

# **PhD (Preliminary Qualifying) Examination**

## **Syllabus for Paper 1: Research Methodology (Computer Science)** (with effect from 2014 Admission)

### **Unit - 1**

Research Methodology:

Introduction to Scientific Research, Meaning, Objectives and Significance of Research Motivation in Research, Types of research approaches, Quantitative research methods, Research methods versus methodology, Research process, Criteria of good research, Research problems, Necessity of defining the problem, Technique involved in defining the problem, Design and Development Research Methods, Meaning of research design, Need for research design, Features of a good design, Different research designs, Basic principles of experimental designs, Ethics in research, Building expertise in the areas of interest, generating the base content in the selected area, literature survey for research work, arriving at directions of research, Formulation of research title, development of criteria based research proposal.

### **Unit – II**

Probability and Statistics:

Probability as a measure of uncertainty, probabilities for events, axioms, probability rules, Failure time data analysis, Hazard models, conditional probability, Bayes' rule, random variables, probability distributions, discrete and continuous distributions, univariate and multivariate distributions, joint, marginal, conditional distributions, expected values (mean, variance, covariance), sampling/simulation, study of a population or distribution, System reliability, Stochastic process, Software tools for Mathematical and statistical analysis, Scilab/SPSS.

### **Unit – III**

Linear Algebra:

Introduction to vectors, vector and linear combinations, lengths and dot product, solving linear equations, vector space and subspace, orthogonality of the four subspaces, eigen values and eigen vectors, linear transformations.

### **Unit – IV**

Scripting Languages:

Overview: The nature of scripting languages, scripting vs programming, Python Programming. Regular expressions, Network programming, Internet client programming, Multithreaded programming, GUI programming, Database programming, Web clients and servers, Web programming: CGI and WSGI, Web frameworks: Django, web services.

## **Unit – V**

Technical writing using LaTeX:

Scientific Writing : Significance of report writing, Structure and Components of Research Report, Types of Report: research papers, thesis, Research Project Reports, Precautions for writing research reports, Pictures and Graphs, Citation Styles, Oral presentation, Exposure to LaTeX, Installation, MikTeX, TeXnicCenter, Creating reports and articles, Text environment, Math environment, Figures, Tables, BibTeX - reference manager, Camera Ready Preparation.

### **REFECENCES:**

1. C.R.Kothari, *Research Methodology Methods & Techniques*, 2nd Edition, Wishwa Prakashan Publishers.
2. Misra R.P, *Research Methodology – A Hand Book*, Concept publishing Company, New Delhi 1988
3. Kai Lai Chung, *A Course in Probability Theory*, Third Edition, Academic Press.
4. Gilbert Strang, *Introduction to Linear Algebra*, 3rd edition, Wellesley-Cambridge Press and SIAM
5. David Barron, *The World of Scripting Languages*, Wiley Publications.
6. *Core Python application programming*, Third edition Wesley J Chun, PEARSON.
7. Leslie Lamport, *LaTeX: A Document Preparation System*, Second Edition.

**Ph.D. (Preliminary Qualifying) Examination**  
**Model Question Paper**(with effect from 2014 Admission)  
Paper-I : Research Methodology (Computer Science)

Time: 3 Hours

Maximum: 70 Marks

Answer any SEVEN Questions  
All questions carry EQUAL Marks

1. What is research problem? Define the necessity of identifying a research problem.
2. Discuss the characteristics of a good research design.
3. Reduce these matrices to their ordinary echelon form U:

$$A = \begin{bmatrix} 1 & 2 & 2 & 4 & 6 \\ 1 & 2 & 3 & 6 & 9 \\ 0 & 0 & 1 & 2 & 3 \end{bmatrix} \text{ which are the free variable and which are the pivot variables?}$$

4. How many 5 by 5 permutation matrices have  $\det P = +1$ ? Those are even permutations. Find one that needs four exchanges to reach the identity matrix.
5. Define and explain Bayes' rule.
6. Explain the following terms
  - a. Linear independence
  - b. Orthogonality of two vectors
  - c. Eigenvalues
7. How do we share global variables across modules in Python? Describe how to send mail from a Python script.
8. How do you make an array in Python? What is used to create Unicode string in Python?
9. Write a short note on Structure and Components of Research Report.
10. Discuss about Text environment and Math environment in LaTeX.

(7X10=70 marks)