Research Aptitude Test - 2021

Syllabus

RESEARCH METHODOLOGY

Research Aptitude: Research: Meaning, characteristics and types; Steps of research; Methods of research; Research Ethics; Paper, article, workshop, seminar, conference and symposium; Thesis writing; its characteristics and format.

Reasoning (Including Mathematical): Number series; letter series; codes; Relationships; classification.

Logical Reasoning: Understanding the structure of arguments; Evaluating and distinguishing deductive and inductive reasoning; Verbal analogies; Word analogy – Applied analogy; Verbal classification.

Reasoning Logical Diagrams: Simple diagrammatic relationship, multidiagrammatic relationship; Venn diagram; Analytical Reasoning.

Data Interpretation: Sources, acquisition and interpretation of data; Quantitative and qualitative data; Graphical representation and mapping of data.

Communication: Nature, Characteristics and Types; Barriers; Effective classroom communication; Non-verbal communication

ELECTRONICS AND COMMUNICATION ENGINEERING

Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Energy bands in silicon, intrinsic and extrinsic silicon.

Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers, PN junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, PIN and avalanche photo diode, Basics of LASERs. Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor; FET amplifiers. Amplifiers: Boolean algebra, minimization of Boolean functions; logic gates; Definitions and properties of Laplace transform continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform.

Digital modulation: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), TDMA, FDMA and CDMA and GSM.

Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth.

Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation.

Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers.

Basics of Antennas: parameters, array antennas, measurements; frequency band, microwave components, TWT, Gun diode, different types of radar, radar antennas, radar range equation.

COMPUTER SCIENCE AND ENGINEERING

Programming Fundamentals: Variables, Data Types, Operator & Expression, Data Declaration & Definition, Operator & Expression, C as a Structured Language, Console input and output, Formatted Input/ Output, Control Statement, Nested switch, Iteration Statements for loop, Pointers, Memory Organization, Pointer Arithmetic, Array & String, Complier Vs Interpreters, Arguments & local variables, Storage Class & Scope, Declaration and Initializing Structure, Pre-processor Directive Macro Substitution, File handling, Void Pointer, Bitwise Operator, Graphics In C.

Data Structures: Introduction To Data Structure, Implementation of Data Structure, Array as Data Structure, Polynomial Representation Using Arrays, Sparse Matrices, Drawback of Sequential Storage, Implementation of Linked List, Other Operation & Applications, Generalized Linked List, Operation on Stack, Static & Dynamic Implementation of a Stack, Operation on a Queue, Static & Dynamic Implementation of Queue, Tree Terminology, Binary Search Tree Traversal.

Database Management System: Database and Need for DBMS, Views of data-schemas and instances, Database Design using ER model, Relational Model, Relational Database design, Storage and File Structure, Transaction and Concurrency control, Crash Recovery and Backup, Security and privacy.

Algorithms: Divide and Conquer, Greedy Method, Dynamic Programming, Backtracking, Branch and Bound.

Computer Networks: Introduction to Networking, Common Network Architecture, The OSI Reference Model, Local Area Networks, Broad Band Networks, IP Addressing & Routing, Domain Network Services, Network Applications, SNMP, Network Security.

Operating Systems: Operating system functions and characteristics, Real time systems, Methodologies for implementation of O/S service system, Functions of the system, File access and allocation methods, Structured Organizations, Storage allocation methods, Virtual memory concepts, Hardware Management, Deadlock detection and recovery.

MANAGEMENT

General Management: Concept of Management, Evolution of Management, Functions & Principles of Management.

Managerial Communication: Introduction, Types, Medium, Barriers and Techniques.

Organizational Behavior: Concepts and Significance of OB, Understanding and Managing Behavior - Personality, Perception, Values, Attitudes, Learning and Motivation, Leadership, Managing Conflicts, Organizational Development.

Economics: Introduction, Demand & Supply, Monetary Policy, Fiscal Policy, Union Budget, Current Affairs.

Human Resources Management: Concepts, Human Resource Planning, Recruitment and Selection, Job Analysis, Performance Appraisal, Career Planning, Methods of Training and Development, Dispute Resolution and Grievance Management, Labour Welfare and Social Security Measures.

Financial Management: Concept, Functions, Financial Instruments, Capital Structure & its Theories, Cost of Capital, Capital Budgeting, Working Capital Management.

Marketing Management: Concepts, Nature and Scope, Marketing Mix – Product, Price, Place and Promotion, Role and Relevance of segmentation, Targeting and Positioning, Product Life Cycle, Branding and Packaging, Retailing, Consumer Behavior, Marketing of Services.

Information Technology Management: Concept and Meaning of Technology and Technology Management- Technology; Role and Significance of Technology Management, Impact of Technology on Society and Business- Technology and competition; Forms of Technology- Process technology; Product technology

MATHEMATICS

Calculus: Partial derivatives, total derivative, maxima and minima for multi variable functions Multiple integrals, area and volume; Vector Calculus and Vector theorems

Algebra & Analysis: Countability, Archimedean property, supremum, infimum. Sequences and series, Continuity, differentiability, Riemann sums and Riemann integral, Improper Integrals. Metric spaces, connectedness, compactness, completeness; uniform convergence, contraction mapping principle. Counting techniques, Group Theory, homomorphism, automorphisms; cyclic groups, permutation group, Rings, ideals, domains and fields. Vector spaces, linear transformations, Matrices and Algebra of Matrices, systems of linear equations, eigenvalues and eigenvectors, Cayley-Hamilton Theorem, Inner product spaces, Gram-Schmidt orthonormalization process, Jordan canonical form; bilinear and quadratic forms. Analytic functions, Cauchy-Riemann equations. ; Complex integration: Cauchy's integral theorem Contour integral, Cauchy's integral formula, Power series and expansions, calculus of residues. Conformal mappings, Mobius transformations.

Differential equations: existence and uniqueness for initial and boundary value problems, linear ordinary differential equations of higher order with constant coefficients and variable constant, series solutions (power series, Frobenius method),special functions: Legendre, Bessel, hypergeometric, hermite and laguerre functions and their orthogonal properties; Systems of ordinary differential equations, partial differential equations of first and higher order Laplace, Heat and Wave equations, Integral transform techniques

Numerical Analysis: Solution of transcendental and algebraic equation, system of equation, Interpolation and extrapolation, Numerical differentiation and integration, Numerical solution of initial value problems for ordinary differential equations

Linear Programming: Linear programming models, optimal solution, simplex theory, simplex method, unbounded solution and multiple solution, revised simplex method, Duality, transportation and assignments problems, network analysis using PERT and CPM, Queuing theory