IFS Maths Syllabus or IFoS Maths Syllabus

Paper-I

Section-A

**Linear Algebra:** Vector, space, linear dependence and independence, subspaces, bases, dimensions. Finite dimensional vector spaces. Matrices, Cayley-Hamilton theorem, Eigen values and Eigenvectors, matrix of linear transformation, row and column reduction, Echelon form, equivalence, congruence and similarity, reduction to canonical form, rank, orthogonal, symmetrical, skew symmetrical, unitary, Hermitian, skew-Hermitian forms their Eigen values. Orthogonal and unitary reduction of quadratic and Hermitian forms, positive definite quadratic forms.

**Calculus:** Real numbers, limits, continuity, differentiability, mean-value theorems, Taylor's theorem with remainders, indeterminate forms, maxima and minima, asymptotes. Functions of several variables: continuity, differentiability, partial derivatives, maxima and minima, Lagrange's method of multipliers, Jacobian. Riemann's definition of definite integrals, indefinite integrals, infinite and improper integrals, beta and gamma functions. Double and triple integrals (evaluation techniques only). Areas, surface and volumes, centre of gravity.

**Analytic Geometry:** Cartesian and polar coordinates in two and three dimensions, second degree equations in two and three dimensions, reduction to canonical forms, straight lines, shortest distance between two skew lines, plane, sphere, cone, cylinder, paraboloid, ellipsoid, hyperboloid of one and two sheets and their properties.

Section-B

**Ordinary Differential Equations:** Formulation of differential equations, order and degree, equations of first order and first degree, integrating factor, equations of first order but not of first degree, Clairaut’s equation, singular solution. Higher order linear equations, with constant coefficients, complementary function and particular integral, general
solution, Euler-Cauchy equation. Second order linear equations with variable coefficients, determination of complete solution when one solution is known, method of variation of parameters.

**Dynamics, Statics and Hydrostatics** : Degree of freedom and constraints, rectilinear motion, simple harmonic motion, motion in a plane, projectiles, constrained motion, work and energy, conservation of energy, motion under impulsive forces, Kepler's laws, orbits under central forces, motion of varying mass, motion under resistance. 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. Pressure of heavy fluids, equilibrium of fluids under given system of forces Bernoulli’s equation, centre of pressure, thrust on curved surfaces, equilibrium of floating bodies, stability of equilibrium, metacentre, pressure of gases.

**Vector Analysis**: Scalar and vector fields, triple products, differentiation of vector function of a scalar variable, gradient, divergence and curl in Cartesian, cylindrical and spherical coordinates and their physical interpretations. Higher order derivatives, vector identities and vector equations. Application to Geometry: Curves in space, curvature and torsion. Serret-Frenet's formulae, Gauss and Stokes' theorems, Green's identities.

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**Paper-II**

**Section-A**

**Algebra**: Groups, subgroups, normal subgroups, homomorphism of groups quotient groups basic isomorphism theorems, Sylow's group, permutation groups, Cayley theorem. Rings and ideals, principal ideal domains, unique factorization domains and Euclidean domains. Field extensions, finite fields.
**Real Analysis**: Real number system, ordered sets, bounds, ordered field, real number system as an ordered field with least upper bound property, Cauchy sequence, completeness, Continuity and uniform continuity of functions, properties of continuous functions on compact sets. Riemann integral, improper integrals, absolute and conditional convergence of series of real and complex terms, rearrangement of series. Uniform convergence, continuity, differentiability and integrability for sequences and series of functions. Differentiation of functions of several variables, change in the order of partial derivatives, implicit function theorem, maxima and minima. Multiple integrals.


**Linear Programming**: Linear programming problems, basic solution, basic feasible solution and optimal solution, graphical method and Simplex method of solutions. Duality. Transportation and assignment problems. Travelling salesman problems.

**Section-B**


**Numerical Analysis and Computer programming**:

Numerical methods: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods, solution of system of linear equations by Gaussian elimination and Gauss-Jordan (direct) methods, Gauss-Seidel(iterative) method. Newton's (Forward and backward) and Lagrange's method of interpolation. Numerical integration: Simpson's one-third rule, trapezoidal rule, Gaussian
