Transilvania University of Braşov, Romania

Study program: Fundamental Mathematical Structures

Faculty: Mathematics and Computer Science
Study period: 2 years (master)

1st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fix Point Theory	MM11	6	2	1	-	-

Course description (Syllabus): Mapping on metric spaces; ϕ-contractions; Generalized ϕ-contractions; Common fixed points and coincidence points; Stability of fixed points; Multivalued mappings.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Riemannian Geometry	MM12	6	2	1	-	-

Course description (Syllabus): Riemann manifolds, Levi-Civita connection, isometries; Geodesics on Riemann manifolds: variational theory of the geodesics, Jacobi fields, exponential map; Sectional curvature of the Riemann manifold, Laplace Operator on a Riemann manifold, Hodge de Rham Theorem; Riemann submanifolds: classes of submanifolds

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Geometric Function Theory	MM13	6	2	2	-	-

Course description (Syllabus): Special classes of univalent functions: functions with positive real part, starlike functions, convex functions, α-convex functions, close-to-convex functions; Integral and differential operators; Differential subordinations: Schwarz lemma, the method of differential subordinations, applications; Subordination chains: simple univalence criteria, the method of subordination chains, univalence criteria obtained with the method of subordination chains

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Applied Statistics	MM14	6	2	-	1	-

Course description (Syllabus): Probability space, random variables, distribution function. Properties. Distribution density, Discrete random variables, Continuous random variables: Statistical hypotheses testing. Applications: the case of the normal distribution, of the proportion of a population. Hypotheses testing, confidence intervals. Predictions.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Relativity Theory	MM15	6	2	1	-	-

Course description (Syllabus): Principles of special relativity. Relativistic interval, Minkowski metric, cone structure. Lorentz transformations and their consequences. Vectors, covectors, tensors and differential forms on R^n. Maxwell equations. Differentiable manifolds, Principles of general relativity and consequences.. Elements of cosmology: Friedmann-Lemaitre-Robertson-Walker metric, Big Bang and the expansion of the Universe.

Course title	Code	No. of	Number of hours per week

		credits	course	seminar	laboratory	project
Non-Riemannian Geometry	MM21	6	2	1		-

Course description (Syllabus): Lie groups, Lie algebra associated to a Lie group. Local Lie groups. Applications of Lie groups to differential equations. Symplectic and almost symplectic manifolds. Hamiltonians on a symplectic manifold, Hamiltonian vector field, Poisson bracket and applications. Contact manifolds, Reeb vector field. Complex and almost complex manifolds. Hermitian and Kahler manifolds, holomorphic sectional curvature.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Coding Theory and Cryptography	MM22	6	2	2	-	-

Course description (Syllabus): Information Theory Basics: Coding Theory: Linear codes – Hamming and Golay. Number Theory: efficient algorithms for large integer arithmetic, primality problems and main deterministic tests, probabilistic tests. Cryptography: prime numbers cryptography, symmetrical and asymmetrical schemes.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Stochastic Processes and Applications	MM23	6	2	1	-	-

Course description (Syllabus): Probability space Conditional expectation with respect to a sigma-algebra Stopping times Doob's optional stopping theorem Martingale transforms Inequalities and convergence theorems, Brownian motion. Probabilistic solution of Dirichlet problem for Laplace's equation. Probabilistic solution of Dirichlet problem for Poisson's equation. Probabilistic solution of heat equation, Feynman-Kac formula. Black-Merton-Scholes formula.

.Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Theory of Distributions and Applications	MM24	6	2	1	-	-

Course description (Syllabus): Fundamental spaces of distributions; The derivative of distributions; the primitive of distributions; Product of distributions; Differential and partial differential equations in distributions; Elements of convex analysis; Banach reflexive spaces; Sobolev spaces; Inferior semi-continuous functions; properties; Subdifferential of a function; Yoshida approximation and resolvent of multivalued operators; Semi-groups of operators; Equations of evolutions

Course title		Code	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Elected (1)	Operator Theory	MM25	6	2	1	-	-

Course description (Syllabus): Linear continuous operators, Classes of operators, Algrebas of operators, Spectral theory, Functional calculus; Types of differentiabilities, Differential forms. Semigroup of operators

2st Year

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Approximation Theory	MM31	8	2	2	-	-

Course description (Syllabus): Density theorems; The theory of best approximation; Jackson's type theorems; Markov's and Bernstein's inequalities; Approximation by positive linear operators; Korovkin type theorems, Approximation by sequences of projectors.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Reliability of Systems	MM32	8	2	1	1	-

Course description (Syllabus): Lifetimes; Stochastic orderings; Structure function of coherent systems; Renewal processes; Markov models in reliability; Asymptotic results

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Optimal control	MM41	8	2	2	-	-

Course description (Syllabus): Element of convex analysis, Lower semicontinuous functions; subdifferentials, Fenchel's theorem, Linear problems of control, Optimal linear control, Pontreaghin's principle, Quadratic optimal control.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Fractal theory	MM42	7	2	2	-	-

Course description (Syllabus): Cantor's set, Sierpinski triangle, Koch curve, Takagi-type functions, Topological dimension, Hausdorff measure, Hausdorff dimension, Pompeiu-Hausdorff metric, Iterative systems of functions, Attractors of a iterative system of functions and their properties, Hutchinson metric and Hutchinson measure, Fractal interpolation.
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Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Scientific Seminar	MM43	6	-	4	-	-

Course description (Syllabus): Presentation of new and significant new results in a certain fields of mathematics: Algorithms and computability, Special chapters in the theory of analytic function, Integral operators, Optimization theory, Gronwall inequalities and applications, Complements of Finsler spaces, Problems of existence and unicity in PDE, Global calculus of variations, Activity of documentation;Training in writing of scientific papers; Elaboration and presentation of a work at the student scientific session.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Specialized practice	MM44	5	-	-	-	2

Course description (Syllabus): Practice in educational and research units in the city and at the University Institut, Practice for using the data base for mathematics, Practice for using the mathematica soft.

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Practice for elaboration of the Master Thesis	MM45	8	-	-	-	4

Course description (Syllabus): Making a synthesis of the knowledge obtained in a field of mathematics; Completion of the own contributions to the study; Redaction of the thesis

Course title	Code	No. of credits	Number of hours per week			
			course	seminar	laboratory	project
Research methodology. Ethics and academic integrity	MM46	2	1	-	-	-

Course description (Syllabus): What is academic ethics. Her need in education and scientific research. Ethics, integrity, morality, legality. The phases of writing and publication of a scientific paper. The content of research paper.Bibliometric indicators of journals.

Course title		Code	No. of credits	Number of hours per week			
				course	seminar	laboratory	project
Elected (2)	Covexity and Inequalities	MM34	8	2	2	-	-

Course description (Syllabus): The general theory of convexity, Classical inequalities, Inequaliries in Hilbert space, Geometric inequalities, Analitic inequalities