List of Upper Division Mathematics Courses with Details

ADVANCED MATH GPA : 3.67

Hr	Title	Mark	Instructor	Topics	Text (if well-defined)
3	Partial Differential Equations	A	Mikhail Vishik	Classification of first- and second-order PDEs, their origin as basic models of waves, diffusion, dispersion, potential equations, and vibrations, and the properties of their solutions. Also talked about method of characteristics, maximum principles, Green's functions, eigenvalue problems, and Fourier expansion methods.	Partial Differential Equations: An Introduction by Walter A. Strauss
3	Intro Number theory (IBL)	A	Ekin Özman	Introduction to proof writing. Properties of the integers; divisibility; prime numbers; congruences and residues; linear and quadratic forms.	
3	Real Analysis I	B	Rachel Ward	A rigorous treatment of the real numbers; Euclidean spaces; metric spaces; continuity of functions in metric spaces; differentiation and Riemann integration of real-valued functions of one real variable; and uniform convergence of sequences and series of functions.	
3	Algebraic Structures I	B+	Lewis Bowen	structure theory of finite groups, isomorphism theorems, polynomial rings, and principal ideal domains.	Topics in Algebra by Herstein (ch. 1-3,5)
3	Intro to stochastic processes	A	Peter Mueller	Introduction to discrete and continuous time Markov chains; poison and renewal processes; birth and death processes and their applications	Essentials of Stochastic Processes by Rick Durrett (ch. 1-4)
3	Curves and surfaces	A	Dan Freed	Calculus applied to curves and surfaces in three dimensions: curvature and torsion of space curves; Gauss map and curvature of surfaces; Gauss theorem; geodesics; and Gauss-Bonnet theorem.	Elementary Differential Geometry by Pressley
3	Topology I	A	Michael Starbird	An introduction to point set topology; including sets; functions; cardinal numbers; and culminates at the classification of 2-manifolds	Inquiry based learning notes
3	Algebraic Structures II	A-	Ekin Özman	Selected topics from Ring theory and Field Theory including quadratic number rings/fields and Galois theory.	Algebra by Artin
3	Complex Analysis (Graduate)	A-	Thomas Chen	Complex differentiation, Cauchy-Riemann eqns, conformality, holomorphic functions, analytic functions, stereographic projection, contour integration, Cauchy's theorem, Liouville's theorem, Morera's theorem, harmonic functions, mean value theorem, maximum principle, Moebius transforms, Schwarz lemma, automorphisms of the unit disc and of the upper half plane, holomorphic functions on the Riemann sphere, isolated singularities and residues, meromorphic functions, Laurent series, winding number, cycles, null homology, generalized Cauchy theorem, residue theorem, uniqueness theorem, analytic continuation, convergence and normal families, Mittag-Leffler theorem, Weierstrass and Hadamard factorization theorems, order and genus of entire functions, Riemann mapping theorem, Poisson formula, Poisson kernel, Harnack inequality, approximation of identities, Dirichlet problem on the unit disc with continuous L^1 boundary data, analytic functions between Riemann surfaces, Valency, degree, genus, Riemann-Hurwitz formula, elliptic functions, Weierstrass function, and fundamental domains.	Ahlfors

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3	Real Analysis (Graduate)	A	Lewis Bowen	Outermeasures; measures; sigma-algebras; measurability and continuity of functions; Littlewood's 3 principles; Lusin's Theorem; Lebesgue integration; Riemann integration; Lebesgue differentiation theorem; convergence theorems; functions of bounded variations; absolute continuous functions; convex functions; L^p spaces; Banach spaces; Hilbert spaces; Signed measures; Hahn decompostions; Jordan decompositions; Radon-Nikodym; Dual of L^p; Caratheodory's Extension Theorem; Product measures; Fubini's and Tonelli's; convolutions; spaces of measures; Riesz representation theorem; Fourier transforms	Measure and Integral by R.L. Wheeden and A. Zygmund (ch. 1-11)
3	Algebraic Topology (Graduate)	B	Michael Starbird	Classification of 2-manifolds; homotopy; fundamental groups; Van Kampen theorem; covering spaces; universal covers; subgroup correspondence; $\mathbb{Z}/2$ homology; mayer-vietoris sequences; applications (in fixed point theorem; Jordan separation theorem etc.); $\mathbb{Z}$ homology.	Inquiry based learning notes
3	Homotopy Type Theory (Graduate)	audit	Andrew Blumberg	introducing homotopy type theory from propositional logic; (ETCS) set theory; type and dependent types; lambda-calculus; correspondence with cartesian closed categories; fibration cofibration; inductive types; simplicial sets; kan complex and fibrations; univalence axioms; path inductions; h-levels; inductive types; and finally proved $\pi_1(S^1)$ is $\mathbb{Z}$ using homotopy type theory methods.	
3	Differential Topology (Graduate)	A-	Andrew Neitzke	smooth maps and manifolds, Sard's Theorem and transversality, intersection theory, Whitney embedding, fiber and vector bundles, tangent and cotangent bundles, orientations, Brouwer's fixed point theorem, Borsuk-Ulam theorem, vector fields and flows, Poincare-Hopf theorem, Gauss-Bonnet theorem for hypersurfaces, de Rham cohomology, differential forms and integration, Stoke's theorem, Lefschetz formula	Guillemin and Pollack
3	Topics in D-modules (Graduate)	audit	Sam Gunningham	derived categories and functors, quasi-coherent sheaves, pull and push functors (6 operations), base-change, good filtrations, sheaves on manifolds, Verdier duality, constructible and perverse sheaves, holonomic D-modules, Riemann-Hilbert correspondence, analytic D-modules, regular singularities, irregular singularities, singular supports	D-Modules, Perverse Sheaves, and Representation Theory by Hotta and Tanisaki
3	Algebra I (Graduate)	B	Felipe Voloch	Groups (groups, subgroups, quotient groups, group actions, direct products, solvable groups) and Rings (rings, domains, PIDs, UFDs, polynomial rings, modules, modules over PIDs)	Dummit and Foote
3	K-theory as it appears in Geometry (Graduate)	A	Dan Freed	homotopy invariance, group completion, fiber bundles, Hopf invariant, Fredholm operators, Clifford algebras, Kuiper's theorem, classifying spaces, Atiyah-Singer loop map, Atiyah-Bott-Shapiro construction, Topology of skew-adjoint Fredholm operators, Bott periodicity, geometry and representation of compact lie groups, groupoids and vector bundles, Dirac family of operators, AS Index theorem, loop groups	
3	Topology of 4-Manifolds (Graduate)	audit	Robert Gompf	complex surfaces ($\#_{\pm n}\mathbb{CP}^2, K3, E(n)$) and classification, Heegaard splittings, Kirby diagrams, handlebodies, Kirby calculus, plumbings, spin structures and obstruction theory, topological blow-ups and blow-downs, branched covers and resolutions, elliptic surfaces, lefschetz fibrations, Casson handles and exotic $\mathbb{R}^4$'s	Gompf's 4 Manifolds and Kirby Calculus
1	Reading course	A	Andrew Blumberg	Cup products, Poincare duality, (co)fibrations and (co)fiber sequences, CW complexes	May's Concise Course

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3	Rational Homotopy Theory (Graduate)	audit	Jonathan Campbell	Postnikov towers, Eilenberg-MacLane spaces, Serre spectral sequence, rational homotopy groups of spheres, localizations, model categories, small object argument, Sullivan algebras, simplicial sets, rational differential forms, poincare lemma, relating SSets and CDGAs via geometric realization and rational PL forms, bar constructions, A_∞ algebras, Quillen's model	