

Master's Degree in Management Science and Engineering

September 2011

The program of Master of Science in Management Science and Engineering (MS&E) prepares individuals for a life-long career addressing critical technical and managerial needs in private and public decision making. Department requirements for the M.S. degree provide breadth across some of the areas of the department, and flexibility for meeting individual objectives of depth in a particular area of concentration. The Master's degree may be a terminal degree program with a professional focus, or a preparation for a more advanced graduate program. The M.S. degree can normally be earned in one academic year (three academic quarters) of full-time work, although students may choose to continue their education by taking additional MS&E courses beyond that year. Students completing 15 or more units per quarter can easily complete the degree in three quarters. Students completing 8-10 units per quarter can complete the degree in five quarters. Background requirements, taken in addition to degree requirements, must be met by students who have had insufficient course work in mathematical sciences, computer science, engineering and/or natural sciences.

Description of the Master's Program

Students in the Master of Science program in MS&E must take a minimum of 45 unduplicated course units at Stanford as follows:

- at least five core courses (breadth)
- at least three other courses in an area of concentration of their choice (depth)
- a course in probability unless a college-level course in probability has already been passed
- a project course requirement
- the remaining units in elective courses.

Background requirements

Students must have had or must take the following (or equivalent) courses before the M.S. degree is conferred: Mathematics 41, 42, 51 (one full year of college-level calculus), CS 106A (one quarter of computer programming), and an additional 15 units (one year) of engineering, mathematical sciences, or natural sciences. These courses do not count toward the 45 units of the M.S. degree. Courses taken to meet MS&E background requirements may be at either the undergraduate or graduate level, and may be taken as credit/no credit. These additional background requirements would typically be met by students who have a Bachelor's degree in engineering, mathematical sciences or natural sciences.

Core courses (breadth)

M.S. students must take at least five courses out of the following eleven options:

- Dynamic Systems (MS&E 201) or Stochastic Decision Models (MS&E 251)
- Linear and Nonlinear Optimization (MS&E 211)
- Probabilistic Analysis (MS&E 220)
- Stochastic Modeling (MS&E 221) or Simulation (MS&E 223)
- Economic Analysis (MS&E 241)
- Decision Analysis I (MS&E 252) or Engineering Risk Analysis (MS&E 250A)

- Accounting (MS&E 240)* or Investment Science (MS&E 242/242H/242S)*
- Inventory Control and Production Systems (MS&E 261)*
- Organizational Behavior (MS&E 280)*
- Global Entrepreneurial Marketing (MS&E 271)*
- Strategy in Technology-Based Companies (MS&E 270)*

Students may not waive core courses. They may, however, petition to substitute an approved, more advanced MS&E course in the same area. Courses used to satisfy the core requirement must be taken for a letter grade, must be taken for a minimum of three units each, and may not also be used to satisfy the concentration requirement. Courses marked with an * are limited enrollment courses.

Courses in an area of concentration (depth)

Students must complete a departmentally approved set of three or more letter-graded courses taken for a minimum of three units each, in an area of concentration of one of the following types:

1. An area of concentration in the MS&E department (see list in Appendix B).
2. An area of concentration in one of the other departments or centers of the School of Engineering
3. In exceptional cases, a coherent area of concentration designed by the student.

Petitions for student-designed concentrations must list the three proposed courses (taken for three units or more and at the 200-level or above) and include a brief justification. The petition must be submitted to Student Services no later than the fifth week of the quarter prior to graduation.

Project course requirement

Students must take either a designated project course or two designated integrated project courses (see list in Appendix A). The project course(s) must be taken for letter grade, and must be taken for a minimum of three units and may also be used to satisfy the core or concentration requirement.

Additional requirements

- At least 45 units must be in courses numbered 100 and above.
- At least 27 units must be in courses numbered 200 and above in the MS&E department, taken for a letter grade and a minimum of three units each, and at least 36 letter graded units must be in MS&E or closely related fields. Closely related fields include any department in the School of Engineering, mathematics, statistics, economics, sociology, psychology, or business.
- The degree program must be completed with a grade point average of 3.0 or higher.
- A maximum of three units of language courses (numbered 100 and above) may be applied toward the degree.
- A maximum of three units of 1-unit seminars, colloquia, workshops, etc., in any department, may be applied toward the degree, and a maximum of one unit of MS&E 208 Curricular Practical Training may be applied toward the degree.
- A maximum of 18 Non-Degree Option (NDO) units through the Stanford Center for Professional Development (SCPD) may be applied toward the degree.
- Courses in athletics do not apply towards the degree.

Appendix A:

List of the project courses of the MS&E department

MS&E regular project courses (courses that are constituted of one project)

MS&E 250B Project Course in Engineering Risk Analysis
MS&E 348 Optimization of Uncertainty and Applications in Finance
MS&E 444 Investment Practice
MS&E 445 Projects in Wealth Management
MS&E 452 Decision Analysis Projects
MS&E 464 Global Project Coordination
MS&E 485B Cross-cultural Design
MS&E 491 Clean Energy Development

MS&E integrated project courses (courses that include both lectures and a project)

MS&E 201 Dynamic Systems
MS&E 206 Art of Mathematical Modeling
MS&E 211 Linear and Nonlinear Optimization
MS&E 212 Mathematical Programming and Combinatorial Optimization
MS&E 234 Organizational Change and Information Systems
MS&E 242 Investment Science
MS&E 242H Investment Science Honors
MS&E 243 Energy and Environmental Policy Analysis
MS&E 248 Economics of Natural Resources
MS&E 256 Technology Assessment and Regulation of Medical Devices
MS&E 262 Supply Chain Management
MS&E 264 Sustainable Product Development and Manufacturing
MS&E 265 Supply Chain Logistics
MS&E 266 Management of New Product Development
MS&E 270 Strategy in Technology-Based Companies
MS&E 271 Global Entrepreneurial Marketing
MS&E 273 Technology Venture Formation
MS&E 274 Dynamic Entrepreneurial Strategy
MS&E 277 Creativity and Innovation
MS&E 280 Organizational Behavior: Evidence in Action
MS&E 294 Climate Policy Analysis
MS&E 295 Energy Policy Analysis
MS&E 311 Optimization
MS&E 315 Numerical Optimization
MS&E 337 Information Networks
MS&E 339 Approximate Dynamic Programming
MS&E 347 Credit Risk: Modeling and Management
MS&E 349 Capital Deployment
MS&E 355 Influence Diagrams and Probabilistic Networks

*Appendix B:*List of the approved concentrations (depth) of the MS&E department**Decision and Risk Analysis**

<u>Course #</u>	<u>Title</u>	<u>Units</u>
250A	Engineering Risk Analysis	3*
250B	Project Course in Engineering Risk Analysis	3
251	Stochastic Decision Models	3*
252	Decision Analysis I: Foundations of Decision Analysis	3-4*
254	The Ethical Analyst	3
255	Decision Systems I	3
256	Technology Assessment and Regulation of Medical Devices	3
351	Dynamic Programming and Stochastic Control	3
352	Decision Analysis II: Professional Decision Analysis	3-4
353	Decision Analysis III: Frontiers of Decision Analysis	3
355	Influence Diagrams and Probabilistic Networks (<i>alternate years</i>)	3
452	Decision Analysis Projects	3

Economics and Finance

<u>Course #</u>	<u>Title</u>	<u>Units</u>
241	Economic Analysis	3-4*
242/H/S	Investment Science	3*
243	Energy and Environmental Policy Analysis	3
245G	Finance for non-MBAs	3-5
247G	International Finance Management	4
247S	International Investments (<i>summer only</i>)	3
248	Economics of Natural Resources	3-4
249	Economic Growth and Development (<i>summer only</i>)	3
342	Advanced Investment Science	3
347	Credit Risk: Modeling and Management	3
349	Capital Deployment (<i>alternate years</i>)	3
444	Investment Practice	3-4
445	Projects in Wealth Management	3-4

* These courses are also listed as core courses. You may use them to satisfy *either* the core *or* the concentration requirement, *but not both*.

Energy and Environment

<u>Course #</u>	<u>Title</u>	<u>Units</u>
243	Energy and Environmental Policy Analysis	3
248	Economics of Natural Resources	3-4
264	Sustainable Product Development and Manufacturing	3-4
294	Climate Policy Analysis (<i>alternate years</i>)	3
295	Energy Policy Analysis (<i>alternate years</i>)	3
491	Clean Energy Development	3
CEE 207A	Energy Resources	3-5
EARTHSYS 247	Controlling Climate Change in the 21 st Century	3
EARTHSYS 275	The California Coast: Science, Policy, and Law	3-4
EE 293A	Fundamentals of Energy Processes	3-4
EE 293B	Fundamentals of Energy Processes	3
LAW 603	Environmental Law and Policy	3
MATSCI 302	Solar Cells	3
ME 260	Fuel Cell Science and Technology	3
ME 370A	Energy Systems I: Thermodynamics	3
ME 370B	Energy Systems II: Modeling and Advanced Concepts	4

Information Science and Technology

<u>Course #</u>	<u>Title</u>	<u>Units</u>
234	Organizational Change and Information Systems	3
236/236H	Game Theory with Engineering Applications	3
237	The Social Data Revolution: Data Mining & Electronic Business	3
238	Leading Trends in Information Technology	3
239	Computational Advertising	3
332	Security and Risk in Computer Networks	3
334	Computation of Equilibria	3
335	Queuing and Scheduling in Processing Networks	3
336	Topics in Game Theory with Engineering Applications	3
337	Information Networks (<i>alternate years</i>)	3
338	Advanced Topics in Information Science and Technology	3
339	Approximate Dynamic Programming	3
CS 364A	Algorithmic Game Theory	3
EE 284	Introduction to Computer Networks	3
EE 384S	Performance Engineering of Computer Systems and Networks	3

Operations Research

<u>Course #</u>	<u>Title</u>	<u>Units</u>
211	Linear and Nonlinear Optimization	3-4*
212	Mathematical Programming and Combinatorial Optimization	3
221	Stochastic Modeling	3*
223	Simulation	3*
236/236H	Game Theory with Engineering Applications	3
251	Stochastic Decision Models	3*
310	Linear Programming	3
311	Optimization	3
312	Advanced Methods in Numerical Optimization	3
313	Vector Space Optimization (<i>alternate years</i>)	3
314	Linear and Conic Optimization w/ Applications (<i>alternate years</i>)	3
315	Numerical Optimization	3
316	Discrete Mathematics and Algorithms	3
317	Algorithms for Modern Data Models	3
318	Large-Scale Numerical Optimization	3
319	Approximation Algorithms (<i>alternate years</i>)	3
321	Stochastic Systems	3
322	Stochastic Calculus and Control (<i>alternate years</i>)	3
323	Stochastic Simulation (<i>alternate years</i>)	3
325	Topics in Stochastic Optimization (<i>alternate years</i>)	3
332	Security and Risk in Computer Networks	3
334	Computation of Equilibria	3
335	Queuing and Scheduling in Processing Networks	3
336	Topics in Game Theory with Engineering Applications	3
337	Information Networks (<i>alternate years</i>)	3
338	Advanced Topics in Information Science and Technology	3
339	Approximate Dynamic Programming	3
348	Optimization of Uncertainty and Applications in Finance	3
351	Dynamic Programming and Stochastic Control	3
355	Influence Diagrams and Probabilistic Networks (<i>alternate years</i>)	3
EE 384S	Performance Engineering of Computer Systems and Networks	3

* These courses are also listed as core courses. You may use them to satisfy *either* the core *or* the concentration requirement, **but not both**.

Organizations, Technology and Entrepreneurship

<u>Course #</u>	<u>Title</u>	<u>Units</u>
271	Global Entrepreneurial Marketing	3-4*
273	Technology Venture Formation	3-4
274	Dynamic Entrepreneurial Strategy	3
276	Entrepreneurial Management and Finance	3
277	Creativity and Innovation	4
280	Organizational Behavior: Evidence in Action	3-4*
283	Scaling up Excellence in Organizations	4
ENGR 245	Technology Entrepreneurship and Lean Startups	3-4
STRAMGT 353	Entrepreneurship: Formation of New Ventures	4
STRAMGT 356	Creating a Startup I	4
STRAMGT 366	Creating a Startup II	4

Policy and Strategy

<u>Course #</u>	<u>Title</u>	<u>Units</u>
271	Global Entrepreneurial Marketing	3-4*
273	Technology Venture Formation	3-4
274	Dynamic Entrepreneurial Strategy	3
276	Entrepreneurial Management and Finance	4
277	Creativity and Innovation	3
292	Health Policy Modeling	3
293	Technology and National Security	3
294	Climate Policy Analysis (<i>alternate years</i>)	3
295	Energy Policy Analysis (<i>alternate years</i>)	3
299	Voluntary Social Systems	3
ENGR 245	Technology Entrepreneurship and Lean Startups	3-4
STRAMGT 353	Entrepreneurship: Formation of New Ventures	4
STRAMGT 356	Creating a Startup I	4
STRAMGT 366	Creating a Startup II	4

* These courses are also listed as core courses. You may use them to satisfy *either* the core *or* the concentration requirement, *but not both*.

Production and Operations Management

<u>Course #</u>	<u>Title</u>	<u>Units</u>
236	Game Theory with Engineering Applications	3
260	Introduction to Operations Management	3-4
261	Inventory Control and Production Systems	3*
262	Supply Chain Management	3
264	Sustainable Product Design and Manufacturing	3-4
265	Supply Chain Logistics (<i>alternate years</i>)	4
266	Management of New Product Development	3
268	Operations Strategy	3
464	Global Project Coordination	3-4

Although we expect most M.S. students to select from the above list, students with exceptionally strong analytical backgrounds may wish to take a 300-level doctoral course in this area, such as 361 through 365. These 300-level courses are also allowed as concentration courses in Production and Operations Management.

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