VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

VITMEE 2027

Master's Entrance Examination



SYLLABUS

Admission to MCA, M.Sc. Data Science and M.Sc. Artificial Intelligence & Machine learning (2 Year) Degree Programmes (2027 - 2028)

VIT-Vellore | VIT-Chennai | VIT-AP | VIT-Bhopal

VITMEE - 2027 SYLLABUS
Master of Computer Applications (MCA)
M.Sc. Artificial Intelligence and Machine Learning (AI & ML)
Question Paper Code - MC

MATHEMATICS:

Algebra: Fundamental operations in Algebra, Expansion, factorization, quadratic equations, indices, logarithms, arithmetic, geometric and harmonic progressions, binomial theorem, permutations and combinations.

Calculus: Functions of single variable, limit, continuity and differentiability, Mean value theorems, indeterminate forms and Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value-theorems of integral calculus, total derivatives, Lagrange method of multipliers.

Differential Equations: Differential equations of first order and their solutions, linear differential equations with constant coefficients, homogenous linear differential equations.

Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and conquer; Connected components, Spanning trees, Shortest paths. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds.

Probability: Probability theory, Dependent and independent events, frequency distributions, and measures of dispersions, Skewness and Kurtosis, random variable and distribution functions, mathematical expectations, Binomial, Poisson, normal distributions.

Algebra and Complex Analysis: Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Canonical forms, diagonal forms, triangular forms, Quadratic forms, reduction and classification of quadratic forms Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius trans- formations—Fourier series—harmonics.

Calculus and its Applications: Linear ordinary differential equations (ODEs), variation of parameters, Sturm-Liouville problem. Partial differential equations (PDEs) - Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations. Transformation techniques—Laplace transformation—Fourier transforms—z—transformation to solve differential and difference equations.

Numerical Methods: Numerical solutions of algebraic and transcendental equations iteration methods and Newton—Raphson method, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods-Numerical differentiation and integration, Numerical solutions of ODEs and PDEs.

Descriptive statistics, Exploratory Data Analysis: Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate)

Expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Standard discrete and continuous univariate distributions. Correlation and simple and multiple linear regression. Test of hypotheses—Large and small sample tests confidence intervals. Chi-square test goodness of fit. Simple non parametric tests for one and two sample problems, rank correlation and test for independence. ANOVA.

Date Structures: Arrays, Stacks, Queues, linked Lists. Sorting techniques, Searching Techniques, Trees and Graph terminology and representation in memory, binary search tree, traversal techniques of graphs and Trees.

Computer Networks: Network models, Internet model, OSI model, Physical Layer - Analog and Digital Signals, Analog and Digital Transmission, Coding, Sampling. Data Link Layer - Error detection and correction, Data link control and Protocols, Stop and wait, Go-back-n, Selective repeat. Network Layer - Inter-networks, Addressing, unicast and multicast routing, Presentation Layer.

Programming in C: Data types, Declarations, Expressions, statements and symbolic constants, inputOutput functions. Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators. Control statements: While, do-while, for statements, nested loops, if else, switch, break, Continue, comma operators. Storage types: Automatic, external, register and static variables. Functions: Defining and accessing, passing arguments, Recursion.

Database Management Systems: DBMS architecture, Data models, data independence, E-R model, normalization, Relational Model: concepts, constraints, languages. Data storage, indexing, query processing, design and programming SQL.

Operating Systems: Process management, Process States, Process Control Block, Process and Threads, CPU Scheduling, Scheduling algorithm, Process Synchronization and Deadlock, Memory management, Virtual memory concepts paging and segmentation File organization, Blocking and buffering, file descriptor, File and Directory structures, I/O Devices.

Computer Architecture: Boolean algebra and computer arithmetic, flip-flops, design of combinational and sequential circuits, instruction formats, addressing modes, interfacing peripheral devices, types of memory and their organization, interrupts and exceptions. Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine instruction and Assembly Language.

VITMEE - 2027 SYLLABUS
M.Sc. (Data Science)
Question Paper Code – DS

Section 1: Mathematics

Foundational Mathematics: Logic - Basic principles of logical reasoning and argumentation - Truth tables - Logical connectives – Simple Mathematical proofs, including induction - Counting. Set Theory: Sets and subsets - Operations on sets - Venn diagrams - Cartesian products - Relations and their properties - Functions, types of functions - Equivalence relations - Partial orders. Number Systems: Natural numbers, integers, rational, real numbers, complex numbers - Modular arithmetic.

Sequences and Series of Real Numbers: Sequences of real numbers, convergence of sequences, bounded and monotone sequences, convergence criteria for sequences of real numbers, Cauchy sequences, sub sequences, Bolzano-Weierstrass theorem, Series of real numbers, absolute convergence, tests of convergence for series of positive terms: comparison test, ratio test, root test; alternating series: Leibnitz test for convergence of alternating series.

Calculus: Functions of one and two variables: Domain, range, limits, continuity. Differentiation: Derivative rules, maxima and minima, applications. Integration: Indefinite and definite integrals, area under curves, basic techniques of integration. Partial derivatives for functions of two variables. Vector Calculus: gradient, divergence, curl and properties.

Linear Algebra: Algebraic expressions and identities - Linear equations and inequalities in one and two variables. Matrices: Types, operations, rank, determinant, inverse, solving linear systems. Vector spaces: Subspaces, linear independence and dependence, basis and dimension. Eigenvalues and eigenvectors: Computation, properties.

Differential equations: Ordinary differential equations of first order: linear equations, exact differential equations, integrating factor, orthogonal trajectories; homogeneous differential equations, linear second-order differential equations with constant coefficients, method of variation of parameters for nonhomogeneous differential equations.

Section 2: Statistics

Descriptive Statistics: Measures of central tendency, measures of dispersion, moments, skewness and kurtosis.

Probability: Axiomatic definition of probability and properties, conditional probability, and multiplication rule. Independence of events, Theorem of total probability, Bayes' theorem.

One-dimensional Random Variables: Probability mass function, probability density function and cumulative distribution functions. Mathematical expectation, moments. Chebyshev's inequality.

Standard Distributions: Binomial, negative binomial, geometric, Poisson, Uniform, exponential and Gaussian distributions.

Limit Theorems: Weak law of large numbers. Central limit theorem (i.i.d.with finite Variance case only).

Section 3: Computer Science

Programming Concepts: Flowcharts and pseudocodes: Designing and interpreting. Variables, arithmetic, logical, bitwise and conditional operators. Input/output, simple functions. Ability to read and interpret algorithms written in simple pseudocode. Control structures: Conditional statements, loops (iteration). Recursion: Concept and simple examples

Algorithms: Searching, sorting, asymptotic worst-case time and space complexity,
algorithm design techniques.

Data structures: Arrays, stacks, queues, linked lists.

ENGLISH COMMUNICATION

20 Questions

1. Grammar

   Subject – Verb Agreement
   Tense forms
   Voice
   Conditionals

2. Writing Technical Instructions

3. Writing Memos & Writing Minutes

4. Transcoding

5. Preparing Questionnaire

6. Proof Reading

7. General vocabulary: Synonyms, Antonyms, Words often confused

8. Question Tags

9. Polite Expressions