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Mathematics Syllabus for Uttarakhand State Civil Services Main Exam-2011

MATHEMATICS

PAPER-I

Linear Algebra: Vector space, bases, dimension of a finitely generated space, Linear transformations, Rank and nullity of a linear transformation, Cayley Hamiliton theorem, Eigenvalues and Eigenvectors. Matrix of a linear transformation. Row and column reduction. Echelon form. Equivalence, Congruence and similarity. Reduction to canonical forms. Orthogonal, symmetrical, skew-symmetrical, unitary, Hermitian and skew-Hermitian matrices-their eigenvalues, orthogonal and unitary reduction of quadratic and Hermitian forms. Positive definite quadratic forms. Simultaneous reduction.

Calculus: Real numbers, limits, continuity, differentialbility. Mean-value theorems, Taylor's theorem, indeterminate forms, Maxima and Minima. Curve Tracing. Asymptotes. Functions of several variables, partial derivatives, maxima and minima, Jacobian. Definite and indefinite integrals Double and triple integrals (techniques only), application to Beta and Gamma Functions. Areas, Volumes, Centre of gravity.

Analytical Geometry of Two and Three Dimensions: First and second degree equations in two dimensions in Cartesian and polar coordinates. Plane, sphere, paraboloid, Ellipsoid, hyperboloid of one and two sheets and their elementary properties. Curves in space. Curvature and torsion. Frenet's formulae.

Differential Equations: Orders and Degree of a differential equation, differential equations of first order and first degree, variables separable. Homogeneous, linear, and exact, differential equations. Differential equations with constant coefficients. The complementary function and the particular integral of e^{ax}, cosax, sinax, x^m, e^{ax} cosbx, e^{ax} sinbx.

Vector Analysis: Vector Algebra, Differentiation of Vector function of a scalar variable, Gradient, divergence and curl in Cartesian, cylindrical and spherical coordinates and their physical interpretation. Higher order derivatives. Vector identities and vector equations, Gauss and Stokes Theorems.

Tensor Analysis: Definition of a Tensor, Transformation of coordinates, contravariant and convariant tensors. Addition and multiplication of tensors, contraction of tensors. Inner product, fundamental tensors, Christoffel symbols, convariant differentiation, Gradient curl and divergence in tensor notation.

Statics: Equilibrium of a system of particles, work and potential energy. Friction. Common catenary. Principle of Virtual work. Stability of equilibrium. Equilibrium of forces in three dimensions.

Dynamics: Degree of freedom and constraints, Rectilinear motion, Simple harmonic motion in a plane. Projectiles, Constrained motion, work and energy. Motion under impulsive forces, Kepler's laws. Orbits under central forces. Motion of varying mass. Motion under resisting medium.

Hydrostatics: Pressure of heavy fluids. Equilibrium of fluids under given system of forces. Centre of pressure. Thrust on curved surfaces. Equilibrium of Floating bodies, stability of equilibrium and Pressure of gases, problem relating to atmosphere.

PAPER-II

Algebra: Groups, subgroups, normal subgroups homomorphism of groups, quotient groups, Basic isomorphism theorems, Sylow theorems. Permutation Groups. Cayley's theorem. Rings and ideals, Principal ideal domains, Unique factorization domains and Euclidean domains, Field Extension, Finite fields.

Real Analysis: Metric spaces, their topology with special reference to R" sequence in metric space. Cauchy sequence, completeness. Completion continuous functions, Uniform continuity, properties of continuous functions on Compact sets. Riemann Stieltjes Integral, Improper integrals and their conditions of existence. Differentiation of functions of several variables. Implicit function theorem, maxima and minima.

Absolute and Conditional Convergence of series of real and Complex terms, Rearrangement of series, Uniform convergence, infinite products. Continuity, differentiability and integrability for series, Multiple integrals.

Complex Analysis: Analytic functions, Cauchy's theorem, Cauchy's Integral formula, power series, Taylor's series, Singularities, Cauchys' Residue theorem and Contour integration.

Partial Differential Equations: Formation of partial differential equations, Types of integrals of partial differential equations of first order Charpits method, Partial differential equation with constant coefficients.

Mechanics: Generalised coordinates, Constraints, holonomic and non-holonomic systems, D'Alembert's Principle and Langranges' equations, Moment of inertia, Motion of rigid bodies in two dimensions.

Hydrodynamics: Equation of continuity, momentum and energy, inviscid flow theory- Two dimensional motion, streaming motion, Sources and Sinks.

Numerical Analysis: Transcendental and polynomial Equations-Methods of tabulation, bisection, regula-falsi, secants and Newton-Rephson and order of its convergence. Interpolation and Numerical Differentiation-polynomial interpolation with equal or unequal step size. Numerical differentiation formulae with error terms.

Numerical Integration of Ordinary Differential Equations: Euler's method, multistep-predictore Corrector methods-Adam's and Milne's method, convergence and stability, Runge-Kutta Methods.

Operational Research: Mathematical Programming-Definition and some elementary properties of convex sets, simplex methods, rectangular games and their solutions.