Research Entrance Test(RET)

Syllabus

For

Computer Science

Under

Faculty of Science

SECTION A - RESEARCH METHODOLGOY

Introduction to Research Methodology: Definition and Meaning of Research, Objective of Research, Motivation in Research, Research Approaches, Signification of Research, Research Method versus Methodology, Importance of Research, Characteristics of Research, Steps in Research, Research Process.

Types and Methods of Research: Classification of Research, Pure and Applied Research, Exploring or Formulative Research, Descriptive Research, Diagnostic Research/Study, Evaluation research/Studies, Action Research, Experimental Research, Analytical Study of Statistical Method, Historical Research, Surveys, Case Study, Field Studies

Research Design and Planning: Meaning of Research Design, Need for Research Design, Feature of Good Design Features of a Good Design, Different Research Design The planning process, Selection of a Problem for Research,Formulation of the Selected Problems, Hypothesis formation, Measurement, Feasibility Study, Budget Plan, Timeline, Developing a Research Design/Plan.

Defining the Research Problem: Defining Problem, Selecting Problem, Necessity, Techniques Involved, Formulation of Research problem, Definition of Research Objectives.

Review of Research Literature: Purpose, Use of Literature Review, Literature Survey,Function of Literature Survey, Maintain a Notebook, Developing a bibliography, Locating Relevant Information, Use of Library & Electronic Databases, Preparation and Presentation of Literature Review, Research ArticleReviews, Theoretical Models and Framework. Identification of Gaps in Research,Role of Online Tools.

Report Writing: Types of Reports, Planning of Report Writing, Significance of Report Writing, Different Steps in Report Writing, Research Report Format,Principles of Report Writing, Documentation, Data and Data Analysis Reporting in a Thesis, Writing of Report, Typing of Report, Briefing, Finalizing.

Research Publication: Thesis, Research paper, Review Article & Technical Reports: Organization of Thesis and Reports, Formatting Issues, CitationMethods, References, Effective Presentation of Research, Quality indices of Research Publication, Impact Factor, Immediacy Factor, indexing and other Citation Indices.

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

Thesis Report: Basic Elements: Thesis Elements, Paper Elements, Order ofThesis and Paper Elements, Concluding Remarks, Identification of the Author and His Writing, Author's Name and Affiliation, Joint Authorship of a Paper, Genuine Authorship and Order of Authors, Identification of Writing, Title, Keyboards, Synopsis, Preface and Abstract, Typical Examples, Chapters and Sections,Introductory Chapters and Section, Core Chapters and Sections, Text Support,Materials, Figures and Tables, Mathematical Expressions and Equations, References, Appendixes and Annexure, Listing of Materials, Numbering of Elements, Pagination, Numbering of Chapters, Sections and Subsections, Numbering of figures and Tables Equation Numbering, Appendix Numbering, Reference Numbering.

Sampling: 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.

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

Processing of Data: Editing, Classification and Coding, Transcription, Tabulation, Introduction to Statistical Software -MINITAB, SPSS, Graphical Representation, Measures of Relationship, Simple Regression Analysis, Multiple Correlation and Regression, Partial Correlation

Statistical Analysis of Data: Statistical Analysis, Measures of Central Tendency, Measures of Dispersion, Measures of Association/Relationship, Correlation and Variances, Probability distributions, Binomial, Poisson, Uniform,Normal and Exponential, 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), Chi-square Test, ANOVA, ANOCOVA,Non-parametric Methods, Multivariate Analysis.

Numerical Methods: Introduction Numerical Computing and Computer, Computer Codes and Arithmetic, Approximation and Errors, Root of Nonlinear Equations, Direct and Iterative Solution of Linear Equations, Curve Fitting Methods for Interpolation and Regression, Numerical Differentiation and Integration, Boundary-value and Eigen-value Problems, Solution of Ordinary and Partial Differential Equations.

Simulation Tool MATLAB: Introduction to MATLAB, Basics, Loop, User-Defined Functions, Additional Data Types and Plots Types, Advance Features, Input/ Output Function, Graphics, Graphical Interface, MATLAB Compiler, Some MATLAB Tools and Simulation.

 Modern Soft Computing Techniques: Fuzzy Set Theory, Artificial NeuralNetworks, Artificial Intelligence and Expert Systems, Neuro Fuzzy Modeling, Optimization, Genetic Algorithm, Operational, Research, Bio-Inspired Theory, Application of Computational Intelligence, Machine Learning, Computer Vision, Parallel Computing.

References:
1. Programming in MATLAB by Marc E. Hermitter, Thomson Brooks.
 2. MATLAB programming by Rudrapratap.
3. An introduction to ResearchMethodology ,Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002., RBSA Publishers.
 4. Research Methodology: Methods and Techniques Kothari, C.R., 1990.. New Age International.
5. Research Methodology, Sinha, S.C. and Dhiman, A.K., 2002., Ess Publications. Vol2 .
6. Research Methods: the concise knowledge base Trochim, W.M.K., 2005., Atomic Dog Publishing.

SECTION B: **Computer Science**

Introduction to Programming

Introduction to Computer based problem solving, Programs and Algorithms.
Functions: Scope rules, Parameters passing techniques, function returning pointers, recursion, pointer to function.
The Preprocessors: # define, # error, # include, Conditional compilation directives.
Memory Management in C: Static and dynamic allocation system, Concept of heap, NULL pointers, void pointers, dynamic memory allocation function.
Interrupts and Interrupts service routines: Introductions to interrupts, CPU registers, working of interrupts, ROM BIOS services and functions.
Files: Stream and files, File handling functions, files and structures string and files, Random access files, Buffered file processing file service
Concept of object oriented programming, advantages and functionality of object orientation, different inheritance technique, implementation of polymorphism, operator overloading. a nd advanced topic related to oops.

Discrete Mathematical Structure
Sets, Relation, Function, Lattice, Boolean algebra,Combinatorics, Generating function, recurrence relations, Graph theory & different algorithms, breadth first search, depth first search Kruskal & Prim's algorithms.Finite State Machines & Language: Finite state machines, semi groups, Machine languages and regular language, Simplification of machines.

Computer Architecture, Microprocessor & Microcontrollers
Digital Circuit,Logic gates, Boolean Algebra, Karnaugh map, combinational circuits, Latches & flip flops, Sequential circuits.Principles of Computer Design,Register transfer language, Memory organization.Input-Output Devices, Instruction set design, microprogramming.Microprocessor and Microcontroller: Overview of 8085, architecture of 8086 microprocessor, registers, addressing modes, instructions, directives, procedures and macro, Assembly language programming, Interfacing devices 8237/8257, 8253/8254, 8255, 8259, 8251, 8279 RS 232, 8051 MICROCONTROLLER, Interfacing, interrupts.

Operating System
Basic concepts of operating system and its functions
Memory Management, Introduction to Multiprogramming, relocatable partitioned memory management, paged memory management, segmented memory management, , other memory management schemes (swapping, overlays)
Processor Management, Job scheduler, process scheduling, structure of processor management, job scheduling, multi processor systems, Dead Locks Detection, prevention, recovery.
Device Management: Techniques for Device Management, dedicated Devices, Input or Output Devices, Storage Devices, Channels and Control units.
Introduction to Distributed operating system, Issues in the design distributed O.S.

Design and Analysis of Algorithm

Technique for design & performance analysis of algorithm of some computationals problems, Asymtotaic notation, bounding summations, recurrances, best case and worst case and average analysis.

Design Techniques: Devide and conqure, dynamic programming and memorization, greedy strategy, back tracking branch and bund.

Elementry Data Structure : Concept and operations on arrays, stack, queue, Linked list and trees. Evaluation of arithmetic expression using Stacks. List Representation.

Graph : Type and significance and implementations.Searching and Sorting Techniques.

Intractbility : Class ?, NP and NO completeness.

Database Management System:

Introduction to DBMS Architecture & Modeling, database design,E-R Model, specialization, generalization, categorization.

Relational DBMS ,Normalization ,Relational Algebra & Relational Calculus, Domain Relational calculus .

SQL ,Concept of SQL, advantage of SQL, Join, Union , Intersection, Minus, cursors in SQL, Embedded SQL, Backup and Recovery : Database backups, H/w protection and redundancy, transaction logs, database recovery, data storage, causes of failure

Database Security and Integrity, data security risks, dimension of security, Granting and revoking privileges and roles, authenticating users to the database.

Distributed databases: Advantages, techniques & concepts Object oriented database

Computer Graphics & Animation

Line Generation:Points, lines, planes, pixels and frame buffers, vector & character generationGraphics Primitives:Display devices, Primitive devices, Display file structure, Display control text. Polygons,Segments: Segments table, creating deleting & renaming a segment visibility, image transformation.Windowing & Clipping ,Three dimension: 3-d geometry primitives, transformations, projection, clipping Hidden Line & Surfaces: back face removal algorithms, hidden line methods,Rendering & Illumination, Introduction to animation, using animation tools, GIF animators, Macromedia Flash , Photoshop.

Data Communication and Computer Networks

Data networks and their topologies and types, Data communication architecture, switching technique for data transmission, Different protocols at every layer, Modulator, demodulator, Internetworking ISDN, Telemetry, analog and digital telemetry, Telemetry and carrier communication system: Overview of modulation technique- AM, FM and PM, suitability carrier communication security.

Software Engineering

Introduction to software development process, Software Metrics Design metrics, Data structure metrics , information Flow metrics, Software Project Planning: Cost estimation, static, single & multivariate models, COCOMO models , Risk management, Software requirement Analysis and

Specifications, data flow diagram, data dictionaries, entity relationship diagrams, s/w requirements and specifications.
Software design: Cohesion and coupling, Software reliability: Failure & faults,
Software Testing & debugging, testing tools & Standards, Software Maintenance: Management of maintenance, Reverse engineering, Software RE- engineering, Configuration management-Documentation.

Compiler Construction & Design

Introduction to Compiling, Assemblers, Loaders & Linkers, Finite Automata And Regular Expressions: Finite Automata(FA),Non- deterministic finite automata (NFA), transforming NFA to DFA , regular sets & expressions, properties of regular sets, Context Free Grammar, Parsing, Syntax Directed Translations, Intermediate code generation , representation of 3 address statements,
Storage Management Code Generation & optimization

Interface Programming

Concepts and Terminology, Writing Windows applications, event handling, Windows Details, Graphics Device Interface and Drawing Primitive, Control of Window, Icons and Cursors, Multimedia and Sound Resources, Creating and Display Images, Adding Menu, Keyboard Accelerators, Adding Dialog Boxes: Dialog box creation and management, Special Control and Dialog Boxes.

Internetworking Technology

Internetworking model, Application & Layers, Physical & Data Link layers Network Layer & path Determination, Routers,TCP/IP, IP-Addressing, IP-Routing configuration, Multi protocol Routing, Traffic Management with Access – Lists.
Introduction to WAN connections, configuration of X.25, Configuration of Frame-Relay
Multi service Access technologies : V_0IP, V_0ATM, V_0FR, Virtual Private Network, IP-Multicast, Q_0S Networking, Internet Access Technologies: Security, Directory-Enable Networking, Network Caching Technologies.

Parallel Processing

Concept of parallelism; Mechanism for uni processor systems; Parallel computer architecture; Pipelining and vector processing requirements and computers; Instruction and arithmetic pipelining; Parallel algorithms for array processors, SIMD computers & performance enhancement; Microprocessor architecture & programming: functional structures, interconnection networks, multiprocessors; Parallel algorithm for multiprocessors and data flow computers; Data driven computing and languages.

Artificial Intelligence & Expert Systems

Overview of AI,Knowledge representation schemes,Search and Control Strategy: AI Applications,Expert System,Decision making processes, evaluation of DSS, adaptive design approach to DSS development, Integrating expert and DSS.

References: All standard books in respective domain.