

Suggested curriculum in Complex and Functional Analysis

Responsible: Prof. Jan Stochel, Assoc. Prof. Włodzimierz Zwonek

1st year

title	kind of activity	hours/week	hours/year	form of crediting	credits
General School Seminar	seminar	2	60	participation	4
Seminar	seminar	2	60	participation	6
Mathematical Analysis	lectures, classes	2 2	60 30	exam	12
Functions of One Complex Variable	lectures	2	60	exam	8
Measure And Integration	lectures	2	30	exam	4
Functional Analysis	lectures	2	60	exam	8
Operator Theory	lectures	2	30	participation	3
Functions of Several Complex Variables	lectures	2	30	participation	3
Tutorials	tutorial	2	60	as arranged with tutor	4

2nd year

title	kind of activity	hours/week	hours/year	form of crediting	credits
General School Seminar	seminar	2	60	participation	4
Seminar	seminar	2	60	participation	6
Operator Theory	lectures	2	30	exam	4
Functions of Several Complex Variables	lectures	2	30	exam	4
Methods of Hilbert's Spaces	lectures	2	60	exam	8
Pluripotential Theory	lectures	2	60	exam	8
Tutorials	tutorial	2	60	as arranged with tutor	4
Diploma project	individual work	10	300	diploma exam	30

Mathematical Analysis. Improving of the basic knowledge of the modern Mathematical Analysis comprising among others: differentiability (implicit function theorem, local invertibility theorem, the Taylor formula, extrema of functions of several real variables etc.) and integrability (change of variables, multiple integrals, the Fubini theorem, integration of differential forms) of real functions, defined in subsets of Banach spaces and manifolds and their mutual relations (the Stokes theorem).

Responsible: Assoc. Prof. Robert Wolak

Functions of one Complex Variable. Introduction into the theory of holomorphic functions of one complex variable. Complex numbers, holomorphic functions, their properties and applications (residue theory). The Riemann mapping theorem.

Responsible: Prof. Józef Siciak

Measure and Integration. The Lebesgue integral (with respect to positive measure) and $L^p(\mu)$ -spaces. Complex measures, the Radon-Nikodym theorem. Differentiation of measures. Functions of bounded variation and absolutely continuous functions.

Responsible: Prof. Jan Stochel

Functional Analysis. Fundamentals of functional analysis: topological vector spaces, locally convex spaces, the Hahn-Banach theorem and its applications, duality and weak topologies, the Banach-Alaoglu theorem, the Banach-Steinhaus theorem (the principle of uniform boundedness), the open mapping and closed graph theorems. An introduction to the theory of Banach algebras and C^* -algebras: the Gelfand-Mazur theorem, the non-emptiness and compactness of the spectrum of an element of a Banach algebra, the space of characters of a commutative Banach algebra, the Gelfand transform, the Gelfand-Naimark theorem and the spectral theorem.

Responsible: Prof. F.H.Szafranec

Operator Theory. General theory of linear (bounded and unbounded) operators together with examples. Special classes of operators, in particular: orthogonal projections, isometries (Wold's decomposition), compact operators, symmetric and self-adjoint operators (Cayley's transform), formally normal and normal operators. The spectral theorem for normal operator and the operator calculus of Stone-von Neumann. Elements of the theory of operator C^0 -semigroups.

Responsible: Prof. Jan Stochel

Functions of Several Complex Variables. Introduction into the theory of several complex variables; similarities and differences between the theories of one and several complex variables (the Poincaré theorem, pseudoconvexity and domains of holomorphy, the Levi problem).

Responsible: Prof. Marek Jarnicki

Methods of Hilbert's Spaces. Elements of the theory of extensions and dilations of operators, moment problems (including the Hamburger, Stieltjes and Herglotz ones), orthogonal polynomials, selected interpolation problems of complex analysis (including the Pick-Nevanlinna, Loewner and Carathéodory-Fejér ones) and their generalizations.

Responsible: Prof. F.H.Szafraniec

Pluripotential Theory. Survey of the most important notions and results of the pluripotential theory and its connections with the analysis of several complex variables. Plurisubharmonic functions, the Monge-Ampere operator, the Dirichlet problem.

Responsible: Assoc. Prof. Zbigniew Błocki

Seminar – presentation of some topics of the contemporary Mathematical Analysis carried out in one of the Department seminars.