Details on Selected Upper Division Courses

#	Title	Topics	Text (if well-defined)	Instructor
M 175T	CONFERENCE COURSE	Cup products, Poincare duality, (co)fibrations and (co)fiber sequences, CW complexes	May's Concise Course	Andrew Blumberg
M 392C	K THEORY AS IT APPEARS IN GEOMETRY (Graduate)	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		Dan Freed
M 380C	ALGEBRA (Graduate)	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. Chapter 1-12	Felipe Voloch
M 382D	DIFFERENTIAL TOPOLOGY (Graduate)	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	Andy Neitzke
M 381C	REAL ANALYSIS (Graduate)	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	Wheeden, Zgymond, Chapter 1-11	Lewis Bowen
M 382C	ALGEBRAIC TOPOLOGY (Graduate)	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.	IBL	Michael Starbird

Note: IBL stands for Inquiry-Based Learning. There students prove major theorems without traditional lectures or textbooks

#	Title	Topics	Text (if well-defined)	Instructor
M 381D	COMPLEX ANALYSIS (Graduate)	Cpx 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, $SL_2(\mathbb{Z})$, and fundamental domains.	Alfhors	Thomas Chen
M 373L	ALGEBRAIC STRUCTURES II	Selected topics from Ring theory and Field Theory including quadratic number rings/fields and Galois theory.	Algebra by Artin	Ekin Ozman
M 372K	PARTIAL DIFF EQUATN AND APPLIC	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.	Staruss, Partial Differential Equations, Chapter 1-9, 12	Mikhail Vishik
M 367K	TOPOLOGY I	An introduction to point set topology; including sets; functions; cardinal numbers; and culminates at the classification of 2-manifolds	IBL	Michael Starbird
M 365G	CURVES AND SURFACES	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.	Pressley, Elementary Differential Geometry	Dan Freed
M 362M	INTRO TO STOCHASTIC PROCESSES	Introduction to discrete and continuous time Markov chains; poison and renewal processes; birth and death processes and their applications	Durrett, Essentials of Stochastic Processes, Chapter 1-4	Peter Mueller
M 341	LINEAR ALGEBRA/MATRIX THRY-HON	Vector spaces; linear transformations; matrices; linear equations; determinants. Emphasis on rigor and proofs.		Ronny Hadani
M 328K	INTRO TO NUMBER THEORY-IBL	introduction to proof writing. Properties of the integers; divisibility; prime numbers; congruences and residues; linear and quadratic forms.	IBL	Ekin Ozman
ASE 381P	8-STOCH DETEC, ESTM, & CNTRL	Hypothesis Testing, ML, MAP, Nonlinear estimations, (Extended) Kalman Filters, Sigma point filters, Particle Filters	Bar-Shalom, et. al., Estimation with Applications to Tracking and Navigation	Todd Humphreys
E 394F M	FINITE ELEMENT METHODS	1D, 2D Continuous Galerkin, Mixed Methods, nonautonomous equations, discontinuous Galerkin	Oden, Finite Elements, Vol. 1	Mary Wheeler
ASE 389P	7-GLOBAL POSITIONING SYSTEM	GPS signal Processing, Broad Spectrum, Error Coding, Software GPS receiver		Todd Humphreys

Details on Some Audited Classes

#	Title	Topics	Text (if well-defined)	Instructor
M 380C	RATIONAL HOMOTOPY THEORY (Graduate)	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		Jonathan Campbell
M 175T	TOPOLOGY OF 4-MANIFOLDS (Graduate)	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	Robert Gompf
M 392C	TOPICS IN D-MODULES (Graduate)	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		Sam Gunningham
M 382D	HOMOTOPY TYPE THEORY (Graduate)	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.		Andrew Blumberg

Note: Auditing for me means that (almost) every lecture was attended but only some problems/readings were attempted.