Semester 2, 2010

Title: Algebra 3: Advanced Topics in Algebra (Algebraic Number Theory)

Topics include: Dedekind Domains, Ideal Class Group, Cyclotomic Extensions, Valuation Theory, Theorem on the Finiteness of the Class Number, Dirichlet's Unit Theorem

Textbook: "Algebraic Number Theory" by James Milne

Lecturers: Dr. James Borger and Prof. Amnon Neeman

Grade: HD (97%)

Title: Finite Group Theory: Subnormality, Split Extensions, and Commutators

Topics include: Chermak-Delgado Theorem, Subnormality Theory (Wielandt Zipper Lemma, Luchini's Theorem, Baer's Theorem, Horosevskii's Theorem etc.), Split Extensions (Schur-Zassenhaus Theorem, Hall's Theorems etc.), Commutator Computations

Textbook: "Finite Group Theory" by Martin Isaacs

Supervisor: Dr. Elizabeth Ormerod

Grade: HD (97%)

Semester 1, 2011

Title: Analysis 2 Honours: Topology, Lebesgue Integration, and Hilbert Spaces

Topics include: Point-set Topology (Connectedness and Compactness, Countability and Separation Axioms, Urysohn's Lemma and Tietze's Extension Theorem etc.), Measure Theory and Lebesgue Integration, Hilbert Spaces

Textbooks: "Real Analysis" by Halsey Royden and "Real Analysis: Measure Theory, Integration, and Hilbert Spaces" by Elias Stein and Rami Shakarchi

Lecturer: Prof. John Hutchinson

Grade: HD (98%)

Title: Algebraic Geometry: Varieties and Scheme Theory

Topics include: Affine and Projective Varieties (e.g., Hilbert's Nullstellensatz, Cones, Parameter Spaces, Grassmannians, Hilbert Polynomials), Sheaf Theory, Scheme Theory

Textbooks: "Algebraic Geometry: A First Course" by Joe Harris, "Algebraic Geometry" by Robin

Hartshorne, "Algebraic Geometry and Arithmetic Curves" by Qing Liu

Supervisor: Dr. James Borger

Grade: HD (95%)

Title: Commutative Algebra

Topics include: Localization, Primary Decomposition, Noetherian and Artinian Rings, Completions, and Dimension Theory

Textbook: "An Introduction to Commutative Algebra" by Michael Atiyah and Ian Macdonald

Supervisor: Prof. Amnon Neeman

Grade: HD (98%)

Title: Topics in Fourier Analysis

Topics include: Weak L^p Spaces, Convolution, Interpolation Theorems (Marcinkiewicz, Riesz-Thorin etc.), Maximal Functions, Distribution Theory, Fourier Multipliers, Fourier Analysis on the Torus

Textbook: "Classical Fourier Analysis" by Loukas Grafakos

Supervisor: Prof. Andrew Hassell

Grade: HD (95%)

Semester 2, 2011

Title: Complex Analysis Honours

Topics include: Holomorphic Functions, Conformal Mappings, Singularities, Residue Theorem

Textbook: "Functions of One Complex Variable I" by John Conway

Lecturer: Dr. Alexander Isaev

Grade: HD (93%)

Title: Schemes: Local Properties and Cohomology

Topics include: Local Properties of Schemes, Sheaf Cohomology

Textbooks: "Algebraic Geometry" by Robin Hartshorne and "Algebraic Geometry and Arithmetic Curves" by Qing Liu

Supervisor: Dr. James Borger

Grade: HD (90%)

Title: Advanced Commutative Algebra

Topics include: Homological Algebra (e.g., the Tor and Ext Functors), Flatness and Faithful Flatness, Associated Primes, Constructible Sets and Chevalley's theorem, Depth, Normal and Regular Rings

Textbook(s): "Commutative Algebra" by Hideyuki Matsumura

Supervisor: Prof. Amnon Neeman

Grade: HD (95%)

Semester 1, 2012

Title: Differential Geometry Honours

Topics include: Differentiable Manifolds, Vector Fields and Integral Flows, Lie Groups and Lie Algebras, Differential Forms (e.g., Stokes' theorem, de Rham cohomology), Riemannian Geometry (Geodesics, Hopf-Rinow Theorem, Curvature)

Lecturers: Dr. Travis Willse and Dr. Katja Sagerschnig

Grade: HD (92%)

Title: Lie Groups and Lie Algebras

Topics include: Schur Orthogonality, Peter-Weyl Theorem, Existence and Conjugacy Theorems for Maximal Tori, Theory of Roots and Weights, Weyl

Character Theorem and the Weyl Integration Formula, Schur-Weyl Duality

Textbooks: "Lie Groups" by Daniel Bump and "Compact Lie Groups" by Mark Sepanski

Supervisor: Dr. Peter O'Sullivan

Grade: HD (90%)

Title: Vector Bundles and K-theory

Topics include: Topological K-theory, Bott Periodicity, Adams Operations, Characteristic Classes, J-homomorphism

Textbook: "Vector Bundles and K-theory" by Allen Hatcher

Supervisor: Dr. Vigleik Angeltveit

Grade: HD (89%)

Semester 2, 2012

Title: Soergel Bimodules and Khovanov Homology

Topics include: Categorification, the Category O, Soergel bimodules, Khovanov homology

Papers: "Geometric Representation Theory" by Dennis Gaitsgory, "A Functor-Valued Invariant of

Tangles" by Mikhail Khovanov and "Diagrammatics of Soergel Bimodules" by Ben Elias and Mikhail Khovanov

Supervisor: Dr. Anthony Licata

Grade: HD (93%)

Title: Spectral Sequences in Algebraic Topology

Topics include: Serre Spectral Sequence, Cohomology of Eilenberg-Maclane Spaces, Steenrod algebra and its dual, EHP sequence, Adams Spectral Sequence, Cohomology of The Spectra HZ, KU and KO

Textbook: "Spectral Sequences in Algebraic Topology" by Allen Hatcher

Supervisor: Dr. Vigleik Angeltveit

Grade: HD (94%)

Title: Riemannian Geometry

Topics include: Geodesics and Convex Neighborhoods, Jacobi fields, Isometric Immersions (the second fundamental form and the fundamental equations), the Hopf-Rinow and Hadamard Theorems, Spaces of Constant Curvature, the Bonnet-Myers and Synge-Weinstein theorems, the Rauch Comparison theorem, the Morse Index theorem, and the Sphere theorem

Textbook: "Riemannian Geometry" by Manfredo do Carmo

Supervisor: Dr. Travis Willse

Grade: HD (100%)

Semester 1, 2013

Title: Trace Methods in Algebraic K-theory

Topics include: Hochschild and Cyclic Homology, Algebraic K-theory, Dennis Trace Map, Quillen's Calculation of the Algebraic K-theory of Finite Fields, Gamma Spaces and S-Algebras

Papers/Textbook: "Cyclic Homology and the Lie Algebra Homology of Matrices" by Jean-Louis Loday and Daniel Quillen, "Cyclic Homology, Derivations, and the Free Loopspace", "On the General Linear Group and Hochschild Homology", "Relative Algebraic K-theory and Cyclic Homology" by Thomas Goodwillie, "On the Cohomology and K-theory of the General Linear Groups over a Finite Field" by Daniel Quillen, "Local Methods in Algebraic K-theory" by Randy McCarthy, Ian Dundas, and Thomas Goodwillie

Supervisor: Dr. Vigleik Angeltveit

Grade: HD (90%)

Title: Symplectic Geometry

Topics include: Cotangent Bundles and Generating Functions, Darboux-Moser-Weinstein theory, Contact and Kahler Manifolds, Hamiltonian Mechanics, Moment Maps, Symplectic Reduction, Classification of Symplectic Toric Manifolds via Delzant Polytopes

Textbook: "Symplectic Geometry" by Ana Canas da Silva

Supervisor: Dr. Travis Willse

Grade: HD (100%)

Title: Morse Theory

Topics include: Fundamental Theorem of Morse Theory, Proof of Bott Periodicity via Morse theory, Morse homology

Textbook/Lecture Notes: "Morse Theory" by John Milnor and "Lectures Notes on Morse Homology" (with an eye towards Floer theory and pseudoholomorphic curves) by Michael Hutchings

Supervisor: Dr. Brett Parker

Grade: HD (95%)

Title: Braid Group Actions

Topics include: Roquier Complex, Triply Graded Link Homology

Paper: "Triply-Graded Link Homology" by Mikhail Khovanov

Supervisor: Dr. Anthony Licata

Grade: HD (92%)

Semester 2, 2013

Title: The h-principle

Topics include: Legendrian Knots, Holonomic Approximation, Ample Differential Relations, Isocontact Embeddings

Textbook/Paper: "An Introduction to the h-principle" by Yakov Eliashberg and Nikolai Mishachev and "Loose Legendrian Embeddings in High Dimensional Contact Manifolds" by Emmy Murphy

Supervisor: Dr. Brett Parker

Title: Braid Groups

Topics include: Braid Group Actions, Dehornoy Ordering

Papers/Lecture Notes: "Notes on Link Homology" by Marta Asaeda and Mikhail Khovanov, "Ordering the Braid Groups" by Roger Fenn, Michael Greene, Dale Rolfsen, Colin Rourke and Bert Wiest, "Quivers, Floer

Cohomology, and Braid Group Actions" by Mikhail
Khovanov and Paul Seidel

Supervisor: Dr. Anthony Licata