



**VIT**<sup>®</sup>  
Vellore Institute of Technology  
(Deemed to be University under section 3 of UGC Act, 1956)

**Vellore - 632 014, Tamil Nadu, India.**

**SCHOOL OF ADVANCED SCIENCES**

**DEPARTMENT OF MATHEMATICS**

**VIT MATHFEST - 2024**

## **Syllabus for Talent Exam and Quiz - PG Level**

### **1. Abstract Algebra**

Groups - Semigroups and Monoids - Subgroups- Abelian groups - Homomorphism - Lagrange's Theorem- Group codes.

### **2. Graph Theory**

Basic Concepts of Graph Theory - Planar and Complete graph - Matrix representation of Graphs - Graph Isomorphism - Connectivity - Cut sets - Euler and Hamilton Paths- Shortest Path algorithms- Trees - properties of trees - distance and centres in tree - Spanning trees - Spanning tree algorithms- Tree traversals- Fundamental circuits- Bipartite graphs - Chromatic number - Chromatic partitioning - Chromatic polynomial.

### **3. Fourier Series**

Fourier series - Euler's Formulae - Dirichlet's conditions- Change of Interval- Half Range Series - RMS value - Parseval's identity.

### **4. Partial Differential Equations**

Formation of Partial differential equations- Singular integrals - Solutions of standard types of first order Partial differential equations- Lagrange's linear equation- Method of separation of variables.

### **5. Real Analysis**

Definition of sequence and sub sequence Limit of a sequence - Convergent sequence- Bounded sequence Monotone sequence Operations on convergent sequence. Series of real numbers Convergence and divergence Series with non-negative terms - Alternating series Conditional convergence and absolute convergence Tests for absolute convergence - Properties of monotonic functions - Functions of bounded variation - Total variation - Additive property of total variation - Total variation on  $[a, x]$  as a function of  $x$  - Functions of bounded variation expressed as the difference of two increasing functions - Continuous functions of bounded variation.

## **6. Complex Analysis**

Complex variable- Analytic functions- Cauchy's- Riemann equations- Laplace equation and Harmonic functions- Construction of Harmonic conjugate and analytic functions- Conformal mappings- Elementary transformations- Translation, Magnification, Rotation, Inversion- Exponential and square transformations ( $w=e^z, z^2$ ) - Bilinear transformations- cross ratio- Images of regions bounded by straight lines under the above transformations.

## **7. Discrete Mathematics**

Partially Ordered Relations - Lattices as Posets – Hasse Digram – Properties of Lattices – Boolean algebra- Properties of Boolean Algebra - Boolean functions.

## **8. Linear algebra**

Rank of matrix -Gaussian elimination and Gauss Jordan methods - Elementary matrices- permutation matrix - inverse matrices - System of linear equations - LU factorizations - Vector space- Subspace- Linear combination- Span- Linearly dependent – Linearly Independent- Bases- Dimensions- Finite dimensional vector space- Row and column space- Rank and nullity. Linear transformations- Basic properties- Invertible linear transformation- Matrices of linear transformations- Vector space of linear transformations- Change of bases and Similarity.

## **9. Probability Distributions**

Binomial distribution- Poisson distribution- Normal distribution- Gamma distribution- Exponential distribution- Weibull distribution.

## **10. Numerical Differentiation and Integration**

Numerical differentiation with interpolation polynomials-maxima and minima for tabulated values - Trapezoidal rule, Simpsons  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rules. –Romberg's method. Two and Three point Gaussian quadrature formula.

## **11. Operations Research**

Integer Linear Programming Problems and its types - Concept of Cutting Plane - Gomory's All Integer Cutting Plane Method - Gomory's mixed Integer Cutting Plane method - Branch and Bound Method.

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