1. MATH-SHU 201 Honors Calculus (2020 Fall)
    a. Course Instructor: Wei Wu
    b. Course Texts: Rudin, Walter. Principles of mathematical analysis. 1953.
    c. Course Description: This is a rigorous course in single-variable calculus for mathematics majors, providing preparation for advanced courses in analysis. Topics covered include number systems, functions, graphs, vectors, polar coordinates, limits, continuity, least upper bounds, compactness, the derivative, Mean Value Theorems, Taylor Expansion, convexity and concavity, inverse functions, parametric curves, Riemann sums, integrals, and the fundamental theorem of calculus.
    d. Course Grade: A-
    e. Credits: 4

2. MATH-SHU 141 Honors Linear Algebra I (2020 Fall)
    a. Course Instructor: Siran Li
    b. Course Texts: Axler, Sheldon. Linear algebra done right. springer publication, 2015. Treil, Sergi. "Linear algebra done wrong." (2016).
    c. Course Description: This is the first semester of a 2-semester sequence in linear algebra for advanced mathematics majors. Topics covered include number system and logic, fields, vector spaces, linear independence, dimension, linear transformations, rank, matrices, eigenvalues, eigenvectors, determinants, eigenspaces, multiplicities of eigenvalues, diagonalization, characteristic polynomials, and the Cayley-Hamilton theorem.
    d. Course Grade: A
    e. Credits: 4

3. MATH-SHU 328 Honors Analysis I (2021 Spring)
    a. Course Instructor: Yuning Liu
    b. Course Texts: Rudin, Walter. Principles of mathematical analysis. 1953. Johnsonbaugh, Richard, and William E. Pfaffenberger. Foundations of mathematical analysis. Courier Corporation, 2012.
    c. Course Description: This course is a continuation of Honors Calculus. Topics covered include integration techniques, trigonometric functions, the logarithm, exponential functions, Stone-Weierstrass theorem as approximation by polynomials, sequences, series, convergence, uniform convergence, power series, Taylor series, complex numbers and functions, Euclidean spaces, Metric spaces, and basic topology including compactness and connectedness. Final topics are Fourier Series expansion.
    d. Course Grade: A-
    e. Credits: 4

4. MATH-SHU 142 Honors Linear Algebra II (2021 Spring)
    a. Course Instructor: Siran Li
    b. Course Texts: Axler, Sheldon. Linear algebra done right. springer publication, 2015. Treil, Sergi. "Linear algebra done wrong." (2016).
    c. Course Description: This course is a continuation of Honors Linear Algebra I. Topics covered include the Schur decomposition theorem, inner product spaces, the Gram-Schmidt process, orthogonality, adjoint maps, spectral theory, self-adjoint, normal, and unitary maps, bilinear forms, singular value decomposition, reducibility of maps, nilpotence, the rational canonical form and Jordan decomposition theorem, minimal polynomials, the Penrose-Frobenius theorem. Advanced examples include Quantum Mechanics, Schödinger's equations and Heisenberg Uncertainty Principle.
    d. Course Grade: A-
    e. Credits: 4

5. MATH-SHU 329 Honors Analysis II (2021 Fall)
    a. Course Instructor: Yuning Liu
    b. Course Texts: Rudin, Walter. Principles of mathematical analysis. 1953. Fleming, Wendell. Functions of several variables. Springer Science & Business Media, 2012.
    c. Course Description: This course is a continuation of Analysis I, with emphasis on functions of several variables. Topics are Differentiation of functions of several variables: partial derivatives, differential, extreme value problems, convexity and Hessian; Vector-valued functions of several variables: Linear transformation, differentiable transformations, inverse function theorem, implicit function theorem, Lagrange multiplier; Integration: elements of measure theory, iterated integrals, change of variables; Vector calculus: line integral, the theory of curves, introduction to the theory of surfaces and differential forms.
    d. Course Grade: A
    e. Credits: 4

6. MATH-SHU 362 Honors Ordinary Differential Equations (2021 Fall)
    a. Course Instructor: Pierre Tarres
    b. Course Texts: Boyce, William E., and Richard C. DiPrima. Elementary differential equations and boundary value problems. Wiley, 2020.
    c. Course Description: This course introduces the main ideas of ordinary differential equations. It will cover vector fields, proof of local existence and uniqueness of solutions of first-order differential equations by Picard's fixed point iteration, stability, higher order linear differential equations and their set of fundamental solutions (with proof of characterization by the Wronskian), Series Solutions of second order linear differential equations (ordinary points, proof of Fuchs Theorem, regular singular points and indicial equation), Laplace transform and numerical methods, nonlinear systems, boundary value problems.
    d. Course Grade: A
    e. Credits: 4

7. MATH-SHU 238 Honors Theory of Probability (2022 Spring)
    a. Course Instructor: Wei Wu
    b. Course Texts: Grimmett, Geoffrey, and David Stirzaker. Probability and random processes. Oxford university press, 2020.
       Shreve, Steven E. Stochastic calculus for finance II: Continuous-time models. Vol. 11. New York: springer, 2004.
    c. Course Description: Topics covered include axioms of mathematical probability, combinatorial analysis, the binomial distribution, Poisson and normal approximation, random variables, probability distributions, Integration/ Expectation, conditional distributions and expectation, functions of random variables, Radon-Nikodym derivatives, Random walks, Generating functions and characteristic functions, Convergence of random variables, laws of large numbers and Markov chains and their applications.
    d. Course Grade: A
    e. Credits: 4

8. MATH-SHU 263 Partial Differential Equations (2022 Spring)
    a. Course Instructor: Jinzi Huang
    b. Course Texts: Strauss, Walter A. Partial differential equations: An introduction. John Wiley & Sons, 2007.
       Evans, Lawrence C. Partial differential equations. Vol. 19. American Mathematical Society, 2022.
    c. Course Description: Many laws of physics are formulated as partial differential equations. This course discusses the 4 classical equations: Transport, Wave, Heat and Laplace starting from the simplest examples, such as diffusion, gravity, and static electricity. Nonlinear conservation laws and the theory of shock waves are discussed, as well as further applications to physics, chemistry, biology, and population dynamics.
    d. Course Grade: A
    e. Credits: 4

9. MATH-SHU 282 Functions of a Complex Variable (2022 Spring)
    a. Course Instructor: Pedro Antonio Santoro Salomão
    b. Course Texts: Brown, James Ward, and Ruel V. Churchill. Complex variables and applications. McGraw-Hill, 2009.
       Stein, Elias M., and Rami Shakarchi. Complex analysis. Vol. 2. Princeton University Press, 2010.
    c. Course Description: Complex numbers and complex functions. Differentiation and the Cauchy-Riemann equations. Cauchy's theorem and the Cauchy integral formula. Singularities, residues, and Laurent series. Fractional Linear transformations and conformal mapping. Analytic continuation. Open mapping theorem and the Riemann Mapping theorem.
    d. Course Grade: A
    e. Credits: 4

10. MATH-SHU 339 Real Variables (2022 Spring)
   a. Course Instructor: Yuning Liu
   b. Course Texts: Stein, Elias M., and Rami Shakarchi. Real analysis: measure theory, integration, and Hilbert spaces. Princeton University Press, 2009.
      Evans, Lawrence C. Partial differential equations. Vol. 19. American Mathematical Society, 2022.
   c. Course Description:This is an introductory course on modern analysis. The topics to be discussed include: Lebesgue measure and integration, measurable functions and sets, convergence theorems, Lebesgue differentiation theorem, elements of Hilbert space and Banach space, Riesz's representation theorem, Sobolev space and its applications to partial differential equations.
   d. Course Grade: A
   e. Credits: 4

11. MATH-SHU 234 Mathematical Statistics (2022 Fall)
   a. Course Instructor: Shuyang Ling
   b. Course Texts: Wasserman, Larry. All of statistics: a concise course in statistical inference. Vol. 26. New York: Springer, 2004.
      Schervish, Mark J., and Morris H. DeGroot. Probability and statistics. Vol. 563. London, UK:: Pearson Education, 2014.
   c. Course Description:This course offers an introduction to mathematical statistics. It covers the essential topics of statistics including point estimation, interval estimation, Bayesian inference, hypothesis testing, and linear and logistic regression. This class requires a good prior understanding of probability theory, calculus, and linear algebra.
   d. Course Grade: A
   e. Credits: 4

12. MATH-SHU 345 Introduction to Stochastic Processes (2022 Fall)
    a. Course Instructor: Pedro Antonio Santoro Salomão
    b. Course Texts: Lawler, Gregory F. Introduction to stochastic processes. CRC Press, 2018. Williams, David. Probability with martingales. Cambridge university press, 1991.
    c. Course Description:This is an introductory course in stochastic processes. Stochastic processes are widely used as modeling tools in many fields of application, including finance, physics, biology and engineering. The course will include an introduction to measure theory, the basic theory of discrete and continuous time Markov chains,branching processes, Poisson point processes, Brownian motion and martingales. In the final part of the course, more advanced topics such as stochastic integrals, free fields are covered.
    d. Course Grade: A
    e. Credits: 4

13. MATH-SHU 348 Honors Algebra I (2022 Fall)
    a. Course Instructor: Shengkui Ye
    b. Course Texts: Michael, Artin. Algebra 2nd edition. Pearson, 2010.
    c. Course Description:This introduction to abstract algebra is a rigorous study of groups and rings. Topics covered include permutations, symmetric and linear groups, quotient groups and cosets, First Isomorphism, group product, group actions and the Sylow theorems, classification of finitely generated abelian groups, polynomial, quotient rings, ideals, principal ideal domains, unique factorization, and the Nullstellensatz.
    d. Course Grade: A
    e. Credits: 4

14. MATH-SHU 997 Independent Study: Mathematics (2022 Fall)
    a. Course Instructor: Pedro Antonio Santoro Salomão
    b. Course Texts: Evans, Lawrence C. Partial differential equations. Vol. 19. American Mathematical Society, 2022.
    c. Course Description:This is an Independent Study program on 2-4 chapters in Evans Partial Differential Equations. I presented to professor Salomão the topics on Laplace, Heat and Wave equations, including Existence, Uniqueness, Regularity theories, Maximum Principles and Harnack's Inequality. I did self-study in method of characteristics and Transform methods. In the final weeks, we studied Hamilton-Jacobi equations and took a quick glance at symplectic geometry. I delivered a final report on Laplace, Wave, Heat equations.
    d. Course Grade: A
    e. Credits: 2

15. MATH-UA 349 Honors Algebra II (2023 Spring)
    a. Course Instructor: Bruce Kleiner
    b. Course Texts: Michael, Artin. Algebra 2nd edition. Pearson, 2010.
       Serre, Jean-Pierre. Linear representations of finite groups. Vol. 42. New York: Springer, 1977.
    c. Course Description:Principal ideal domains, polynomial rings in several variables, unique factorization domains. Modules. Fields, finite extensions, constructions with ruler and compass. Galois theory, solvability by radicals. Group Representation and Character Theory.
    d. Course Grade: A
    e. Credits: 4

16. MATH-UA 375 Topology (2023 Spring)
    a. Course Instructor: Efe A. Ok
    b. Course Texts: Ok, Efe A. Applied Point Set Topology.
    c. Course Description:Topics cover the basic theories of metric spaces, topological spaces, manifolds, quotient spaces, connectedness, compactness, Tychonoff's theorem, separation axioms, normal spaces, Urysohn's lemma, with little exposure to covering spaces, fundamental groups, and homotopy groups. The final part of the course will be devoted to topological groups and topological fixed point theory and invariance of dimension.
    d. Course Grade: A-
    e. Credits: 4

17. MATH-UA 377 Differential Geometry (2023 Spring)
    a. Course Instructor: Chao Li
    b. Course Texts: Do Carmo, Manfredo P. Differential geometry of curves and surfaces: revised and updated second edition. Courier Dover Publications, 2016.
    c. Course Description:Parametrized curves, curvature and torsion, Frenet frames and the isoperimetric inequality, the Jacobian and differential of a map, regular surfaces, tangent planes, differential and area, the Gauss map and the curvature, Gauss's theorem, covariant differentiation, geodesics and parallel transport, the Gauss-Bonnet theorem.
    d. Course Grade: A
    e. Credits: 4

18. MATH-GA 2440 Real Variables II (2023 Spring)

   a. Course Instructor: Jalal Shatah
   b. Course Texts: Folland, Gerald B. Real analysis: modern techniques and their applications. Vol. 40. John Wiley & Sons, 1999.
      Lax, Peter D. Functional analysis. Vol. 55. John Wiley & Sons, 2002.
   c. Course Description:Convolution and Young's Inequality. Marcinkiewicz Interpolation. Maximal Function, weak Lp. BV Functions and Lebesgue Differentiation. Rearrangement Inequalities. Basics of Functional Analysis (Hahn-Banach, Closed Graph). Operator Theory. Basics of Fourier Analysis. Distributions. Sobolev Spaces, Sobolev Embeddings. Hardy's Inequalities and Poincaré inequality.
   d. Course Grade: A-
   e. Credits: 3

19. MATH-GA 2500 Partial Differential Equations (2023 Spring)

   a. Course Instructor: Alexander Dunlap
   b. Course Texts: Evans, Lawrence C. Partial differential equations. Vol. 19. American Mathematical Society, 2022.
   c. Course Description:Topics to be covered include: tools from analysis (Fourier transform, distributions, and Sobolev spaces, including embedding and trace theorems); linear elliptic pde (weak solutions, regularity, Fredholm alternative, symmetry and self-adjointness, completeness of eigenfunctions; maximum principles and Perron's method; boundary integral methods); selected methods for solving nonlinear elliptic pde (fixed point theorems, variational methods); parabolic and hyperbolic pde (energy methods, semigroup methods, steepest-descent pde's); viscosity solutions of first-order equations.
   d. Course Grade: A
   e. Credits: 3

20. MATH-UA 998 Independent Study: Mathematics (2023 Summer)
    a. Course Instructor: Chao Li
    b. Course Texts: Han, Qing, and Fanghua Lin. Elliptic partial differential equations. Vol. 1. American Mathematical Soc., 2011.
    c. Course Description:This is a Summer term Independent Study program on Elliptic Partial Differential Equations by Lin. I did weekly-presentations to professor Li on Maximum Principles, Weak Solutions, De Giorgi-Nash-Moser, Hölder and Harnack's Inequality, Schauder Estimate, Viscosity Solution, Existence of Solutions, Perron's Method and Lax-Milgram. We managed to finish up the book and write short reports on fully non-linear elliptic PDEs.
    d. Course Grade: A
    e. Credits: 2

21. MATH-GA 2650-002 Advanced Topics in Analysis: Introduction to Ergodic Theory (2023 Fall)
    a. Course Instructor: Lai-sang Young
    b. Course Texts: Cornfeld, Isaac P., Sergei Vasilevich Fomin, and Yakov Grigor'evǐc Sinai. Ergodic theory. Vol. 245. Springer Science & Business Media, 2012.
       Walters, Peter. An introduction to ergodic theory. Vol. 79. Springer Science & Business Media, 2000.
    c. Course Description:This course is an introduction to ergodic theory, a probabilistic approach to dynamical systems. Topics include ergodicity, the Ergodic Theorems, mixing properties, entropy; ergodic theory of continuous and differentiable maps including Lyapunov exponents.
    d. Course Grade: A
    e. Credits: 3

22. MATH-GA 2650-003 Advanced Topics in Analysis: Analysis and Applications of Harmonic Maps (2023 Fall)
    a. Course Instructor: Fanghua Lin
    b. Course Texts: Lin, Fanghua, and Changyou Wang. The analysis of harmonic maps and their heat flows. World Scientific, 2008.
    c. Course Description:This is a special topics course in Analysis/PDEs on the analytic aspect of the theory of harmonic maps, in particular, the energy minimizing, energy stationary and weakly harmonic maps and the related regularity (partial regularity) theory. We shall also study the singular sets of such maps, and also discuss the associated gradient and other type flows. Applications and related theory of liquid crystals and Ginzburg-Landau approximations will be also addressed.
    d. Course Grade: A
    e. Credits: 3

23. MATH-UA 997 Independent Study: Mathematics (2023 Fall)
    a. Course Instructor: Vlad Vicol & Fanghua Lin
    b. Course Texts: Buckmaster, Tristan, and Vlad Vicol. "Convex integration and phenomenologies in turbulence." EMS Surveys in Mathematical Sciences 6.1 (2020): 173-263. Han, Qing, and Fanghua Lin. Elliptic partial differential equations. Vol. 1. American Mathematical Soc., 2011.
    c. Course Description:This is a joint Independent Study program with Prof. Vicol and Lin. For Vicol, I read 3 of his papers on convex integration schemes and presented them to him. The focus was on the Onsager's Theorem, Intermittent Navier-Stokes and Intermittent Euler's. I write a report for each presentation and answer questions from the author. For Lin, I asked questions on Moving Plane Method, Krylov-Safonov, Wiener Criterion and capacity, Perron's Method, as continuation of the summer Independent Study with professor Li.
    d. Course Grade: A
    e. Credits: 2

24. MATH-SHU 997 Independent Study: Mathematics (2023 Fall)
    a. Course Instructor: Vahagn Nersesyan
    b. Course Texts: Kuksin, Sergei, and Armen Shirikyan. Mathematics of two-dimensional turbulence. Vol. 194. Cambridge University Press, 2012.
    Bedrossian, Jacob, and Vlad Vicol. The mathematical analysis of the incompressible Euler and Navier-Stokes equations: an introduction. Vol. 225. American Mathematical Society, 2022.
    c. Course Description:This is Independent Study serving as Senior Thesis Requirement, and a continuation of our summer DURF program. After reading through Incompressible Eulers and NS, and Introduction to Stochastic Calculus by Evans, we read Stochastic Navier-Stokes in 2D. Topics include Polish space, Prokhorov theorem, Bogoluvbov-Krylov, and NS with random-forced kicks and white in-time noise. The goal is to use Bogoluvbov-Krylov to show the existence of stationary measures for the above stochastically forced NS systems.
    d. Course Grade: A
    e. Credits: 4