

Ph.D. Course Work Paper I

Paper Title: Research Methodology
Attempt 6 questions with one question from each unit

Max Marks: 100
Time: 3 hours

Unit – I

Research: Meaning, Purpose, Critical thinking, and Objectives. Various steps in research process. Criteria for good research. Research approaches – Qualitative vs Quantitative. Research types – Descriptive, Exploratory, Analytical, and Predictive.

Unit – II

Literature Survey: Sources, Collection, Selection, Theoretical background, Critical analysis, Observations, Recommendations and Scientific theory.

Research Question & Hypotheses: Necessity, Problem formulation (Scientific method vs Arbitrary method), Prediction, Reviewing and Rethinking, Research question and Hypotheses. Qualities of a good Hypotheses. Types of Hypotheses.

Unit – III

Experimental Design: Basic terminology (Independent and Dependent variables, Experiment unit, Subject, etc.). Types of Experimental design – Repeated measures, Independent samples, Matched pairs, Factorial design.

Data Collection: Collection of Primary data – Questionnaire, Interviews, Case Studies. Collection of Secondary data (Published/Unpublished).

Validation: Significance, Construction, Internal and External validity, Threats to validity.

Unit – IV

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

Writing: Structure and Components of a research report. Writing a technical paper. Importance of revisions. Academic databases for Computer Science discipline. Software for reference management (Mendeley) and manuscript formatting (LaTeX).

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 graph plots. 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.

Reference Books:

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 methods for everyday life: Blending qualitative & quantitative approaches"*, Scott W. Vanderstoep & Deirdre D. Johnston, Wiley, 2009.
4. *"Research Imagination: An introduction to qualitative & quantitative methods"*, Paul S. Gray, John B. Williamson, David A. Karp, John R. Dalphin, Cambridge University Press, 2007.
5. *"Writing for Computer Science"*, Justin Zobel, Springer-Verlag, 2014.
6. *"Writing your thesis"*, Paul Oliver, Sage Publication, 2004.
7. *"Ethics in Research"*, Ian Gregory, Continuum Research Methods Series, Continuum, 2003.
8. Goon A M, Gupta M K, Dasgupta B.(1998):*Fundamentals of Statistics (V-1)*,World Press
9. Yule G.U & Kendall M.G(1950): *An Introduction to the Theory of Statistics*, C.Griffin
10. Kendall M.G. & Stuart A. (1966): *Advanced Theory of Statistics (Vols 1 & 2)*

Ph.D. Coursework Paper II

Paper Title: Recent Advances in Computer Science
Attempt 5 questions with one question from each section

Max Marks: 100
Time: 2.5 hours

UNIT – I:

Big Data: Definition and Explanation. Characteristics of Big Data (Basic, 3V and 5V). Why Big Data is important? Types of Big Data: Structured, Semi-structured, and unstructured.
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).