Syllabus for RET Examination
Sub : Mathematical Sciences

Real Analysis:
Sequences and series of functions, uniform convergence.
Riemann sums and Riemann integral.
Functions of bounded variation, Lebesgue measure, Lebesgue integral.
Functions of several variables, directional derivative, partial derivative ,derivative as a linear transformation.
Metric spaces, compactness, connectedness, Normed Linear Spaces of continuous functions as examples.

Complex Analysis:
Analytic functions, Cauchy-Riemann equations.
Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem,Maximum modulus principle,Schwarz lemma,Open mapping theorem.
Taylor series,Laurent series, calculus of residues.
Conformal mappings, Mobius transformations.

Algebra:
Permutations,combinations,pigeon-hole principle,inclusion-exclusion principle ,derangements.
Fundamental theorem of arithmetic,divisibility in Z, congruences ,Chinese Remainder theorem, Euler's -function,primitive roots.$\varnothing$
Groups,subgroups,normal subgroups,quotient groups ,homomorphisms,cyclic groups,permutation groups,Caley's theorem ,class equations,Sylow theorems.
Rings,ideals,prime and maximal ideals,quotient rings,unique factorization domain,principal ideal domain,Euclidean domain.
Polynomial rings and irreducibility criteria.
Fields, finite fields,field extensions.

Topology:
Basic concepts of Topology: Base, subbase, Product space,Continuous functions in topological space, Separation axioms, connectedness, Covering properties,

Ordinary Differential Equations(ODEs)
Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs,system of first order ODEs.
General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm-Liouville boundary value problem, Green's function.

Partial Differential equations(PDEs)
Lagrange and charpit methods for solving first order PDEs,Cauchy problem for first order 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.

Numerical Analysis
Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method,Rate of Convergence,solution of system of linear algebraic equations using Gauss elimination and Gauss-Seidel methods,Finite differences,Lagrange,Hermite and spline interpolation,Numerical differentiation and integration,Numerical solutions of ODEs using Picard,Euler,modified Euler and Runge-Kutta methods.

Linear Integral Equations
Linear integral equation of the first and second kind of Fredholm and Volterra type,solutions with separable kernels, Characteristic numbers and eigenfunctions , resolvent kernel.

Classical Mechanics
Generalized coordinates,Lagrange's equations,Hamilton's canonical equations, Hamilton's principle and principle of least action,Two-dimensional motion of rigid bodies,Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.