

# DOCTOR OF PHILOSOPHY IN MANAGEMENT SCIENCE AND ANALYTICS

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The **Ph.D. in Management Science and Analytics** program prepares graduates to identify pressing issues facing the business community, structure problems and gather data, and create innovative, impactful analysis and solutions.

Emphasizing both analysis and synthesis, the program delivers a comprehensive, advanced education in how to apply quantitative methods, analytical tools, and computer models to complex decision-making in business, finance, and other disciplines.

Through specializations in quantitative finance and analytics and rigorous dissertation work, students master a data-intensive approach to management science and research methodologies that can be applied to any aspect of business.

Stuart School of Business is a global leader in bridging technology and business, offering distinctive education that trains students to become outstanding professionals in economics, finance, analytics, marketing, business, public administration, operations, and management.

Business at Illinois Tech has a prestigious history that dates back to the late 1800s, with some of the nation's first courses in "Family and Consumer Science" (including "Home Economics" and "Household Management") being offered by the Lewis Institute, Stuart's original home, and the Institute's subsequent formation of the Department of Business and Economics in 1926.

Over a period of more than 125 years, building on curricular innovations by Julia A. Beveridge and George N. Carman, and on foundational scholarly works by trailblazing Illinois Tech scholars Herb A. Simon (author of *Administrative Behavior*, later awarded the Nobel Prize in Economics), Karl Menger (developer of the St. Petersburg paradox in economics) and Abe Sklar (developer of the Copula in financial modeling), the Stuart School of Business has refined education in business disciplines.

A long-standing leader in curricular innovation, in 1990, building on the foundational works of numerous Illinois Tech scholars, and Harold L. Stuart's own contributions to finance and the broader business community, the Stuart School of Business established quantitative finance as an academic discipline, with a world's first postgraduate Master's program in Financial Markets and Trading – a program that highlighted a new model for embedding into a postgraduate academic program the emphases on career readiness and connectedness with the business community, and transformed business school education.

Today, the Stuart School of Business continues to be a frontier innovator in accredited education, offering academic programs and co-curricular opportunities that place students on the path to self-actualization and career success. Leadership, entrepreneurship, experiential learning, positive societal impact, and connectedness to the business community, combined with a human-centered approach to student development, and an unyielding focus on student success, continue to be core pillars at Stuart. Stuart is accredited by the Association to Advance Collegiate Schools of Business (AACSB) – an accreditation achieved by fewer than 6% of business schools worldwide.

Stuart's Ph.D. in Management Science and Analytics offers comprehensive coverage on the application of quantitative methods, analytical tools, and computer models to decision-making problems in business, finance, analytics, and operations management.

## Program Goals

The program prepares students and working professionals for careers in academia as well as executive and management positions in business, government, and consulting sectors. The PhD program emphasizes both analysis and synthesis. The required courses provide the tools to analyze business problems and to develop new systems or new solutions. Once students master these skills, their dissertation work involves structuring a problem, gathering data where appropriate, and solving it. The research methodologies of management science and analytics can be applied to any aspect of business. The program's goal is to facilitate the contribution of new knowledge to the field of business through applied research that addresses important problems in operations and finance.

## Admission Requirements

Applicants to the PhD in Management Science and Analytics submit comprehensive credentials for the undergraduate and/or graduate degree(s) that was/were already completed, an essay outlining the fit between the applicant's background, expertise, and career goals, a detailed CV describing academic/work experience, and letters of recommendation. Journal publications or conference presentation activities of PhD applicants that attest to their research experience and future research potential are preferred, although not essential.

The following description outlines additional requirements for each track within the PhD in Management Science and Analytics:

1. Students who have completed requirements for the MS in Management Science and Analytics at Stuart.
2. M-track with Analytics concentration: a graduate degree considered equivalent to the MS in Marketing Analytics degree offered at Stuart.

3. M-track with Quantitative Finance concentration: a graduate degree considered equivalent to the MS in Finance degree offered at Stuart.

## Curriculum

Applicants to the PhD program must have completed a master's degree with a graduate level business core, or a master's in finance or equivalent degree. For applicants who have a master's degree but have not completed the business core, some prerequisite courses will be required.

This program is selective and small with a high degree of interaction between faculty and students, and a mentor relationship with a faculty adviser. The PhD committee carefully matches the interest of the student with the expertise of the faculty member. The program offers two concentrations: analytics and quantitative finance.

### Analytics Concentration

The PhD program with a concentration in Analytics is well positioned in terms of opportunities for graduates in the career marketplace. Graduates can pursue career options ranging from traditional academia (teaching in schools offering programs focused on analytics) to positions in consulting, industry, and government that require expertise in business analytics, predictive modeling, and management of big data. The program offers opportunities to develop specialized skills involving analytics in fields such as marketing, networks, and supply chain management.

### Quantitative Finance Concentration

Graduates of the PhD program with a concentration in Quantitative Finance have a wide choice of careers. In addition to a traditional academic career focused on teaching and research in finance and economics related disciplines, graduates may also work in investment and commercial banking, trading, and risk management, as well as in technology and other private-sector companies. Dissertation research in this area may include a wide range of topics such as risk modeling, time series analysis, and investment analysis.

## Doctor of Philosophy in Management Science and Analytics program admission for students enrolled in MS in Management Science and Analytics Program

MS students enrolled in the MS in Management Science and Analytics program may apply for admission to PhD program after passing the PhD qualifying exam (they only have two opportunities to take the PhD Qualifying exam). If accepted into the PhD program, the student will be able to transfer all completed MS coursework (maximum of 33 credit hours) to the PhD program. For example, if a MS student enters the PhD program after completing 33 credit hours (but did not file for graduation with a MS degree), they need to complete 15 credit hours of additional PhD coursework in consultation with the PhD program director. After completing 24 credit hours required for PhD dissertation research, the student will have satisfied the 72 credit hours required after the undergraduate degree, and complete other PhD program requirements in order to graduate with a PhD degree.

In summary, MS students who transfer to the PhD program will complete 48 credit hours of required graduate coursework (this includes any uncompleted core/elective courses in the MS program, uncompleted but required PhD-MS coursework, and other customized courses as suggested by the Program Director), and 24 credit hours of dissertation research.

Code	Title	Credit Hours
<b>Basic Core Requirements</b>		<b>(12)</b>
MSC 511	Mathematical Economics I - Microeconomics	3
MSC 512	Econometrics and Statistics I	3
MSC 514	Mathematical Economics II - Microeconomics and Macroeconomics	3
MSC 515	Econometrics and Statistics II	3
HUM 601	Teaching Assistant Seminar	0
<b>Advanced Core Requirements</b>		<b>(6)</b>
MSC 611	Philosophy of Management	3
MSC 612	Advanced Research Methods	3
<b>Specialization Courses</b>		<b>(18)</b>
See Specializations tab for required courses		18
<b>Ph.D. Research</b>		<b>(36)</b>
MSC 691	Research and Thesis PhD	24

MS Students in Management Science and Analytics who join the PhD in Management Science and Analytics program should not file for MS graduation; they can transfer MS coursework (maximum 33 credits) to the PhD program. After joining the PhD program, they are required to complete: (i) 12 credit hours of PhD courses that are not a part of the MS curriculum, (ii) any MS electives that remain to be completed, (iii) PhD coursework that is a part of the MS curriculum that remains to be completed, (iv) other customized graduate courses as prescribed by the PhD program director and (v) 24 dissertation research credits. The goal here is to satisfy the university requirement of 72 credits (48 graduate coursework credits and 24 dissertation research credits) needed after the undergraduate degree to graduate with a PhD degree.

**Total Credit Hours** 72

## Doctor of Philosophy in Management Science and Analytics program admission for Applicants with an Earned Master's Degree

Students who enter the PhD program after completing a Master's degree (other than MS in Management Science and Analytics) from the Stuart School or from another Institution

In the first year, full-time students will complete the PhD basic core (a two-course sequence in mathematical economics and another two-course sequence in econometrics and statistics) and complete two additional specialization courses. The PhD qualifying exam must be taken after completing six PhD courses in Year 1 as shown in the Plan of Study grid below. If a student does not pass the qualifying exam in their first year, they will have the opportunity to retake the exam in their second year.

In the second year, full-time students will complete the PhD advanced core (MSC 611 and MSC 612) and four specialization courses (as shown under Year 2 in the Plan of Study grid below). After completing all the required PhD coursework at the end of the second year of full-time study, a written PhD comprehensive examination is required. This examination is a rigorous review of the level of competency achieved through PhD coursework. The comprehensive exam may be taken only twice. If a student did not pass the PhD comprehensive exam after two attempts, they will be terminated from the PhD program.

In the third and fourth year of graduate study, full-time students will focus on developing and completing their PhD dissertation, and satisfying other program requirements in order to graduate with a PhD degree. Part-time students may take additional time to complete the program.

As shown below, students will need 72 hours beyond their undergraduate degree to meet the requirements of the PhD program. The program allows the transfer of 12 credit hours from the completed MS degree. Taken together, these 12 transfer credit hours, 36 hours of PhD seminar coursework and dissertation research (24 credit hours) will account for the required 72 credit hours needed to graduate with a PhD degree after the undergraduate degree.

Students who enter the PhD program after completing the MS in Management Science and Analytics degree at the Stuart School

For students who join the PhD program after graduating with a MS in Management Science and Analytics degree, the PhD program director will develop a customized set of graduate courses that the student should complete in order to substitute for courses that are common to both MS and PhD programs in Management Science and Analytics, in consultation with appropriate PhD-MS faculty. In such cases, the program allows the transfer of 12 credit hours from the completed MS degree. Taken together, these 12 transfer credit hours, 12 credit hours of PhD courses that are not a part of the MS program, a customized set of substitution courses for 24 credit hours (as described above), and dissertation research (24 credit hours) will account for the required 72 credit hours needed to graduate with a PhD degree after the undergraduate degree. Students are required to successfully pass the PhD qualifying and comprehensive exams, complete the PhD dissertation, and satisfy other program requirements in order to graduate with a PhD degree.

Code	Title	Credit Hours
<b>Basic Core Requirements</b>		<b>(12)</b>
MSC 511	Mathematical Economics I - Microeconomics	3
MSC 512	Econometrics and Statistics I	3
MSC 514	Mathematical Economics II - Microeconomics and Macroeconomics	3
MSC 515	Econometrics and Statistics II	3
HUM 601	Teaching Assistant Seminar	0
<b>Advanced Core Requirements</b>		<b>(6)</b>
MSC 611	Philosophy of Management	3
MSC 612	Advanced Research Methods	3
<b>Specialization courses</b>		<b>(18)</b>
See Specializations tab for required courses		18
<b>Ph.D. Research</b>		<b>(36)</b>

MSC 691	Research and Thesis PhD	24
Transferred credits from a master's degree awarded to the student before entering the PhD program. In summary, the PhD requirement of 72 credit hours (after the undergraduate degree) is satisfied with 36 PhD-level course credit hours, 24 Dissertation Research Credit hours (MSC 691), and additional 12 credits transferred from a previously awarded master's degree. For students who join the PhD program after graduating with a MS in Management Science and Analytics degree, the PhD program director will develop a customized set of graduate courses that the student should complete in order to substitute for courses that are common to both MS and PhD programs in Management Science and Analytics, in consultation with appropriate PhD-MS faculty. In such cases, the program allows the transfer of 12 credit hours from the completed MS degree. Taken together, these 12 transfer credit hours, 12 credit hours of PhD courses that are not a part of the MS program, a customized set of substitution courses for 24 credit hours (as described above), and dissertation research (24 credit hours) will account for the required 72 credit hours needed to graduate with a PhD degree after the undergraduate degree.		12
<b>Total Credit Hours</b>		<b>72</b>

## Program of Study

Stuart requires that at least the first two years of study be completed on a full-time basis. After completion of coursework and qualifying/comprehensive exam requirements, the dissertation research may be done off campus if suitable arrangements for supervision are made.

When a student is ready to begin dissertation research work, the Dean of Stuart will appoint a mutually acceptable research adviser to supervise the student's research. The student will work with the adviser to form a dissertation committee (composed of at least four full-time faculty members including the adviser, one of whom will be a representative from outside the student's field) before beginning work on a dissertation project that must be an original investigation of high quality. Students are required to defend a dissertation proposal before the dissertation committee. After the dissertation project is completed, the student will appear before the dissertation committee to defend the dissertation project. Usually, the dissertation proposal defense and the dissertation defense are at least six months apart.

Full-time students usually take five years, though may take up to six years to complete the degree. After six years, students may petition for an extension, but they must reapply to the program and may be required to retake a comprehensive examination.

Students entering the program may transfer courses from a graduate program at another AACSB-accredited university if the student has not used the courses to satisfy the requirements for a degree at the university.

Some students may be required to take prerequisite courses in mathematics, statistics, or computer programming before being admitted to a graduate course. Undergraduate course offerings, which typically are listed with a primary numeral of four or below, cannot be used as free electives in the Ph.D. program.

## Management Science Specializations

### Analytics

Code	Title	Credit Hours
<b>Required Courses</b>		<b>(18)</b>
MSC 615	Predictive Analytics	3
MSC 616	Social Media Marketing Analytics	3
MSC 651	Quantitative Marketing Models	3
MSC 652	Supply Chain Analytics	3
MSC 653	Current Topics in Marketing Analytics	3
MSC 655	Visual Analytics - Data Analytics & Visualization	3
<b>Total Credit Hours</b>		<b>18</b>

### Quantitative Finance

Code	Title	Credit Hours
<b>Required Courses</b>		<b>(18)</b>
MSC 613	Structured Fixed Income Portfolios	3
MSC 614	Quantitative Investment Strategies	3
MSC 621	Corporate Finance	3
MSC 623	Investments	3
MSC 631	Theory of Finance I	3

MSC 633	Theory of Finance II	3
<b>Total Credit Hours</b>		<b>18</b>