

Department of Computer Science and Engineering

Ph.D. Entrance Exam Syllabus – 2022

1. Research Methodology

Introduction to Research: Meaning and importance of Research, Types of Research, Research Design and Stages, Selection and Formulation of Research Problem, Objective(s) and Hypothesis Developing Research Plan – Exploration, Description, Diagnosis, Experimentation, Determining Experimental and Sample Design.

Ethics and related issues in research: Concepts in ethics, Intellectual Property Rights, Plagiarism, Fraud and misconduct in science, Unscientific practices in thesis work.

Collection and analysis of data: Sources of Data – Primary and Secondary Types of Data – Categorical (nominal and ordinal), Numerical (discrete, continuous, ratio and interval)

Statistical Graphics – Histograms, Frequency Polygon, Stemplots, Bar Graphs, Pareto Charts, Pie Charts, Scatterplots, Boxplots, Descriptive Analysis – Frequency Distributions, Measures of Central Tendency, Measures of Variation/Dispersion, Skewness and Kurtosis,

Information sources: Types of publications, Indexing and abstracting services, Online library, Search engines, Citation indexes, Citations analysis, Online searching methods, Initiatives for knowledge management.

Scientific writing: Structure and Components of Scientific Reports – Types of Report – Technical Reports and Thesis – Significance – Different steps in the preparation – Layout, Structure and Language of Typical Reports – Illustrations and Tables – Bibliography, Referencing- Citation of sources in the text, Reference management softwares, and Foot Notes.

2. Mathematical and Analytical skills

Basics of propositional logic and predicate logic, elementary set theory, elementary number theory, principles of counting, fundamentals of probability theory, basics of linear algebra, random variables, fundamentals of statistics, basic principles of calculus, basics of graph theory and information theory.

3. Problem Solving Approaches

Defining Problems, Categorizing Problems, Problems in Different Fields, Descriptive Tasks and Problems, Analytical Tasks, Analytical Problems, The Problem-Solving Process

Understanding the Problem, Strategies for Understanding and Beginning the Problem, Check your Marking Criteria! Starting with What You Know, Using Specialized

Knowledge, Problem-Solving with Special Cases, Strategies for Problem-Solving with Specialized Knowledge & Special Cases, Using Special Cases to Solve Problems

Seeking Different Perspectives, Learning from Other People, Applying Forms of Reasoning and Thinking, Questioning Assumptions & Considering Alternatives, Questioning Assumptions: The 9 Dot Problem, Using Creative Strategies, The Importance of Creativity, Evaluating Solutions, Strategies for Evaluating Solutions.

Case study of problems, framing questions and solutions based on case study. There are several steps that one should use to solve any mathematical problem. Many of these ideas apply to problems in other sciences. Read definitions of any unknown terms. Look at known results regarding these terms. Draw pictures, if applicable. Try to find an equivalent problem. Modify the problem. See what happens if you leave out a hypothesis or add a new one. Choose effective notation. Look for symmetry or parity. Divide into cases. Try working from conclusion to hypotheses. Try contradiction. Consider extreme cases.

4. Fundamentals of Computer Science and Engineering

Discrete Mathematics - Digital Logic - Computer Organization and Architecture- Programming and Data Structures – Algorithms - Theory of Computation - Compiler Design - Operating System - Relational Database Management System – Software engineering - Business Computing - Web Development and Web Scripting - Communication and Network Concepts.

5. Advanced Computer Technological Knowledge

Big Data Concepts: Types of Data, File System Vs Hadoop Distributed File System.

Machine Learning: Linear Algorithms: Linear Regression, Logistic Regression

Non-Linear Algorithms: Decision Trees, K-Nearest Neighbors,

Internet of Things: Sensor, Actuators, RFIDs and Wireless Sensor Networks, IoT architecture, Technology behind IoT, IoT Examples

Artificial Intelligence: Intelligent Agent, search algorithms, predicate logic.

Software Engineering: Development methodologies, Software security life cycle

Network Security: TCP/IP and OSI Network Security

Block Chain Technology: Technological and Cryptographic Elements in Blockchain, Blockchain Platforms.