List of Courses

Yunsheng Li *UCSD Ph.D. Applicant in Mathematics, Fall 2024*

Course Number	Title	Instructor	Grade	Subjects Covered	Textbooks Used
MA101a	Mathematical Analysis I	Fumin Ma	A+	Rigorous treatment of Calculus: sequences of numbers, continuous functions, differential functions, Taylor theorem.	Gengzhe Chang and Jihuai Shi, *Mathematical Analysis Tutorial (Volumes 1 and 2)*, Higher Education Press.
MA103A	Linear Algebra I-A	Yimao Chen	A		Gilbert Strang, *Linear Algebra and Its Applications, 4th Edition*, Thomson Brooks/Cole.
MA102a	Mathematical Analysis II	Fumin Ma	A+	Riemann integral, topology of Euclidean spaces, multi-variable differentiation and integration.	Gengzhe Chang and Jihuai Shi, *Mathematical Analysis Tutorial (Volumes 1 and 2)*, Higher Education Press.
MA104b	Linear Algebra II	Yimao Chen	A	Vector spaces, linear maps, eigenvalues, singular values, spectral theorem, Jordan form.	Sheldon Axler, *Linear Algebra Done Right, 3rd Edition*, Springer.
MA231	Mathematical Analysis III (H)	Fumin Ma	B-	Power series, improper integral, Fourier analysis, integration on curves and surfaces.	Gengzhe Chang and Jihuai Shi, *Mathematical Analysis Tutorial (Volumes 1 and 2)*, Higher Education Press.
MA323	Topology	Yifei Zhu	A+	Topological spaces, metric spaces, connectedness and compactness, separation axioms, fundamental group, Seifert-van Kampen theorem.	James Munkres, *Topology, 2nd Edition*, Pearson.
MA209-16	Elementary Number Theory	Yong Hu	A	Divisibility and congruences of integers quadratic residues and reciprocity, arithmetic functions, Minkowski's theorem.	Kenneth H. Rosen, *Elementary Number Theory and Its Application, 6th Edition*, Pearson; Tom M. Apostol, *Introduction to Analytic Number Theory*, Springer.
MA219	Abstract Algebra (H)	Zhan Li	A	Group theory, commutative rings, fields, Galois theory.	Joseph J. Rotman, *First Course in Abstract Algebra with Applications, 2nd Edition*, Prentice Hall; Serge Lang, *Algebra, 3rd Edition*, Springer.
MAT8021	Algebraic Topology	Yong Hou	A-	Fundamental group, covering spaces homology and cohomology theory, Lefschetz fixed point theorem, Poincaré duality, Khovanov homology as a course project.	Allen Hatcher, *Algebraic Topology*, Cambridge University Press.
MA232	Complex Analysis (H)	Ingrid Irmer	A+	Holomorphic functions, meromorphic functions, Cauchy's residue theorem, argument principle, multivalued functions, entire functions, conformal maps, Riemann mapping theorem.	Elias M. Stein and Rami Shakarchi, *Princeton Lectures in Analysis II, Complex Analysis*, Princeton University Press.
MA327	Differential Geometry	Shaochuang Huang	A+	Curves and surfaces in 3-dim Euclidean spaces, Gauss map, curvatures, geodesics, Gauss-Bonnet theorem.	Mantredo P. do Carmo, *Differential Geometry of Curves and Surfaces*, Prentice-Hall.

MA230	Ordinary Differential Equations A (H)	Jana Hertz	A+	First-order differential equations, linear differential equations, systems of first-order linear differential equations, existence and uniqueness of solutions of Cauchy problems, fundamental matrices, nonlinear differential equations, stability.	William E. Boyce, Richard C. Diprima and Douglas B. Meade, *Differential Equations and Boundary Value Problems, 11th Edtion*, Wiley; Tongren Ding and Chengzhi Li, *Ordinary Differential Equations Tutorial, 2nd Edition*, Higher Education Press.
MA337	Real Analysis (H)	Yannan Qiu	A	Lebesgue integral and differentiation, measure theory, L^p spaces, generalized functions.	Elias M. Stein and Rami Shakarchi, *Princeton Lectures in Analysis III, Real Analysis*, Princeton University Press; Terence Tao, *An Introduction to Measure Theory*; Terence Tao, *An Epsilon of Room, I: Real Analysis: pages from year three of a mathematical blog*, AMS.
MAT7063	Differential Topology	Stavros Garoufalidis	A+	Smooth manifolds, tangent and cotangent bundles, submanifolds, Sard's theorem, vector fields, flows, Lie groups and Lie algebras, Lie derivatives, exponential maps, orientation and integration, Riemannian manifolds, de Rham cohomology.	John M. Lee, *Introduction to Smooth Manifolds, 2nd Edition*, Springer.
MA336	Partial Differential Equations (H)	Shumo Cui	A	Transportation equation, heat equation, Laplace equation, Poisson equation, wave equation, maximum and minimum principle.	Tao Tang and Xuefeng Wang, *Lecture Notes on Partial Differential Equations*; William E. Boyce, Richard C. Diprima and Douglas B. Meade, *Differential Equations and Boundary Value Problems, 11th Edtion*, Wiley.
MA321	Representations of Groups	Qin Li	A+	Representation theory of finite groups, character theory, Fourier analysis, Burnside's theorem, Macky's irreducibility criterion, representation theory of symmetric groups.	Benjamin Steinberg, *Representatino Theory of Finite Groups, An Introductory Approach*, Springer; Jean-Pierre Serre, *Linear Representations of Finite Groups, Translated by Leonard L. Scott*, Springer.
MAT7017	Commutative Algebra	Qin Li	A+	Hilbert's nullstellensatz, Noetherian and Artinian rings, Zariski topology, Krull dimension and transcendence degree, localization, principal ideal theorem, integral extension, Jacobian criterion.	Gregor Kemper, *A Course in Commutative Algebra*, Springer; M. F. Atiyah and I. G. Macdonald, *Introduction to Commutative Algebra*, Addison-Wesley.
MAT7003	Functional Analysis (PG)	Raul Ures	A+	Hahn-Banach theorem, weak and weak* topologies, compact operators, Fredholm operators, spectral theory, unbounded self-adjoint operators.	Peter D. Lax, *Functional Analysis*, Wiley; Tosio Kato, *Perturbation Theory for Linear Operators*, Springer.
MA302	Functional Analysis	Zhan Li	A+	Normed linear spaces, Banach spaces, Hilbert spaces, dual spaces, Hahn-Banach Theorem, uniformly bounded principle, open mapping theorem, closed graph theorem.	Martin Schechter, *Principles of Functional Analysis, 2nd Edition*, AMS.

MA212	Probability and Statistics	Jie Xiong	A	random variables, expectation, conditioning, standard distributions (Binomial, geometric, hypergeometric, Poisson, exponential, normal), limit theorems, parametric estimations.	John A. Rice, *Mathematical Statistics and Data Analysis, 3rd Edition*, Cengage Learning.
MAT7065	Several Complex Variables and Complex Geometry	Zhan Li	A-	Multi-variable holomorphic functions, pseudo-convexity, plurisubharmonic functions, L^2 estimates and extension problems, Bergman kernels, Hodge theory, Kahler manifolds.	Takeo Ohsawa, *Analysis of Several Complex Variables*, AMS; Daniel Huybrechts, *Complex Geometry, An Introduction*, Springer.
MA423	Seminar in Geometry and Topology	Yifei Zhu	P	Differential forms, de Rham cohomology, Mayer-Vietoris sequences, Poincaré lemmas, Mayer-Vietoris argument (Künneth formula, Poincaré duality), cohomology theory on vector bundles, Mayer-Vietoris principle and its applications, presheaves and Čech cohomology, application of de Rham cohomology in quantum mechanics (topological phase).	Raoul Bott and Loring W. Tu, *Differential Forms in Algebraic Topology*, Springer.
MAT8020	Abstract Algebra II	Hui Gao	B	Group theory (Jordan-Holder theorem, Sylow theorem), classification of finite abelian groups, ring theory (UFD, PID), modules (chain conditions), fields, Galois theory.	Thomas W. Hungerford, *Algebra*, Springer.
MA306	Algebraic Geometry	Hang Zhao	A-	Prevarieties, spectrum of rings, schemes, fiber product, schemes over fields, tangent spaces, smooth morphisms, regular schemes, normal schemes, vector bundles, divisors.	Ulrich Görtz and Torsten Wedhorn, *Algebraic Geometry I, Schemes*, Vieweg+Teubner; Joe Harris, *Algebraic Geometry, A First Course*, Springer Science+Business Media.
MAT7075	Algebraic Geometry	Longting Wu	P	Affine varieties, sheaves of regular functions, varieties, projective varieties, Grassmannian, birational maps, blow up, smooth varieties, schemes, sheaves of modules, quasi-coherent sheaves.	Andreas Gathmann, *Algebraic Geometry, Class Notes TU Kaiserslautern 2021/22*; Robin Hartshorne, *Algebraic Geometry*, Springer.
MAT8024	Differential Manifolds	Ingrid Irmer	P	Smooth manifolds, tangent and cotangent bundles, vector bundles, submanifolds, vector fields, flows, orientation and integration, Riemannian manifolds, principal bundles.	John M. Lee, *Introduction to Smooth Manifolds, 2nd Edition*, Springer.
MAT7059	Topics in Algebra and Number Theory	Efim Zelmanov	A-	Free semigroups, free associative algebras, confluent reduction systems, Gröebner-Shirshov bases theorem, Schreier systems, Dehn functions, free products, Ping-Pong lemma, residually finite groups, Wreath products, Burnside's problems, tensor products, Brauer group, rings of fractions, ultraproducts.	No textbook. Taught with Efim Zelmanov's hand-written lecture notes. For the contents of the course, see my notes at `https://li-yunsheng.github.io/Notes/Notes_of_Zelmanov_s_Algebraic_Lectures.pdf`.

MAT7064	Topics in Geometry and Topology	Ziming Ma	A	Riemannian manifolds, connection, curvature and torsion forms, Riemannian connection, Bianchi identities, exponential maps, curvatures, geodesics, Hopf-Rinow theorem, Jacobi fields, Rauch comparison theorem, Cartan-Ambrose-Hicks theorem.	Clifford Henry Taubes, *Differential Geometry, Bundles, Connections, Metrics and Curvature*, Oxford University Press; S. Gallot, D. Hulin, and J. Lafontaine, *Riemannian Geometry*, Springer-Verlag.
MAT7076	Algebraic Curves	Zhan Li	A+	Mainly focusing on Riemann surfaces: Riemann surfaces, projective curves, holomorphic functions, meromorphic functions, examples (complex tori, hyperelliptic Riemann surfaces), differential forms, integration, divisors, Riemann-Roch theorem and its applications.	Rick Miranda, *Algebraic Curves and Riemann Surfaces*, AMS.
MAT8025	Introduction to Dynamic Systems		In Progress		Michael Brin and Garrett Stuck, *Introduction to Dynamical Systems*, Cambridge University Press; Boris Hasselblatt and Anatole Katok, *A First Course in Dynamics with a Panorama of Recent Developments*, Cambridge University Press; Boris Hasselblatt and Anatole Katok,*Introduction to the Modern Theory of Dynamical Systems*, Cambridge University Press.