Brian J. Lee

Transcript of Technical Coursework

Last updated May 17, 2026.

Subjects marked **(G)** are graduate-level. Course numbers follow MIT's most recent renumbering; the original numbers are listed in parentheses when applicable.

MIT

Computer Science — Systems, Programming, and Algorithms

A 6.1910 (6.004), *Computation Structures*, S. Hanono Wachman, D. Sanchez.
Undergraduate introduction to digital systems and computer architecture. Combinational and sequential circuits, hardware description languages and synthesis, instruction-set abstraction for programmable hardware, single-cycle and pipelined RISC processor implementations, multi-level memory hierarchies, virtual memory, exceptions, I/O, and parallel systems.

A 6.1010 (6.009), *Fundamentals of Programming*, D. S. Boning, A. Chlipala, S. Devadas, A. Hartz.
Introduction to programming in Python, with emphasis on programming methodology, complexity management, algorithmic techniques, data abstraction, testing, and debugging. Data types, recursion, functional and object-oriented design patterns, large-scale software design.

A- 6.1220J (6.046J), *Design and Analysis of Algorithms*, E. Demaine, M. Goemans, S. Raghuraman.
Intermediate Algorithms class. Sorting, search trees, heaps, hashing; divide-and-conquer; dynamic programming; greedy algorithms; amortized analysis; graph algorithms and shortest paths. Advanced topics include network flow, computational geometry, number-theoretic algorithms, polynomial and matrix calculations, caching, parallel computing, and randomized algorithms with rigorous probabilistic analysis.

Computer Science — Machine Learning

A (G) 6.7900 (6.867), *Machine Learning*, S. Sra, T. Jaakkola, P. Agrawal.
Introductory graduate machine learning course from the perspective of statistical inference. Supervised Learning (Linear and Additive Models, Generalization, UAH, Regularization and Sparsity, PAC Learning, VC Dimension), Neural Networks, Robustness, Unsupervised Learning (Dimensionality Reduction, Self-Supervised Learning, Contrastive Learning), Generative Modeling, Variational Inference, Co-Variate Shift, Few Shot Learning, Reinforcement Learning

A (G) 6.8300 (6.869), *Advances in Computer Vision*, P. Isola, W. T. Freeman.

Graduate computer vision course centered on geometry and deep learning. Image formation, multi-view geometry (classical and learned), differentiable rendering, neural scene representations, correspondence and optical flow, generative modeling for images and video (including diffusion models and conditional probabilistic models), contrastive and masking-based representation learning, and vision for embodied agents.

A **6.4210**, *Robotic Manipulation*, T. Lozano-Perez.

Autonomous robotic manipulation in unstructured environments. Rigid-body kinematics and dynamics, perception (both 3D-geometric and deep-learning-based), grasp synthesis, trajectory optimization, collision-free and contact-rich motion planning, task-and-motion planning, planning under uncertainty, and model-based and learning-based control. Project work uses the Drake simulator on cloud-based robotic platforms.

A+ **(G) 6.S978**, *Deep Generative Models*, K. He.

Graduate seminar on deep generative modeling. Variational autoencoders, autoregressive models, normalizing flows, generative adversarial networks, score-based and diffusion models, consistency models, flow matching, and large-scale applications in vision, video, geometry, robotics, biology, and material science. Combines instructor lectures, guest lectures, and student paper presentations covering the latest research frontiers.

A **(G) 6.S966 (8.S301)**, *Symmetry and its Application to Machine Learning*, T. Smidt.

Graduate seminar on group representation theory as a toolkit for building symmetry-preserving algorithms in machine learning, with applications in physics, chemistry, and geometry. Topics: Euclidean and permutation groups; regular, reducible, and irreducible representations; tensor products and Clebsch-Gordan coefficients; statistics of group-representation vector spaces; equivariant neural networks (E(3)-equivariant networks, message passing on geometric graphs); and mechanisms for symmetry breaking.

Probability and Statistics

A **(G) 6.7810 (6.438)**, *Algorithms for Inference*, D. Shah, M. Wainwright.

Graduate introduction to inference via probabilistic graphical models. Directed and undirected graphical models and factor graphs over discrete and Gaussian distributions; hidden Markov models and linear dynamical systems; sum-product, junction-tree, and Viterbi algorithms; forward-backward, Kalman filtering and smoothing; variational methods, mean-field theory, loopy belief propagation; sampling and Glauber dynamics with mixing-time analysis; parameter and structure learning (Baum-Welch, Chow-Liu); particle filtering and graph neural networks.

A **(G) 6.7480**, *Information Theory: From Coding to Learning*, Y. Polyanskiy.

Graduate information theory course centered on applications to modern statistics, machine learning, and computer science. Information measures (entropy, mutual information, Fisher information, f-divergences) and their convex duality and variational characterizations; hypothesis testing and large deviations; universal compression; channel coding (capacity, dispersion, finite-blocklength

bounds); rate-distortion and lossy compression; strong data-processing inequalities. Applications to PAC-Bayes bounds, GANs, tokenization and quantization of LLMs, non-parametric estimation, and communication and computation with noise.
Textbook: Polyanskiy and Wu, *Information Theory: From Coding to Learning*

A **(G) 18.675**, *Theory of Probability*, K. Kavvadias.
Graduate-level introduction to measure-theoretic probability. Random variables and Lebesgue integration; modes of convergence; laws of large numbers; characteristic functions; sums of independent random variables and the central limit theorem; infinitely divisible laws and Lévy processes; Brownian motion; conditioning; martingales and their convergence theorems.
Textbook: Durrett, *Probability: Theory and Examples*; Kallenberg, *Foundations of Modern Probability.*

A- **(G) 18.676**, *Stochastic Calculus*, N. Sun.
Graduate stochastic analysis: Continuous-time martingales and the Doob-Meyer decomposition; quadratic variation; stochastic integration with respect to Brownian motion and continuous semimartingales; Itô's formula; stochastic differential equations; Girsanov's theorem; martingale representation; Markov Processes; Local times and the Tanaka formula;
Textbook: Le Gall, *Brownian Motion, Martingales, and Stochastic Calculus.*

Controls

A+ **6.3100 (6.302)**, *Feedback System Design and Control Theory*, J. White and A. Megretski.
Learn-by-design introduction to classical and modern control. Laplace and Z-transforms, transfer functions and frequency response, stability, tracking and disturbance rejection, root-locus, PID and lead-lag compensation, state-space methods (eigenvalue placement, LQR, observer-based design), system identification and regression, and model-predictive control. Hands-on labs design and build feedback controllers for motors, propeller-levitated arms, magnetic levitators, and two-wheeled vehicles.

Misc.

A **6.3260J/14.15**, *Networks*, A. Wolitzky.
Introduction to modeling and analysis of networked systems across economics, engineering, and the social sciences. Graphs and random-graph models; centrality, contagion, and diffusion; strategic network formation; games on networks; learning in networks; matching, market design, and information aggregation; epidemics and cascading failures in interdependent networks.

A **6.UAT**, *Oral Communication*, T. Eng, H. Balichandran.
Oral communications class for technical speaking.

A **21G.109,110,113**, *Chinese III-V (Streamlined)*, K. Zhou and P. Gao.
Streamlined mandarin sequence for heritage speakers.

A **21G.120**, *Business Chinese*, P. Gao.
Advanced mandarin for business in Mandarin-speaking environments.