MATHEMATICAL PHYSICS

- **Complex variables and complex functions:** Complex variables in2 and 4 dimensions. Functions of complex variable. Cauchy-Riemann conditions. Analytic functions. Singularities on the complex plane. Conformal transformations. Applications to Electrostatic, Magnetostatic and Fluid mechanics.
- **Integration in complex plane:** Integrals of complex functions. Cauchy-Goursat. Cauchy's argument principle, Rouche's theorem, Hilbert transformation. Dispersion relations. Classification of singularities of complex functions. Multivalued functions and Riemann sheets. Taylor and Laurent expansions. Residues. Techniques of complex integrations. Analytic continuation. Asymptotic series. Series resummation. Saddle point approximation. Multiscale perturbation theory.
- **Συναρτήσεις Green:** Definitions, properties and construction. Helmholtz and Poisson equations. Electrostatic problems. Wave equation. Radiation of moving charge. Leinard-Wieckert problem. Schrödinger's equation. The meaning of propagator in quantum mechanics. Liepmann-Schwinger equation. Dirac propagator.
- **Integral Equations:** Green's functions in interacting systems. Fredholm and Voltera integral equations. Neumann series. Helmholtz perturbation theory.

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