

Department of Studies and Research in Computer Applications

Tumkur University, Tumakuru

Syllabus for Ph.D. Computer Science Entrance Test – 2026

PART – A

Research Methodology

Unit – 01

Research Methodology Introduction: Meaning of Research, Objectives and Motivation in Research, Types of Research, Research Approaches, Significance of Research in computer science, Research and Scientific Method, Research Process, Criteria of Good Research.

Defining the Research Problem: What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem.

Research Design and Literature Review: Meaning of Research Design, Need for Research Design, Research Methodology Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs. Review of the literature, searching the existing literature, reviewing the selected literature

Unit – 02

Sampling Design: Implications of a Sample Design, Steps in Sampling Design, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs

Measurement and Scaling Techniques and Methods of Data Collection: Measurement in Research, Measurement Scales, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Important Scaling Techniques. Collection of Primary Data and Collection of Secondary Data.

Testing of Hypotheses: What is a Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Tests of Hypotheses.


Unit – 03

Analysis of Variance and Covariance: Analysis of Variance (ANOVA), The Basic Principle of ANOVA, ANOVA Technique, Analysis of Co-variance (ANOCOVA).

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports.

Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism, Journal Impact Factor, Indexing Databases, Open & Closed Access Journals, Peer review process, Citation, H-Index, i10 index.

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ಜ್ಞಾನಪೀಠ, ಸುಮಕೂರು ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

PART – B

Cognate Subject: Computer Science

Unit – 04: Discrete Structures

Mathematical Logic: Propositional and Predicate Logic, Propositional Equivalences, Normal Forms, Predicates and Quantifiers, Nested quantifiers, Rules of Inference.

Sets and Relations: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

Graph Theory: Simple Graph, Multigraph, Weighted Graph, Paths and Circuits, Shortest Paths in Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and cut-Sets.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

Unit – 05: Computer System Architecture

Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit.

Data Representation: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic – Addition, Subtraction, Multiplication and Division Algorithms.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input-Output, Interrupt.


Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops Subroutines, Input-Output Programming.

Microprogrammed Control: Control Memory, Address Sequencing, Design of Control Unit.

Central Processing Unit: General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, RISC Computer, CISC Computer.

Memory Hierarchy: Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

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Unit – 06: Programming Languages, Data structures and algorithms and Computer Graphics

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Languages Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects: Scalar and Composite Data Types.

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

Object Oriented Programming: Class, Object, Instantiation, Inheritance, Encapsulation, Abstract Class, Polymorphism.

Programming in C++: Tokens, Identifiers, variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions, Class and Objects; Constructors and Destructors; Overloading, Inheritance, Templates, Exception and Event Handling; Streams and Files; Multi file Programs.

Data Structures : Arrays and their Applications; sparse, Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree, B Tree, B+ Tree, B* Tree, Data Structure for Sets, Graphs, Sorting and Searching Algorithms; Hashing.

Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Computer Graphic: Video-Display Devices, Raster-Scan and Random-Scan systems; Graphics Monitors, Input Devices, Points and Lines; Line Drawing algorithms, Mid-Point Circle and Ellipse Algorithms; Scan Line Polygon Fill algorithm, Boundary-fill and Flood-fill.


Unit – 07: Database Management Systems

Database System concepts and Architecture: Data Models, Schemas, and Instances; Three-Schema Architecture and Data Independence; Database Language and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model – Constraints, Languages, Design, and Programming, Relational Database Schemes, Update Operations and Dealing with constraint Violations' Relational Algebra and Relational Calculus; Codd Rules.

SQL: Data Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection.

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Normalization for Relational Databases: Functional Dependencies and Normalizations; algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; Database Security and Authorization.

Unit – 08: System Software and Operating system

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers, Compiler Design.

Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; SystemBoot.

Process Management: Process Scheduling and Operations; Inter process Communication, Communication in Client-Server Systems, Process Synchronization, Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization.

Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management: Contiguous Memory Allocation, Swapping, Paging, Segmentation, Demand Paging, Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

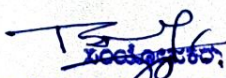
Storage Management: Mass-Storage Structure, Disk Structure, Scheduling and Management, RAID Structures.

Unit – 09: Software Engineering

Software Process Models: Software Process, Generic Process Model- Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, Component Based Development, Aspect-Oriented Software Development, Formal Methods, Agile Process Models- Extreme Programming (XP), Adaptive Software Development, Scrum, Dynamics SystemDevelopment Model, Feature Driven Development, Crystal, Web Engineering.

Software Requirement: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software Requirement and Specification (SRS) Document.

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Software Design: Abstraction, Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Estimation and Scheduling of Software Project: Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts.

Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing.

Unit – 10: Data Communication and Computer Networks

Data Communication: Components of a Data Communication System, Simplex, Half-Duplex and Duplex Modes of Communication; Analog and Digital Signals; Noiseless and Noisy Channels; Bandwidth, Throughput and Latency; Digital and Analog Transmission; Data Encoding and Modulation Techniques; Broadband and Baseband Transmission; Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols; TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses; Switching Techniques.


Functions of OSI and TCP/IP Layers: Framing Error Detection and Correction; Flow and Error Control; Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.

Datagram, Fragmentation and Checksum; IPv6 Packet Format, Routing Algorithms, TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

World Wide Web (WWW): Uniform Resource Locator (URL), Domain Name Service (DNS), Resolution – Mapping Names to Address and Address to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP.

Network Security: Malwares, Cryptography and Steganography; Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

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Question Paper Pattern for PhD Computer Science Entrance Test-2026

- The question paper consists of 100 Multiple Choice Questions (MCes).
- Each question have four options viz., A, B, C, D options.
- Each question carries 1 (One) mark.
- First 30 questions (Question 1to 30) should cover Research Methodology.
- Next 70 questions (Question 31 to 100) from cognitive subject Computer Science

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