

Walchand College of Arts and Science (Autonomous), Solapur
W.H.Marg, Ashok Chowk, Solapur

**Broad Syllabus: For Recruitment Examination of Assistant Professor
in Mathematics**

Broad Area	Scope / Key Concepts
1. Mathematical Analysis	Set Theory; Real Number System; Sequences & Series; Limits & Convergence; Continuity & Uniform Continuity; Differentiability & Mean Value Theorems; Riemann & Lebesgue Integration; Functions of Several Variables; Metric & Normed Spaces; Compactness & Connectedness; Uniform Convergence, Basic Functional Analysis.
2. Linear Algebra	Vector Spaces & Subspaces; Linear Dependence, Basis & Dimension; Linear Transformations; Matrices, Rank & Determinants; Linear Equations; Eigenvalues & Eigenvectors; Cayley–Hamilton Theorem; Change of Basis; Canonical, Diagonal, Triangular & Jordan Forms; Inner Product Spaces; Quadratic Forms
3. Complex Analysis	Complex Numbers & Functions; Analytic Functions; Cauchy–Riemann Equations; Complex Integration; Cauchy Theorems & Integral Formula; Liouville & Maximum Modulus Principles; Taylor & Laurent Series; Residue Calculus; Conformal Mapping & Möbius Transformations
4. Algebra & Number Theory	Permutations & Combinations; Counting Principles; Divisibility & Congruences; Fundamental Theorem of Arithmetic; Chinese Remainder Theorem; Euler Function & Primitive Roots; Groups, Subgroups & Homomorphisms; Quotient & Permutation Groups; Cayley & Sylow Theorems; Rings & Ideals; Polynomial Rings; Fields, Finite Fields, Extensions & Galois Theory, Euclidean domain, PID, UFD.
5. Topology	Topological Spaces; Basis; Dense Sets; Subspace & Product Topology; Separation Axioms; Connectedness & Compactness
6. Ordinary & Partial Differential Equations	First-Order ODEs; Existence & Uniqueness; Systems of ODEs; Linear ODEs; Boundary-Value Problems; Sturm–Liouville Theory; Green’s Functions; First-Order PDEs; Cauchy Problem; Classification of Second-Order PDEs; Higher-Order PDEs; Separation of Variables; Laplace, Heat & Wave Equations
7. Numerical Analysis	Numerical Solution of Algebraic Equations; Iterative & Newton–Raphson Methods; Convergence; Numerical Solution of Linear Systems; Finite Differences; Interpolation; Numerical Differentiation & Integration; Numerical Solution of ODEs; Euler, Modified Euler, Picard & Runge–Kutta Methods
8. Calculus of Variations & Integral Equations	Functionals & Variations; Euler–Lagrange Equation; Conditions for Extrema; Variational Boundary-Value Problems; Fredholm & Volterra Integral Equations; Integral Equations of First & Second Kind; Separable Kernels; Characteristic Numbers & Eigenfunctions; Resolvent Kernel
9. Classical Mechanics	Generalized Coordinates; Lagrangian Mechanics; Hamiltonian Mechanics; Hamilton’s Principle & Least Action; Rigid Body Dynamics; Euler’s Equations; Small Oscillations