# SCHOOL OF HUMANITIES AND SCIENCES

## FINANCIAL MATHEMATICS

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This is an interdisciplinary program that provides a master's level education in applied and computational mathematics, statistics, and financial applications to individuals with strong mathematical skills. The departments of Mathematics and Statistics, in close cooperation with the departments of Economics, and Management Science and Engineering, as well as the Graduate School of Business, provide many of the basic courses.

### GRADUATE PROGRAM IN FINANCIAL MATHEMATICS

The department offers a Master of Science in Financial Mathematics. University requirements for the M.S. are described in the "Graduate Degrees" section of this bulletin.

### MASTER OF SCIENCE IN FINANCIAL MATHEMATICS

*Admission*—To be eligible for admission, students are expected to have taken the following courses or their equivalent:
1. Linear algebra at the level of MATH 104.
2. Advanced calculus (real analysis) at the level of MATH 115.
3. Basic ordinary and partial differential equations at the level of MATH 131 and 132 (basic partial differential equations).
4. Probability at the level of STATS 116; theory of statistics at the level of STATS 200; and stochastic processes at the level of STATS 217 or, preferably, MATH 136/STATS 219.
5. Computer programming at the level of CS 106A,B,or X.

Some of these courses are offered as summer courses and may be taken by candidates lacking the required background.

Candidates for admission must take the general Graduate Record Examination and preferably the subject test in Mathematics as well. Information about these exams can be found at http://www.gre.org.

*Requirements*—The program requires that the student take 45 units of work. Of these 45 units, six courses must be taken from the list of required courses and six must be taken from the list of elective courses, available on the program web site at http://finmath.stanford.edu/academics/required.html and http://finmath.stanford.edu/academics/electives.html. These courses must be taken for a letter grade, but students may elect to take one of the 12 courses credit/no credit. An overall grade point average (GPA) of 2.75 is required. A seminar in Financial Mathematics is an integral part of the program and an opportunity to interact with leading academic and industry speakers (for credit, enroll in STATS 239AB). There is no thesis requirement.

Any remaining units required to complete the 45 total must be taken from the following options:
1. from the approved list of electives with emphasis on computation, information technology, or finance
2. STATS 200, STATS 217, STATS 218, MATH 131, MATH 132, MATH 202 or ECON 140
3. additional (practical) CS courses
4. in the form of an industrial internship in the Bay Area or elsewhere, with the approval and supervision of a faculty member. A written report must be submitted upon completion of the internship. Students who choose to take credit for practical training must sign up for Stats 297 (1-3 units).

Ordinarily, four quarters are needed to complete all requirements.

*Required Courses*—For the M.S. degree in Financial Mathematics, students must fulfill six of the following required courses:
1. In stochastic processes and statistics:
   a. MATH 236. Introduction to Stochastic Differential Equations
   b. STATS 241. Financial Modeling and Risk Management
2. In differential equations, simulation, and computing:
   a. MATH 227. Partial Differential Equations and Diffusion Processes
      *or* STATS 362. Monte Carlo Sampling
   b. MATH 239. Computation and Simulation in Finance
3. In finance and economics:
   a. MS&E 347. Credit Risk: Modeling and Management
      *or* MATH 240. Topics in Financial Mathematics: Fixed Income Models
   b. MATH 238/STATS 250. Mathematical Finance

Courses that are equivalent to the above and have been taken previously may be waived by the adviser, in which case they must be replaced by elective courses in the same subject area.

The requirements must be met within two years of entering the program, or four academic quarters for those already at Stanford.

*Elective Courses*—Each candidate must take at least six approved elective courses from the list below.
1. At least two electives in Probability, Stochastic Processes or Statistics from:
   *Statistics:*
   STATS 202. Data Analysis
   STATS 206. Applied Multivariate Analysis
   STATS 207. Introduction to Time Series Analysis
   STATS 219. Stochastic Processes (Same as MATH 136)
   STATS 220. Continuous Time Stochastic Control
   STATS 237. Time Series Modeling and Forecasting
   STATS 240. Statistical Methods in Finance
   STATS 252. Data Mining and Electronic Business
   STATS 305. Introduction to Statistical Modeling
   STATS 306A. Methods for Applied Statistics
   STATS 310A/B/C. Theory of Probability
   STATS 315A/B/C. Modern Applied Statistics
   STATS 317. Stochastic Processes
   STATS 318. Modern Markov Chains
   STATS 324. Multivariate and Random Matrix Theory
   STATS 343. Time Series Analysis
   EE 376A. Information Theory
   *Mathematics:*
   MATH 136. Stochastic Processes (Same as STATS 219)
   MATH 205A/B. Real Analysis
   MATH 237. Stochastic Equations and Random Media
   *Economics:*
   ECON 275. Time Series Econometrics
2. At least two electives in Differential Equations, Optimization, Simulation, or Computing from:
   *Mathematics:*
   MATH 220. PDE of Applied Mathematics
   MATH 222A. Computational Methods for Fronts, Interfaces, and Waves
   MATH 256A,B. Partial Differential Equations

MATH 261A,B. Functional Analysis
MATH 266. Time Frequency Analysis and Wavelets
*Statistics:*
STATS 212. Applied Statistics with SAS
STATS 227. Statistical Computing
STATS 235. Decision Making in Financial Services
STATS 322. Function Estimation in White Noise
*Computer Science:*
CS 106B. Programming Abstractions
CS 106X. Programming Abstractions (Accelerated)
CS 193D. C++
CS 229. Machine Learning
CS 249A. Object-Oriented Programming: A Modeling and Simulation Perspective
CS 261. Optimization and Algorithmic Paradigms
CS 339. Topics in Numerical Analysis
CS 365. Randomized Algorithms
*Management Science and Engineering:*
MS&E310. Linear Programming
MS&E 311. Optimization
MS&E 312. Advanced Methods in Numerical Optimization
MS&E 313. Vector Space Optimization
MS&E 323. Simulation Theory
MS&E 339. Approximate Dynamic Programming
MS&E 348. Optimization of Uncertainty and Applications in Finance
MS&E 351. Dynamic Programming and Stochastic Control
*Computational and Mathematical Engineering:*
CME 340. Computational Methods in Data Mining
*Graduate School of Business:*
OIT 667. Revenue Management*

3. At least two electives in Economics or Finance from:
*Economics:*
ECON 202N-203N. Core Economics: Modules 1 and 2, 5 and 6 (for non-Economics Ph.D. students)
ECON 210. Core Economics: Modules 3 and 7
ECON 211. Core Economics: Modules 11 and 12
ECON 269. International Financial Markets and Monetary Institutions
ECON 281. Economics of Uncertainty
ECON 284. Topics in Dynamic Economics
*Mathematics:*
MATH 180. Introduction to Financial Mathematics
*Statistics:*
STATS 243. Introduction to Mathematical Finance (summer version of MATH 180)
*Management Science and Engineering:*
MS&E 242H. Investment Science Honors
MS&E 247G. International Financial Management (Same as GSB F323)*
MS&E 247S. International Investments
MS&E 272. Entrepreneurial Finance
MS&E 341. Advanced Economic Analysis
MS&E 342. Advanced Investment Science
MS&E 345. Advanced Topics in Financial Engineering
MS&E 444. Investment Practice*
MS&E 445. Projects in Wealth Management
*Graduate School of Business:*
GSB F320. Debt Markets*
GSB F326. Derivative Securities*
GSB F328. Portfolio Management*
GSB F620. Financial Markets I*
GSB F621. Financial Markets II*
GSB F622. Dynamic Asset Pricing Theory*
GSB F629. Tax and Finance Seminar*
MGTECON 600. Microeconomic Analysis*
MGTECON 604. Advanced Econometrics*
MGTECON 609. Applied Econometric and Economics Research*

*indicates courses of limited enrollment and/or that instructor's preapproval is needed for registration.

Other elective courses may be authorized by the program director if they provide skills relevant to financial mathematics and do not overlap with courses in the candidate's program.

*This non-official pdf was extracted from the* Stanford Bulletin 2009-10 *in August 2009 and is not updated to reflect corrections or changes made during the academic year.*

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