



**ALBERT EINSTEIN SCHOOL OF PHYSICAL SCIENCES
ASSAM UNIVERSITY, SILCHAR
COURSE WORK SYLLABUS FOR Ph. D/M. Phil**

Paper – 1: Research Methodology in Physical Sciences (School Level)

Credit: 04

UNIT – I:

Research: Meaning, objectives, types, approaches. Criteria of good research, research problems, research design. Review of literature: Meaning, objectives, principles and procedure. Report writing: Meaning, significance, types, techniques.

UNIT – II:

Quantitative methods of research: Methods of data collection – experimental data, field data, data from secondary sources. Relation between variables: correlation (both continuous & binary data), regression (both linear & non-linear) for two variables. Test of significance including one-way-anova. Errors and analysis of errors.

UNIT – III:

Computer application in research: Data analysis – use of software like Excel/Matlab/Mathematica/SPSS etc., Word processing – use of software like MS Word/LATEX/End Note etc., Data bases – use of software like MS Access/My SQL etc. Introduction to Computer Network: Network Protocol and topology. Computer simulations: Introduction to mathematical and simulation models, deterministic and stochastic simulation models, continuous and discrete simulation.

UNIT – IV:

Intellectual Property Rights (IPR) – patents, copyrights and related issues. Plagiarism: concept, software, legal aspects. National Science Policies, Ethics in Research

Suggested readings:

1. Research Methodology-Methods and Techniques, New Age International, C. R. Kothari, 2nd Ed. (New Delhi), 2008.
2. Research Methodology: A step-by-step guide for beginners, SAGE Publications, Ranjit Kumar, 2005.
3. Mastering MATLAB by Duane C. Hanselman and Bruce L. Littlefield, 2011.
4. Queueing system-Vol.2-D, Kleinrock, John Wiley & Sons Inc New York, 1976.
5. Computer Network by A. Tanenbaum. Printice Hall Ind. Englewood cliffs N.J., 1981.
6. Data and computer communications by W. Stallings, Mc Millan Pub. Co. New York, 1976.



Department of Statistics
Assam University, Silchar
Ph.D Course Work
Departmental level

Paper 2: Statistical Methods

Credit: 04

Unit I

Random variables, probability distribution of a random variable, functions of a random variable, multi variate random variables.

Unit II

Introduction on limit theorems, modes of convergence, weak and strong law of large numbers, central limit theorem.

Unit III

Order statistics, mixture distribution, truncated distribution, multivariate distributions

Unit IV

Consistency and limiting distributions, sample moment and their distributions, Bayesian method of estimation, non-parametric tests.

References:

- Apostol, T. M. (1985). Mathematical Analysis, Narosa, Indian Ed.
- Das K. K. and Bhattacharjee D. (2008). An Introduction to Probability Theory, Asian Books, New Delhi.
- Feller, W. (1985). Introduction to Probability Theory and its Applications, Wiley Eastern, New Delhi. Freund, J. E. (1998). Mathematical Statistics, PHI, New Delhi.
- Hogg R.V., Craig, A. And McKean J. W. (2005) Introduction to Mathematical Statistics, 6th Edition, Pearson.
- Johnson, S and Kotz (1995). Distributions in Statistics, Vol – I, II and III, Houghton and Mifflin.
- Malik, S. C. and Arora, S. (2002). Mathematical Analysis, New Age International Ltd.
- Wilks S.S. (2007). Mathematical Statistics, Buck Press.



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Paper 3: Advanced Data Mining

Credit: 04

Unit 1: Data Mining and Analysis

Introduction to Data Mining, Measurement and Data, Models and Patterns, Model Structure for Prediction, Models for Probability Distributions and Density Functions, The Curse of Dimensionality, Models for structured data, Pattern Structure

Scoring patterns, Score function for predictive models and descriptive models, scoring models with different complexities, evaluation of models and patterns and robust methods.

Unit II: Search and Optimization Methods and Descriptive Modeling

Searching for models and patterns, parameter optimization methods, E M Algorithm, Optimization with missing data, Online and Single scan algorithm, Stochastic Search and Optimization techniques.

Descriptive modeling, describing data by Probability Distributions, mixture distributions.

Unit III: Clustering

K-means algorithm, K-means in Two Dimensions, Kernel K-means, expectation-maximization clustering, EM in One Dimension, Hierarchical clustering, Number of Hierarchical Clusterings, agglomerative hierarchical clustering.

Unit IV: Classification

Bayes classifier, Naive Bayes classifier, K nearest neighbors (KNN) classifier, decision tree classifier, decision trees, optimal linear discriminant, linear discriminant analysis.

Reference

- Principles of Data Mining by David Hand, Heikki Mannila and Padhraic Smyth Publisher: Prentice-Hall of India Pvt. Ltd.
- Data Mining and Analysis by Mohammed J. Zaki and Wagner Meira Jr., Cambridge University Press.
- The Elements of Statistical Learning: Data Mining, Inference, and Prediction by Trevor Hastie, Robert Tibshirani and Jerome Friedman, Second Edition (Springer Series in Statistics).



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Ph. D Course Work
Departmental Level
Paper 4: Term Paper**

Credit: 04

Term paper shall be assigned to each scholar at the beginning of the semester for its submission to the department. The paper may be preparation of protocol, review of literature, methodology on the assigned research topic and reaching to a conclusion. The term paper may or may not be a part of the research later on taken up by the scholar. The scholar has to present the term paper in front of his/her Research Advisory Committee and defend it. The Research Advisory Committee may also evaluate the continuous progress of the scholar through presentations/discussions during the semester.
