

# **Ph.D. Course Work- Paper I**

**Title: Research Methodology**

**Max Marks: 100**

Attempt 6 questions with one Question from each unit

**Time: 3 hours**

## **UNIT I:**

**Research:** Meaning, Objective, Type of research. Criteria of good research. Research Approaches.

**Research Process:** Problem Definition, Literature survey, Hypothesis Formulation, Research design, data collection, data analysis, Interpretation, Report writing.

## **UNIT II:**

**Research design:** Meaning, Features and need

**Data Collection:** Collection of primary data, Schedules; Collection of secondary data; Published and unpublished.

**Academic databases:** Academic databases for Computer Science discipline.

## **UNIT III:**

**Literature Collection:** Sources of literature collection. Collection of relevant literature. **Review of Literature:** Critical Review of Collected Literature. Identifying strong and weak features of existing methodologies/techniques.

## **Unit IV:**

**Report Writing:** Skills of writing advanced technical papers.

**Presentation:** Skills of presenting advanced technical concepts easily.

**Ethics in Research:** APA Ethics Code, Intellectual property rights, Patent law. Plagiarism – Definition, Various forms, and Avoidance (practices and tools).

## **UNIT V:**

Types of Data: Concepts of population and sample, quantitative and qualitative data, cross-sectional and time-series data, discrete and continuous data, different types of scales. Univariate data – different measures of central tendency, dispersion, relative dispersion, skewness and kurtosis, Graphical Methods like histogram and other graphs Box Plot. Outlier Detection.

## **Unit VI**

Bivariate data – scatter diagram, correlation coefficient and its properties, Correlation ratio, Correlation Index, Intraclass correlation, Concept of Regression, Principles of least squares, Fitting of polynomial and exponential curves. Analysis of Categorical Data: Consistency of data, independence and association of attributes, measures of association – Pearson's and Yule's measures, Fitting of logit model through least squares.

### **References:**

1. *“Research design: Qualitative, Quantitative, and mixed method approaches”*, John W. Creswell, Sage Publications, 2014.
2. *“Research methodology: Methods & Techniques”*, C.R. Kothari, New Age International Publishers, 2004.
3. *“Research Imagination: An introduction to qualitative & quantitative methods”*, Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin, Cambridge University Press, 2007.
4. *“Writing for Computer Science”*, Justin Zobel, Springer-Verlag, 2014.
5. *“Writing your thesis”*, Paul Oliver, Sage Publication, 2004.
6. *“Ethics in Research”*, Ian Gregory, Continuum Research Methods Series, Continuum, 2003.
7. Goon AM, Gupta MK, Dasgupta B. (1998): Fundamentals of Statistics (V-1), World Press
8. Yule G.U & Kendall M.G (1950): An Introduction to the Theory of Statistics, C.Griffin
9. Kendall M.G. & Stuart A. (1966): Advanced Theory of Statistics (Vols 1 & 2)

## Ph.D. Course Work- Paper II

**Title: Recent Advances in Computer Science**

Attempt 5 questions with one Question from each unit

**Max Marks: 100**

**Time: 2.5 hours**

### UNIT – I

**Big Data:** Definition and Explanation. Characteristics of Big Data (Basic, 3V and 5V). Types of Big Data – Structured, Semi-structured, and unstructured. Why Big Data is important? **Big Data Technology Foundation:** Physical Infrastructure (Generation, Computation, Communication, and Storage), Security Infrastructure. Current trends and Challenges.

### UNIT – II

**Cloud Computing:** Overview, Evolution and Characteristics. How Cloud Computing works? Pros and Cons of Cloud Computing. Challenges of Cloud Computing. Comparison with traditional computing architecture (Client/Server). Comparison with other recent computing trends (Grid, Cluster and Distributed Computing).

**Virtualization:** Introduction to virtualization, types and implementation levels.

**Cloud Computing Architecture:** Cloud computing stack, *Introduction to Cloud Service Models* - Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). *Introduction to Cloud Deployment Models* – Public Cloud, Private Cloud, Hybrid Cloud, and Community Cloud. Services provided at various levels.

### UNIT – III

**IoT Definition:** Overview, Application, Potential and Challenges, Architecture, M2M vs IoT.

**Internet vs IoT:** Layers, Protocols, Packet-services, Performance parameters of Packet-networks (Web, P2P, Sensor Networks, & Multimedia).

### Unit IV

Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. The importance of inductive bias.

## **Unit V**

Blockchain: Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

### **References:**

1. “*Big Data for Dummies*”, Judith Hurwith, Alan Nugent, Fern Halper, and Marcia Kaufman, John Wiley & Sons, 2013.
2. “*Big Data – Principles and best practices of scalable real-time data systems*”, Nathan Marz and James Warren, Dreamtech Press, 2016.
3. “*Cloud Computing Bible*”, Barrie Sosinsky, Wiley-India, 2010.
4. “*Cloud Computing: Principles and Paradigms*”, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011.
5. “*Designing Internet-of-Things*”, Adrain McEwen, & Hakim Cassimally, Wiley.
6. “*The Internet of Things*”, Samuel Greengard, MIT Press.
7. “*The Silent Intelligence: The Internet of Things*”, Daniel Kellmerit & Daniel Obodovski, DND Ventures LLC.
8. “*Internet of Things: A hands on approach*”, Arhdeep Bahga, & Vijay Madiseti, Orient Blackswan.
9. *Machine Learning*, Tom Mitchell, McGraw Hill
10. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).