Section 1: Verbal Ability and Reading Comprehension (VARC)

Reading Comprehension (RC):
- **Passage Types**: Extracts from literature, business, science, social sciences, history, etc.
- **Types of Questions**:
  - Main idea or central theme
  - Inference-based questions
  - Fact vs. opinion identification
  - Tone and style of the passage
  - Summary-based questions
  - Author's perspective

Verbal Ability:
- **Para-Jumbles**: Rearranging sentences to form coherent paragraphs
- **Para Summary**: Choosing the correct summary of a given paragraph
- **Odd Sentence Out**: Identifying the sentence that does not fit within the given set
- **Sentence Completion**: Completing sentences using the most logical continuation
- **Sentence Correction**: Grammar-based correction of sentences
- **Inferences**: Drawing logical conclusions from given sentences or passages

Section 2: Data Interpretation and Logical Reasoning (DILR)

Data Interpretation (DI):
- **Tabular Data Interpretation**: Answering questions based on data presented in tables
- **Graphs and Charts**:
  - Bar charts
  - Line graphs
  - Pie charts
  - Histograms
  - Mixed data sets
- **Venn Diagrams**: Questions involving set theory and overlapping data
- **Caselets**: Short descriptions of scenarios followed by questions that test data comprehension and interpretation

Logical Reasoning (LR):
- **Puzzles**: Complex problem-solving involving multiple variables
- **Seating Arrangements**: Linear and circular seating arrangements
- **Blood Relations**: Solving problems related to family relations
- **Syllogisms**: Logical deduction using given premises
- **Input-Output**: Finding patterns based on operations on sequences of numbers or objects
- **Games and Tournaments**: Questions based on ranking, schedules, and tournament formats
- **Clocks and Calendars**: Solving problems related to time, dates, and years
- **Series and Sequences**: Identifying patterns in series of numbers or objects

Section 3: Quantitative Aptitude (QA)

Arithmetic:
- **Percentages**: Calculation of percentages, increase/decrease, successive percentage changes
- **Profit and Loss**: Marked price, discount, profit margin, and break-even analysis
- **Simple and Compound Interest**: Calculation of interest over time
- **Ratios and Proportions**: Direct and inverse proportions, applications in mixtures and solutions
- **Time, Speed, and Distance**: Relative speed, trains, boats, races, and clocks
- **Time and Work**: Work efficiency, pipes and cisterns
- **Averages**: Calculation of means, medians, and weighted averages
- **Mixtures and Alligations**: Solving problems involving mixing of substances in given ratios

Number Systems:
- **Divisibility Rules**: Understanding rules for divisibility by different numbers
- **Factors and Multiples**: Prime factorization, HCF, and LCM
- **Remainder Theorem**: Chinese Remainder Theorem, divisibility properties
- **Cyclicity and Units Digit**: Identifying patterns in the units digits of powers

Algebra:
- **Linear and Quadratic Equations**: Solving equations, roots, and nature of solutions
- **Inequalities**: Solving inequalities and finding ranges of variables
- **Functions and Graphs**: Understanding different types of functions and their graphical representation
- **Progressions**:
  - Arithmetic Progression (AP)
  - Geometric Progression (GP)
  - Harmonic Progression (HP)
- **Logarithms**: Properties and solving logarithmic equations

Geometry and Mensuration:
- **Triangles**: Properties, similarity, and Pythagoras theorem
- **Circles**: Tangents, chords, arcs, and angles
- **Quadrilaterals**: Parallelograms, trapeziums, and rhombuses
- **Polygons**: Regular polygons and their properties
- **Coordinate Geometry**: Distance, section formula, slope, and area of triangles
- **Mensuration**:
  - Area and perimeter of 2D shapes
  - Volume and surface area of 3D objects like cylinders, cones, spheres, and cuboids

Modern Mathematics:
- **Permutations and Combinations**: Counting principles, arrangements, and selections
- **Probability**: Conditional probability, independent events, and Bayes' theorem
- **Set Theory**: Operations on sets, union, intersection, and complement

Computer Science & Information Technology (CS) :

1. **Engineering Mathematics :**

   - **Discrete Mathematics**:
     - Propositional and first-order logic
     - Sets, relations, functions, partial orders, and lattices
     - Monoids and 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
     - Distributions (uniform, normal, exponential, Poisson, binomial)
     - Mean, median, mode, and standard deviation
     - Conditional probability and Bayes' theorem

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

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

4. **Programming and Data Structures**
   - Programming in C
   - Recursion
   - Arrays, stacks, queues, linked lists, trees
   - Binary search trees, binary heaps, graphs

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

6. **Theory of Computation**
   - Regular expressions and finite automata
   - Context-free grammars and push-down automata
   - Regular and context-free languages, pumping lemma
   - Turing machines and undecidability

7. **Compiler Design**
   - Lexical analysis, parsing, syntax-directed translation
   - Runtime environments
   - Intermediate code generation
   - Local optimization, data flow analyses (constant propagation, liveness analysis, common subexpression elimination)

8. **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

9. **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

10. **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, congestion control, UDP, TCP, sockets
    ○ Application layer protocols: DNS, SMTP, HTTP, FTP, Email

General Aptitude (GA) :

1. **Verbal Aptitude**:
    • Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech.
    • Basic vocabulary: words, idioms, and phrases in context.
    • Reading and comprehension.
    • Narrative sequencing.

2. **Quantitative Aptitude**:
    • Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing data), 2- and 3-dimensional plots, maps, and tables.
    • Numerical computation and estimation: ratios, percentages, powers, exponents, logarithms, permutations and combinations, and series.
    • Mensuration and geometry.
    • Elementary statistics and probability.

3. **Analytical Aptitude**:
    • Logic: deduction and induction.
    • Analogy.
    • Numerical relations and reasoning.

4. **Spatial Aptitude**:
    • Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping.
    • Paper folding, cutting, and patterns in 2 and 3 dimensions.

Data Science and Artificial Intelligence (DA) :

1. **Probability and Statistics**:
   - Counting (permutations and combinations)
   - Probability axioms
   - Sample space, events
   - Independent events, mutually exclusive events
   - Marginal, conditional, and joint probability
   - Bayes' Theorem
   - Conditional expectation and variance
   - Measures of central tendency: mean, median, mode
   - Measures of dispersion: standard deviation, correlation, covariance
   - Random variables
   - Discrete random variables and probability mass functions
   - Continuous random variables and probability distribution functions (uniform, exponential, Poisson, normal, standard normal, t-distribution, chi-squared distributions)
   - Cumulative distribution function
   - Conditional probability density function
   - Central limit theorem
   - Confidence intervals
   - Hypothesis testing: z-test, t-test, chi-squared test

2. **Linear Algebra**:
   - Vector space, subspaces
   - Linear dependence and independence of vectors
   - Matrices: projection matrix, orthogonal matrix, idempotent matrix, partition matrix
   - Quadratic forms
   - Systems of linear equations and solutions
   - Gaussian elimination
   - Eigenvalues and eigenvectors
   - Determinant, rank, nullity
   - Projections
   - LU decomposition
   - Singular value decomposition

3. **Calculus and Optimization**:
   - Functions of a single variable
   - Limit, continuity, and differentiability
   - Taylor series
   - Maxima and minima
   - Optimization involving a single variable

4. **Programming, Data Structures, and Algorithms**:
   - Programming in Python
   - Basic data structures: stacks, queues, linked lists, trees, hash tables
   - Search algorithms: linear search, binary search
   - Basic sorting algorithms: selection sort, bubble sort, insertion sort
   - Divide and conquer: mergesort, quicksort
   - Introduction to graph theory
   - Basic graph algorithms: traversals, shortest path

5. **Database Management and Warehousing**:
   - ER-model
   - Relational model: relational algebra, tuple calculus, SQL
   - Integrity constraints
   - Normal forms
   - File organization
   - Indexing
   - Data types
   - Data transformation: normalization, discretization, sampling, compression
   - Data warehouse modeling: schema for multidimensional data models, concept hierarchies, measures

6. **Artificial Intelligence (AI)**:
   - Search algorithms: informed, uninformed, adversarial
   - Logic: propositional, predicate
   - Reasoning under uncertainty: conditional independence representation, exact inference through variable elimination, approximate inference through sampling

7. **Machine Learning**:

   - Supervised Learning:
     - Regression and classification problems
     - Linear regression (simple and multiple)
     - Ridge regression
     - Logistic regression
     - k-Nearest Neighbors
     - Naive Bayes classifier
     - Linear discriminant analysis
     - Support vector machine
     - Decision trees
     - Bias-variance trade-off
     - Cross-validation methods (leave-one-out, k-folds)
     - Multi-layer perceptron, feed-forward neural network

   - Unsupervised Learning:
     - Clustering algorithms: k-means, k-medoid
     - Hierarchical clustering (top-down, bottom-up)
     - Dimensionality reduction: principal component analysis