

SYLLABUS FOR PH.D COMMON ENTRANCE TEST

PAPER -1: RESEARCH METHODOLOGY

Unit 1: Research Methodology

Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.

Unit 2: Defining the Research Problem and Reviewing the Literature

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.

Unit 3: Research Design

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Unit 4: Methods of Data Collection

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Types of Sampling Designs.

Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Unit 5: Testing of Hypotheses

Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International 4th Edition, 2018
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
5. Leedy, P.D. and Ormrod, J.E., 2004 Practical Research: Planning and Design, Prentice Hall.
6. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009.

PAPER -2: Cognate Subject- Information Technology

Unit 1. Discrete Structures

Sets, Relations, Functions, Pigeonhole Principle, Inclusion-Exclusion Principle. Equivalence and partial Orderings, Elementary Counting Techniques Probability: Elements of probability, Bayes theorem.

Computability : Models of computation-Finite Automata, Pushdown Automata, Non-deterministic and NFA, DPDA and PDAs and Languages accepted by these structures. Grammars, Languages, Non-computability and Examples of non-computable problems.

Graph : Definition, walks, paths, trails, connected graphs, regular and bipartite graphs, cycles and circuits. Tree and rooted tree. Spanning trees, Eccentricity of a vertex radius and diameter of a graph. Central graphs. Centre(s) of a tree. Hamiltonian and Eulerian graphs. Planar graphs.

Groups : Finite fields and Error correcting/detecting codes.

Logic: Propositional logic, predicate logic, well formed formulae, Satisfiability and tautology.

Unit 2 Computer Organization and Architecture

Boolean algebra and Minimization of Boolean functions, Flip-flops-types, Race condition and comparison. Design of combinational and sequential circuits.

Representation of Integers : Octal, Hex, Decimal, and Binary. 2's complement and 1's complement arithmetic. Floating point representation.

Combinational Circuit Design, Sequential Circuit Design. Hardwired and Micro-programmed processor design, Instruction formats, Addressing modes, memory types and organizations, Interfacing peripheral devices, Interrupts.

Microprocessor architecture, Instruction set and Programming (8085, P-III/P-IV).
Microprocessor applications.

Unit 3. Programming in C and C++

Programming language concepts, paradigms and models.

Programming in C: Elements of C-Tokens, identifiers, data types, operators in C. Control structures in C. Sequence, Selection and iterations (s). Structured data types in C-arrays, struct, union, String and pointers. I/O statements, User defined and built in functions, Parameter passing.

C++ Programming : Elements of C++- Tokens, identifiers, Variables and constants. Data types. Operators, Control statements, Functions parameter passing, Class and objects. Constructors and destructors. Overloading, Inheritance, Templates, Exception handling.

Object Oriented Programming Concepts: Class, Object, Instantiation, Inheritance, polymorphism and overloading, dynamic binding, reference semantics and their implementation.

Unit 4. Relational Database Design and SQL

Database, E-R diagram, Relational model, Relational Algebra, Relational Calculus, Relational design, Normalization, 1NF, 2NF, 3NF, BCNF and 4NF.

SQL: Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL) commands. Database objects like – Views, indexes, sequences, synonyms, data dictionary.

Unit 5. Data Structures

Data, Information, Definition of data structure. Arrays, stacks, Queues, Linked lists, Trees, Binary trees and traversal, Graphs, priority queues and heaps and assimilated algorithms.

Unit 6. Computer Networks

Network fundamentals : Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless Networks, Inter Networks.

Topologies, Networking Devices. The OSI model, TCP/IP model. Protocols for –(i) Data link layer, (ii) Network layer, and (iii) Transport layer, TCP/IP protocols, Networks security, Network administration.

Unit 7. System Software

Assembly language fundamentals (8085 based assembly language programming). Assemblers -2-pass and single-pass. Macros and macroprocessors.

Loading, linking, relocation, program relocatability, linkage editing.

Text editors. Programming environments. Debuggers and program generators.

Unit 8. Operating Systems

Main features and functions of operating systems. Multiprogramming and Multiprocessing and multi tasking.

Memory Management : Virtual memory, paging, fragmentation.

Concurrent Processing : Mutual exclusion, Critical regions, Semaphores.

Scheduling : CPU scheduling, I/O scheduling, resource scheduling, Deadlock and scheduling algorithms. Banker's algorithm for deadlock handling.

Unit 9. Software Engineering

System Development Life Cycle (SDLC) : Steps, Waterfall model, Prototypes, Spiral model.

Software Metrics : Software Project Management.

Software Design : System design, detailed design, function oriented design, object oriented design, user interface design, Design level metrics.

Coding and Testing: Testing Level Metrics. Software quality and reliability. Clean room approach, Software reengineering.

Unit 10. Algorithmics

Sorting and searching algorithms. Analysis of algorithms, Interpolation and Binary search, Asymptotic notations – big ohm, mega and theta, Average case analysis of simple programs like finding of a maximum of n elements. Recursion and its systematic removal. Quicksort-non-recursive implementation with minimal stack storage. Design of Algorithms (Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound). Lower bound theory, non-deterministic algorithm,-non-deterministic programming constructs. NP-hard and NP-complete problems.

References:

1. I.Erns Horowitz and Sartaj Salmi, Fundamentals of Data Structures in C, Universities Press
2. Ralph P, Grimaldi: Discrete and Combinatorial Mathematics, Pearson Education
3. Ian Sommerville: Software Engineering,, Pearson Education
4. Carl Hamacher, honk° Vranesic, Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002.
5. Introduction to the Design and Analysis of Algorithms, Anany Levitin. Pearson.
6. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles , Wiley-India.
7. Forouzan, A. B. (2007). Data communications & networking (sie). Tata McGraw-Hill Education.
8. Fundamentals of Database Systems, Ram/. Elmasri and Shamkant II, Navathe,, Pearson
9. Beck, L. L. (1997). System software: an introduction to systems programming. Pearson Education India.
10. Balagurusamy, E. (2001). Object-Oriented Programming with C++, 7e. McGraw-Hill Education.

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