



Gyanveer University

Sagar (M.P.)



Ph. D. Entrance Test Syllabus

Session: 2024-25

Computer Science

Part A : Research Methodology

Part B : Computer Science

Part-A

Research Methodology

Research and Types of research: Meaning of Research- Objectives of Research- Motivation in Research. Research methods vs Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs- patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis. Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection – Modeling, Mathematical Models for research, Sampling Methods- Data processing and Analysis strategies. Data Analysis with Statistical Packages – Hypothesis- testing, Generalization-and-Interpretation. Interpretation and report writing - Techniques of interpretation - Structure and components of scientific reports - Different steps in the preparation - Layout, structure and language of the report - Illustrations and tables - Types of report - Technical reports and thesis.

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. volumes.
4. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi
5. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.



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6. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
7. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications.

Part-B

Computer Science

Unit -I Computer Organization and Architecture

Digital Logic: Boolean algebra. Combinational and sequential circuits, Minimization; Number representations and computer arithmetic (fixed and floating point)

Computer Organization: Machine instructions and addressing modes. ALU, data-path and control unit; Instruction pipelining; Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).

Unit -II Programming Languages

Programming in C: Elementary Data Types; Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Pre-processors.

Programming in C++ : Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism, Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions.

Programming in Java: The Java Virtual Machine, Data types, Conditional and looping Statements, Arrays, Methods and functions, Constructors, Overloading methods, Garbage collection, Packages.

Unit -III Data Structures and Algorithms

Data Structures: Arrays, Stacks, Queues, Linked Lists, Trees, Forests, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Graphs, Sorting, Searching.

Algorithms: Performance Analysis of Algorithms – Time and Space complexities, Divide and Conquer, Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound, Breadth-First Search, Depth-First Search, Shortest Path, Minimum Spanning Tree, P and NP Class Problems.

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Unit -IV Database Management Systems

Database System Concepts: Data Models, Schemas, Architecture, ER Model, Relational Model, Relational Algebra, Relational Calculus. Functional Dependency, Multi valued Dependency, Join Dependency, and Normalization Forms. SQL: Types of commands, Constraints, Views, Stored Procedures, Functions, Triggers. Deadlock – Prevention and Avoidance, Heap File Organization, ISAM, Hashing and Indexing.

Unit -V Theory of Computation and Compiler Design

Theory of Computation: Regular expressions and finite automata, Context-free grammars and push-down automata, Regular and context-free languages, Turing machines. Compiler Design: Lexical analysis, parsing, syntax-directed translation.

Unit -VI System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers Operating System: Processes, threads, inter-process communication, concurrency and synchronization; Multicore Programming, Multithreading Models Deadlock; CPU scheduling; Memory management and virtual memory; File systems

Unit -VII Software Engineering

Software Engineering: The Waterfall Model, Incremental Process Models Evolutionary Process Models, Concurrent Models. Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Adaptive Software Development (ASD), Scrum; Requirements Modelling: Requirements Analysis, Scenario-Based Modelling, UML Models, Design Concepts: The Design Process, Design Concepts, the Design Model, Architectural design, and component-level design.

Unit -VIII Data Communication and Computer Networks

Data Communication: simplex, half-duplex and full-duplex mode of data transmission, packet switching and circuit switching, Analog and Digital Signals; Noiseless and Noisy Channels; Digital and Analog Transmission; Data Encoding and Modulation Techniques; switching; Flow and error control techniques Computer Networks: Network Hardware, LAN, MAN, WAN, OSI Reference Model, - Protocol IPv4/IPv6, routers and routing algorithms (distance vector, link state); TCP/UDP and

sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Network Security: authentication, basics of public key and private key cryptography.

Unit -IX Computer Graphics

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing Algorithms, Translation,



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Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates, Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces.

Unit -X Advanced Technologies

Artificial Intelligence & Machine Learning:

Artificial Intelligence: Intelligent Agent, State Space Representation, Heuristic Search Techniques, Adversarial Search Techniques, Knowledge Representation, Uncertain Knowledge Representation, Planning, Linear and Non-Linear, Goal Stack, Hierarchical, STRIPS. Machine Learning: Machine Learning, Types of Learning, Supervised, Unsupervised, Semi-Supervised, Reinforcement Learning Techniques, Models, Tree, Rule, Linear, Distance-Based, Probabilistic. IoT: Introduction, Characteristics, Elements, Transducers and types, Applications

References:

Algorithms: Introduction to Algorithms by Rivest, Cormen, Stein, Leiserson, MIT Press

Operating System: "Operating System Concepts" by Galvin, Silberschatz. WILEY Publishers

Theory of Computation: "Introduction to Automata Theory, Languages and Computation" by Hopcroft, Ullman. Pearson Education Computer Networks: "Computer Networking: A top-down approach" by Kurose-Ross. Pearson

Education

"Computer Networks" by Tanenbaum, Prentice Hall

Computer Organisation: "Computer Organisation" by Carl Hamacher. McGraw Hill

Programming: "Computer Systems: A Programmer's Perspective", Randal E. Prentice Hall

"Java: The Complete Reference, 8th Edition", Herbert Schildt. McGraw Hill

Database Systems: "Fundamentals of Database Systems" – Ramez Elmasri and Shamkant B Navathe, Pearson Publications.

"Database Management Systems" – Raghu Ramakrishnan and Johannes Gehrke, McGraw Hill Publications.

Software Engineering: Roger S Pressman, "Software Engineering- A Practitioners Approach", Sixth Edition, Mc Graw Hill publishers.

Lan SommerVille, "Software Engineering", Eighth Edition, Pearson Education, 2009.

Compiler Design: "Principles of Compiler Design" by Aho and Ullman. Narosa Publishing House



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Digital Logic: "Digital Logic and Design" by Morris Mano. Pearson Education, Prentice Hall.

Software Engineering: "Software Engineering: A Practitioner's Approach" by Pressman. Prentice Hall.

Data Structure: "Fundamentals of Data Structure in C" – Ellis Horowitz and Sartaj Sahni, University Press. "Data Structures and Algorithm Analysis in C" - Mark Allen Weiss, Pearson Education. "Introduction to the Design and Analysis of Algorithms" – Anany Levitin, Pearson Education.

Artificial Intelligence: "Artificial Intelligence" – E. Rich and K. Knight, McGraw Hill Publications.

Machine Learning : "Machine Learning" – Tom M. Mitchell, McGraw Hill Publications. "Machine Learning: The Art and Science of Algorithms that makes sense of Data" – Peter Flach, Cambridge University Press.

IoT: Bahga, Arshdeep, and Vijay Madisetti. "Internet of Things: A Hands-On Approach." (2014).