Faculty of Engineering & Technology
Research Entrance Test (RET)
Syllabus: Information Technology

SECTION A: RESEARCH METHODOLOGY

Unit 1: Introduction: Meaning, Objectives and Motivation of Research, Research Approaches, Importance of Research, Characteristics of Research, Types and Methods of Research.

Unit 2: Design, Planning and Review of Literature: Need and Salient Features of a Good Research Design, Different Research Designs, Problem Selection, Formulation of Chosen Problem, Hypothesis Formation, Measurement, Feasibility, Budget, and Timeline Considerations. Purpose of Literature Survey, Research Article Reviews, Identification of Gaps in Research.

Unit 3: Methods of Data Collection: Meaning and Importance of Data, Sources of Data, Methods of Collecting Primary Data, Use of Secondary Data, Observation Methods, Design of Experiments and Simulation, Tools for Data Collection, Construction of Schedules and Questionnaires, Measurement of Scales and Indices, Pilot Studies, Pre-tests, Experimental Data Sets, Check Sheet.

Unit 4: Sampling and Simulation Tools: Sampling Techniques or Methods, Choice of sampling Techniques, Sample size, Sampling and Non-Sampling errors, Estimation of Population Proportion and Population Mean, Estimation of Standard Error and Confidence Interval.
   Introduction to Simulation, Simulation Modeling Techniques, Simulation Tools & Languages (NS-3, MATLAB, SimPy, Cloudsim, TensorFlow / PyTorch, Scikit-learn, Hadoop / Spark), Formal Verification Tools.

Unit 5: Processing and Statistical Analysis of Data: Editing, Classification and Coding, Transcription, Tabulation, MINITAB, Graphical Representation, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation. Statistical Analysis, Measures of Central Tendency, Dispersion, Correlation and Variances, Probability distributions, Hypothesis Testing, Confidence Interval, Test of Significance, Comparison of two Proportions, Comparison of Means (z test, t test, two sample t test, paired- t test).

Unit 6: Report Writing and Publication: Significance and Types of Reports, Different Steps in Report Writing, Documentation, Data Analysis and its Illustration in Thesis, Research paper, Review Article & Technical Reports: Formatting Issues, Citation Methods, References, Impact Factor, Immediacy Factor, Indexing and other Citation Indices.

Unit 7: Research Ethics: Issues related to plagiarism, Collaborative Models and Ethics, Acknowledgements, Intellectual Property Rights, Copy rights, Copyleft, Patents, Industrial designs, Trademarks. Plagiarism.

Ph.D. Entrance Examination:2025-26

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Unit-1: Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Monoids, Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Linear Algebra, Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition. Calculus: Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.

Probability and Statistics, Random variables. Uniform, normal, exponential, poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

Unit-2: Digital Logic: Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point).

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

Unit-3: Programming and Data Structures: Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Algorithms Searching, sorting, hashing. Asymptotic worst-case time and space complexity. Algorithm design techniques, greedy, dynamic programming and divide-and-conquer. Graph traversals, minimum spanning trees, shortest paths

Unit-4: Theory of Computation: Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Compiler Design Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation. Local optimisation, Data flow analyses: constant propagation, liveness analysis, common sub expression elimination.
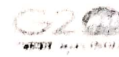
Unit-5: Operating System: System calls, processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling. Memory management and virtual memory. File systems.

Unit-6: Databases: ER-model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

General abbreviations and terminology of ITC, Basics of Internet, Intranet, E-mail, Audio and Video conferencing, Digital initiatives in higher education. ICT and Governance.

Unit-7: Computer Networks: Concept of layering: OSI and TCP/IP Protocol Stacks; Basics of packet, circuit and virtual circuit-switching; Data link layer: framing, error detection, Medium Access Control, Ethernet bridging; Routing protocols: shortest path, flooding, distance vector and link state routing; Fragmentation and IP addressing, IPv4, CIDR notation, Basics of IP support protocols (ARP, DHCP, ICMP), Network Address Translation (NAT); Transport layer: flow control and congestion control, UDP, TCP, sockets; Application layer protocols: DNS, SMTP, HTTP, FTP, Email.