

**SYLLABUS FOR ENTRANCE TEST FOR ADMISSION TO Ph.D. COURSE IN
COMPUTER SCIENCE & APPLICATIONS (w.e.f. 2019-20)**

Marks: 200

Time: 2 Hours

Instructions for Paper Setters: Paper will consist of 100 Multiple Choice Questions. 50 questions will be set from each of Part-I and Part-II. For each correct response, the candidate will get 2 marks. There shall be no negative marks for incorrect response. No marks will be given for unanswered questions.

PART – I

Research Methodology:

Foundations of Research: Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research. Research Process.

Problem Identification & Formulation: Research Question, Hypothesis: Qualities, Types; Research Design, Types of Research Design: Exploratory, Descriptive, Experimental; Qualitative and Quantitative Research, Independent & Dependent variables. Measurement: causality, generalization, replication, Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

Technical Writing: Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism, Thesis Writing: Introduction, review of literature, results, abstract, summary and synopsis, Reference citing and listing.

Statistics: Frequency distributions: Graphical Representation; measures of central tendency, arithmetic mean, geometric mean, harmonic mean, weighted mean, median, mode; Measures of Dispersion, Skewness, Kurtosis.

Probability: Sample space, Event, Mathematical Notation, Laws of probability, types of events, Bayes Theorem.

Curve fitting & Principles of Least Squares, Correlation: Karl Pearson, Rank; Regression.

Sampling: Types, parameter and statistic, Standard Error, Tests of Significance, Hypothesis, Critical Region and Level of significance.

Sampling Distributions: Chi-Square Distribution, T Distribution, F Distribution, Z Distribution; ANOVA

Simulation: Analog vs. Digital simulation, Continuous & discrete system simulation, Simulation of Hypothetical Computer, Inventory system & Corporate system, simulation of PERT, Generation of uniform & Non- uniform random number, Monte Carlo method, Design of experiment, simulation languages.

Optimization: Linear Programming: LPP in the standard form, canonical forms, conversion in standard form, Simplex prevention of cyclic computations in Simplex & Tableau, Big-M method, Dual Simplex & revised simplex.

PART – II

Programming Languages: Paradigms, Data types, operations, Expressions, Control structures, I/O statements, Parameter parsing techniques. Language constructs for object-oriented, functional, logic & concurrent programming, Chomsky hierarchy of formal languages, finite automata & pushdown automata.

Software Engineering: Development models, Metrics, Software Project Management, Analysis, Design: System design, detailed design, function-oriented, Object-oriented analysis & design, user interface design, Coding & Testing, Software quality & reliability, Object Modeling Technique (OMT) methodology, UML.

Computer Networks: Fundamentals, Reference Models, Data Communication, Internetworking: Components and issues; Media access controls, virtual circuits & datagrams, Routing algorithm, Congestion control, Network Security, Firewalls, Internet architecture and protocols.

Data Base: Basic concepts, Characteristics of Database approach, Three-schema Architecture and Data Independence, Data Models, E-R Model, Relational Data Model, SQL Programming Techniques, Relational Database Design, Functional Dependencies, Normalization, Query Processing and Optimization, Transaction Processing Concepts, Concurrency Control Techniques and Recovery Techniques.

Enhanced Data Models for Advanced Applications, Distributed Database and Client-Server Architectures.

Overview of Data Warehousing and OLAP, Data Mining Concepts.

Emerging Database Technologies and Applications.

Data Structure: Arrays, String, Linked Lists - Singly, doubly & Circular List; Stacks, Queues, Priority Queues: Representation & Manipulation; Trees: Binary & Threaded Trees, traversal, Binary Search Tree, Huffman & AVL Trees, B Trees; Graphs: Adjacency Matrix, Path Matrix, Linked Representation, traversal; Searching & Sorting techniques.

Operating System: Functions, Multiprogramming, Multiprocessing & Multitasking, Memory Management, Virtual memory, Paging, Fragmentation. Concurrent Processing: Mutual exclusion, Critical regions, lock & unlock. Scheduling: CPU scheduling, I/O scheduling, Deadlock: avoidance & prevention; UNIX: Structure & commands of UNIX, Interfacing with UNIX, Editors & Compilers for UNIX, LEX & YACC, File system, System calls, Filters, Shell Programming.

Computer Graphics: Components of an Interactive Graphics system, Display systems, Input/output & storage devices, 2D geometry, Graphic operations, 3D Graphics, Animation, Graphic standards, Application Concepts, Projections and Hidden surface elimination.

Digital Image Processing: Applications of digital image processing, Components of an Image Processing system, Image sampling and Quantization. Image Enhancement: Intensity transformations and spatial filtering, Point and Mask based techniques, Histogram processing, Fundamentals of spatial filtering, Smoothing and sharpening spatial filters.

Filtering in frequency domain. Color Image Processing.

System Programming: Assembly language fundamentals, Assemblers - 2 pass & single pass, Macros & Macro processors. Loading, Linking, relocation, program relocatability, linkage editing, Text editors, Programming Environments, Debuggers & program generation. Compilation & interpretation, Bootstrap compiler, Phase of compilation - lexical & syntax analysis, storage allocation, code optimization & generation.

Cloud Computing: Roots of Clouds, Characteristics, Cloud Architecture. Virtualization: Virtualization Types, Virtualization Technologies. Cloud Services & Platforms: Compute services. Federated & Multimedia Cloud Computing: Architecture, Features of Federation Types, Federation Scenarios, Layers Enhancement of Federation; Multimedia Cloud.