Michael Heinz - List of Undergraduate Math Courses

ANALYSIS COURSES

MATH 4181H: Honors Analysis I Autumn 2015
Instructor: Ovidiu Costin *Grade: A*

- Main topics covered: limits and continuity, differentiation, integration, infinite series (all in $\mathbb{R}$).
- Textbook: *Calculus* by Michael Spivak; chapters 1-24 excluding 16, 17, 21.

MATH 4182H: Honors Analysis II Spring 2016
Instructor: Zbigniew Fiedorowicz *Grade: A*

- Main topics covered: topology of $\mathbb{R}^n$, differentiation, the implicit function theorem, various integrals in $\mathbb{R}^n$, Green's/Divergence/Stokes's theorems, infinite series, Fourier series.
- Textbook: *Advanced Calculus* by Gerald Folland; all chapters excluding 7.

MATH 5522H: Honors Complex Analysis Spring 2017
Instructor: Ovidiu Costin *Grade: A*

- Main topics covered: plane topology, analytic functions, complex integration, Cauchy's theorem, harmonic functions, sequences of analytic functions, the residue theorem, conformal mapping, analytic continuation.
- Textbook: *An Introduction to Complex Function Theory* by Bruce Palka; all chapters.

MATH 5530H: Honors Probability Spring 2017
Instructor: Neil Falkner *Grade: A*

- Main topics covered: random variables, expectation, independence and conditioning, Poisson and normal distributions, σ-algebras, the π-λ theorem and monotone class theorem, integration, the monotone convergence theorem, Poisson processes, martingales and random walks.
- Textbooks: *Elementary Probability Theory* by Kai Lai Chung and Farid AitSahlia; chapters 1-7. Lecture notes on topics not covered in the textbook.

MATH 6211: Real Analysis I (Graduate-level) Autumn 2019
Instructors: David Penneys and Barbara Keyfitz *In Progress*

- Main topics covered: measures, integration, point-set topology, some elements of functional analysis, differentiation, Radon measures.
- Textbook: *Real Analysis: Modern Techniques and Their Applications* by Gerald Folland; chapters 1-5 and 7.

MATH 6212: Real Analysis II (Graduate-level) Spring 2020
Instructors: Feride Tiglay and Corey Jones *Future Course*

- Main topics covered: L^p spaces, Fourier analysis, distribution theory and probability theory.
- Textbook: *Real Analysis: Modern Techniques and Their Applications* by Gerald Folland; remaining chapters not covered in MATH 6211.

ALGEBRA COURSES

MATH 5590H: Honors Abstract Algebra I Autumn 2018
Instructor: Sachin Gautam *Grade: A*

- Main topics covered: integers, groups, group actions, Sylow theorems, semidirect products, rings, principal ideal domains, unique factorization domains, polynomials, Hilbert basis theorem, Gröbner bases.
- Textbook: *Abstract Algebra* by David Dummit and Richard Foote; chapters 1-9.

MATH 5591H: Honors Abstract Algebra II Spring 2019
Instructor: Sasha Leibman *Grade: A*

· Main topics covered: modules, vector spaces, tensor products and direct sums, modules over a PID, the Jordan canonical form, fields, polynomials, Galois theory, solvable groups, solvability in radicals.
· Textbook: *Abstract Algebra* by David Dummit and Richard Foote; chapters 10-14.

COURSES IN MISCELLANEOUS MATHEMATICAL TOPICS

MATH 5520H: Honors Linear Algebra and Differential Equations Autumn 2016
Instructor: Henri Moscovici *Grade: A*

· Main topics covered: vector spaces, linear transformations, inner products, determinants, the spectral theorem, existence and uniqueness of solutions to various linear differential equations and other first-order differential equations.
· Textbooks: *Linear Algebra: An Introductory Approach* by Charles Curtis; chapters 1-6 and 9. *An Introduction to Ordinary Differential Equations* by Earl Coddington; chapters 1-5.

MATH 5529H: Honors Combinatorics Autumn 2016
Instructor: Vitaly Bergelson *Grade: A*

· Main topics covered: binomial coefficients, Fibonacci numbers, graphs, geometries, convex sets in Euclidean space, generating functions, Ramsey theory, partition-regular properties in $\mathbb{N}$, IP sets, Hindman's Theorem, van der Waerden's theorem, Szemerédi's theorem, the Hales-Jewett theorem.
· Textbooks: *Combinatorics: Topics, Techniques, Algorithms* by Peter Cameron; chapters 1-14 excluding 8. Assorted handouts from various other textbooks including *Convex Sets and Their Applications* by Steven R. Lay and *generatingfunctionology* by Herbert S. Wilf.

MATH 5576H: Honors Number Theory Autumn 2017
Instructor: Vitaly Bergelson *Grade: A*

· Main topics covered: primes, congruences, quadratic reciprocity, normal numbers, continued fractions, approximation by rationals, some Diophantine equations, arithmetical functions, uniform distribution, some theorems from ergodic Ramsey theory including van der Waerden's theorem, Szemerédi, and Hindman's theorems, Fermat's last theorem, geometry of numbers, p-adic numbers.
· Textbooks: Various chapters from *An Introduction to the Theory of Numbers* by G.H. Hardy and E.M. Wright. Assorted handouts from various other textbooks, including *An Introduction to the Theory of Numbers* by Ivan Niven, Herbert Zuckerman, and Hugh Montgomery, *A Course in p-adic Analysis* by Alain M. Robert, and *Elements of Number Theory* by John Stillwell.

MATH 5540H: Honors Differential Geometry Spring 2018
Instructor: Neil Falkner *Grade: A*

· Main topics covered: curves and surfaces, the Frenet-Serret apparatus, geodesics, Christoffel symbols, the Gauss-Bonnet theorem, general point-set topology, winding numbers, the Jordan curve theorem.
· Textbooks: *Elements of Differential Geometry* by Richard Millman and George Parker; chapters 1-4. Lecture notes on topics not covered in the textbook.

MATH 8160: Topics in Representation Theory (Graduate-level) Autumn 2019
Instructor: Sachin Gautam *In Progress*

· Main topics covered: hyperplane arrangements and root systems, braid groups, Lie algebras and representations, Knizhnik-Zamolodchikov equations, braided tensor categories, quantum groups and representations, deformation theory.
· Textbook: Lecture notes on Differential Equations and Quantum Groups (`https://people.math.osu.edu/gautam.42/A19/notes.html`).

APPLIED MATH AND STATISTICS COURSES

STAT 4202: Introduction to Mathematical Statistics II Autumn 2018
Instructor: Kevin Donges *Grade: A*

- Main topics covered: estimation, confidence intervals, maximum-likelihood estimators, various hypothesis tests, goodness-of-fit, regression, correlation.
- Textbook: *John E. Freund's Mathematical Statistics with Applications* by Irwin and Marylees Miller; chapters 9-14.

MATH 8610: Topics in Applied Mathematics (Graduate-Level) Spring 2020
Instructor: Dustin Mixon *Future Course*

- Main topics covered: diffusion maps, spectral clustering, compressed sensing, community detection, synchronization.
- Lecture notes on Mathematics of Data Science.

MATH 8650: Topics in Mathematical Biology (Graduate-Level) Spring 2020
Instructor: Roberto Facundo Memoli Techera *Future Course*

- Main topics covered: tree metric spaces, hyperbolicity of metric spaces, Gromov's approximation theorems, Billera-Holmes-Vogtman metric spaces of all trees, split decomposition of metrix, Kuratowski embedding into $L^\infty(X)$, one point extensions, Katetov functions, Urysohn universal metric space, injective metric spaces, tight span of metric spaces, Gromov-Hausdorff distance.
- Lecture notes on Hyperbolic Metric Spaces and Phylogenetics.

SOME RELEVANT NON-MATH COURSES

CSE 1222: Introduction to C++ Spring 2016
Instructor: Tianqi Li *Grade: A*

- Main topics covered: basic syntax, variables, assignments, if-else branches, loops, arrays/vectors, user-defined functions, objects and classes, pointers, strings, algorithms.
- Textbook: *Programming in C++* by zyBooks; chapters 1-8.

PHYSICS 6810: Computational Physics Spring 2019
Instructor: Ralf Bundschuh *Grade: A*

- Main topics covered: Unix environment, rounding errors in floating point arithmetic, using scientific computing libraries, numerical differentiation and integration, numerical linear algebra and quantum mechanics, parallel processing, solving differential equations numerically, oscillations/pendulums, chaos, debugging, optimization, random numbers, Monte Carlo methods, Ising model.
- Textbook: Lecture notes on computational physics.