Montgomery, D. C., and Anderson-Cook, C. M. (2009): Response surface methodology, 3rd Edition. Wiley.
5. Venables, W. N. and Ripley, B. D. (2002): Modern applied statistics with S. 4th Edition. Springer.
6. Purohit, S. G., Gore, S. D. and Deshmukh, S. R. (2008): Statistics using R. Narosa.
7. MATLAB online manual.
8. MINITAB online manual.
9. Mathematica online manual.
10. SAS online manual.
11. GAUSS online manual.
12. MAPLE online manual.

Grading will be based on the following methods: participation in class discussions, seminars, reviews, assignments and tests.

Paper II: Advanced methods for statistical research (Probability and Inference)

5 credit course: distribution of credits out of 50 is given in brackets against each topic.

1. Probability theory: Independence, Borel-Cantelli Lemma, Kolmogorov's zero-one law, strong law of large numbers, conditional probability and conditional expectation, martingales. (13)
2. Bayesian approach: Inference, Bayesian computation, Empirical Bayes Inference. (10)
3. Large sample techniques: types of convergence, consistency, Lindeberg-Feller theorem, asymptotic normality, rates of convergence, delta method. (10)
4. Nonparametric curve estimation: Histogram and Kernel density estimators, nonparametric regression. (7)
5. Advanced inference: UMPU, locally most powerful and invariant tests, simultaneous inference, FDR. (10)

References:

1. Berger, James O.(1985): Statistical decision theory and Bayesian analysis, Springer.
2. Bradley P. Carlin, Thomas A. Louis, (2000): Bayes and Empirical Bayes methods for data analysis; theory and methods. Chapman & Hall/CRC.
3. David Roxbee Cox, David Victor Hinkley (1982). Theoretical statistics Chapman and Hall
4. Davison, A. C. and Hinkley, D. V. (1997) Bootstrap Methods and Their Applications. Cambridge: Cambridge University Press.
5. Efron B. and Tibshirani, R. J. (1993): An Introduction to the Bootstrap. Chapman & Hall..
6. Gelman, Andrew (2004): Bayesian data analysis. CRC Press.
7. Ghosh, J. K., Mohan Delampady, Tapas Samanta (2006): An introduction to Bayesian analysis: theory and methods. Springer.
8. Shao Jun (2003). Mathematical Statistics. 2nd Edition, Springer
9. B. W. Silverman (1998). Density estimation for statistics and data analysis. Chapman & Hall/CRC
10. Ripley, Brian D. (1987). Stochastic simulation. WILEY-INTERSCIENCE PAPERBACK SERIES
11. Van der Vaart, A. W. (1998) . Asymptotic Statistics. Cambridge: Cambridge University Press.
12. Geoffrey J. McLachlan and 1 Thriyambakam Krishnan. (1997). The EM Algorithm and Extensions. Wiley.
14. Tanner, M. A. (1996): Tools for statistical inference. Springer
15. Larry Wasserman (2004). All of Statistics. Springer.

Grading will be based on the following methods: participation in class discussions, seminars, reviews, assignments and tests.

Paper III: Reading paper.

5 credit course.

This paper will be assigned by the research guide depending on, but not covering, the research topic.

Grading of this course will be by the research guide and one examiner appointed by the departmental research committee.

One credit will be reserved for publishing research paper(s) in refereed journal(s).

Due credit will be given for participation in National or International Conferences, Seminars, Workshops, etc. (2 out of 50 for every conference, seminar, workshop, etc.)