Data Analytics Engineering, MS

For program contact information, please visit this website (https://mie.northeastern.edu/academics/graduate-studies/ms-daae/#_ga=2817169511782761919158431629 3-4047061391578954920).

The Department of Mechanical and Industrial Engineering offers the Master of Science in Data Analytics Engineering to meet the current and projected workforce demands. This degree program offers students an opportunity to train for industry jobs or to acquire rigorous analytical skills and research experience to prepare for a doctoral program in health, security, and sustainability at Northeastern University. While the core courses for this program are offered by the College of Engineering, students can choose elective courses from diverse disciplines spread across various colleges at Northeastern. The MS degree in data analytics engineering is designed to train students with engineering, science, mathematics, and statistics backgrounds as advanced data analytics professionals and researchers who can transform large streams of data into understandable and actionable information for the purpose of making decisions. The key sectors that require analytics professionals include healthcare, smart manufacturing, supply chain and logistics, national security, defense, banking, finance, marketing, human resources, and sports.

The Master of Science in Data Analytics Engineering program helps students acquire knowledge and skills to:

- Discover opportunities to improve products, processes, systems, and enterprises through data analytics
- Apply optimization, statistical, and machine-learning methods to solve complex problems involving large data from multiple sources
- Process and explore data from a variety of sources, including Internet of Things, an integrated network of devices and sensors, customer touch points, processes, social media, and people
- Work with technology teams to design and build large and complex SQL and NoSQL databases
- Use tools and methods for data mining, Big Data processing, and data visualization to generate reports for analysis and decision making
- Create integrated views of data collected from multiple sources of an enterprise
- Understand and explain results of data analytics to decision makers
- Design and develop data analytics projects

This degree program seeks to prepare students for a comprehensive list of tasks including collecting, storing, processing, and analyzing data; reporting descriptive statistics and patterns; performing diagnostic, predictive, and prescriptive analytics; drawing conclusions and insights; making actionable recommendations; and designing and managing data analytics projects.

General Degree Requirements

To be eligible for admission to any of the MS degree programs, a prospective student must hold a Bachelor of Science degree in engineering, science, mathematics, statistics, or an equivalent field. Students in all master's degree programs must complete a minimum of 32 semester hours of approved coursework (exclusive of any preparatory courses) with a minimum grade-point average of 3.000. Students can complete a master's degree by pursuing any of one of the three tracks: coursework option, project option, and thesis option. Specific degree requirements for each of these tracks can be found under the Program Requirements tab. Students may pursue any program either on a full-time or part-time basis; however, certain restrictions may apply.

Specific Degree Requirements

Core courses for the Master of Science in Data Analytics Engineering provide students with a foundation in algorithms and optimization, statistics, data and knowledge engineering, data mining, and visualization. These courses are designed to provide students with a strong understanding of probability and statistics, statistical learning, optimization methods, data mining, database design, and visualization. Students can select electives from a wide range of fields including business, finance, engineering, healthcare, manufacturing, and urban communities/cities. Elective courses provide students with the knowledge and understanding of descriptive, prescriptive, diagnostic, and predictive analytics as applied to a specific field of interest such as business, healthcare, manufacturing, and urban communities/cities. Alternatively, students can select their electives so that they can prepare for a doctoral program by taking advanced courses in mathematics, statistics, machine learning, natural language processing, and pattern recognition.

Academic and Research Advisors

All nonthesis students are advised by the faculty advisor designated for their respective concentration or program. Students willing to pursue the thesis option must first find a research advisor within their first year of study. The research advisor will guide the students' thesis work, and thesis reader(s) may be assigned at the discretion of their research advisor. The research advisor must be a full-time or jointly appointed faculty in the MIE department. However, if the research advisor is outside the MIE department, before the thesis option can be approved, a faculty member with 51% or more appointments in the MIE department must be chosen as co-advisor, and a petition must be filed and approved by the co-advisor and the MIE Graduate Affairs Committee. Thesis option students are advised by the faculty advisor of their concentration before they select their research advisor(s). The research advisor and co-advisor must serve as thesis readers.

Plan of Study and Course Selection

It is recommended that all new students attend orientation sessions held by the MIE department and the Graduate School of Engineering to acquaint themselves with the coursework requirements and research activities of the department as well as with the general policies, procedures, and expectations.

In order to receive proper guidance with their coursework needs, all MS students are strongly encouraged to complete and submit a fully signed Plan of Study to the department before enrolling in second-semester courses. This form not only helps the students manage their coursework but it also helps the department to plan for requested course offerings. The PS form may be modified at any time as the students progress in their degree programs.

Students pursuing study or research under the guidance of a faculty member can choose the project option by taking Master's Project (IE 7945) . An MS project must be petitioned to the MIE Graduate Affairs Committee and approved by both the faculty member (instructor for Master's Project) and the student's academic advisor. The petition must clearly state the reason for taking the project course; a brief description of the goals; as well as the expected outcomes, deliverables, and grading scheme.

Options for MS Students (Coursework Only, Project, or Thesis)

Students accepted into any of the MS programs in the MIE department can choose one of the three options: coursework only, project, or thesis. Please see the Program Requirements tab on the top menu of this page for more information. MS students who want to pursue project or thesis options must find, within the first year of their study, a faculty member or a research advisor who will be willing to direct and supervise a mutually agreed research project or MS thesis. Moreover, students who receive financial support from the university in the form of a research, teaching, or tuition assistantship must complete the thesis option.

Students who complete the thesis option must make a presentation of their thesis before approval by the department. The MS thesis presentation shall be publicly advertised at least one week in advance and all faculty members and students may attend and participate. If deemed appropriate by the research advisor, other faculty members may be invited to serve as thesis readers to provide technical opinions and judge the quality of the thesis and presentation.

Change of Program/Concentration

Students enrolled in any of the MIE department programs or concentrations may change their current program or concentration no sooner than the beginning of their second full-time semester of study. In order for the program or concentration change request to be considered by the MIE Graduate Affairs Committee, the student must not be in the first semester of their current program, must have a 3.300 GPA, and have completed at least 8 semester hours of required coursework in their sought program at Northeastern.

Graduate Certificate Options

Students enrolled in a graduate degree program in the College of Engineering are eligible to pursue an engineering graduate certificate in addition to or in combination with the MS degree. For more information please refer to Graduate Certificate Programs (https://catalog.northeastern.edu/graduate/engineering/graduate-certificate-programs/). Please note that students pursuing the Master of Science in Data Analytics Engineering are not eligible for the Graduate Certificate in Data Analytics Engineering.

GORDON INSTITUTE OF ENGINEERING LEADERSHIP

Master's Degree in Data Analytics Engineering with Graduate Certificate in Engineering Leadership

Students may complete a Master of Science in Data Analytics Engineering in addition to earning a Graduate Certificate in Engineering Leadership (https://catalog.northeastern.edu/graduate/engineering/multidisciplinary/engineering-leadership-graduate-certificate/). Students must apply and be admitted to the Gordon Engineering Leadership Program in order to pursue this option. The program requires fulfillment of the 16-semester-hour curriculum required to earn the Graduate Certificate in Engineering Leadership, which includes an industry-based challenge project with multiple mentors. The integrated 32-semester-hour degree and certificate will require 16 semester hours of advisor-approved data analytics technical courses.

ENGINEERING BUSINESS

Master's Degree in Data Analytics Engineering with Graduate Certificate in Engineering Business

Students may complete a Master of Science in Data Analytics Engineering in addition to earning a Graduate Certificate in Engineering Business (https://catalog.northeastern.edu/graduate/engineering/mechanical-industrial/engineering-business-graduate-certificate/). Students must apply and be admitted to the Galante Engineering Business Program in order to pursue this option. The integrated 32-semester-hour degree and certificate will require 16 semester hours of the data analytics engineering core courses and 16 semester hours from the outlined business-skill curriculum. The coursework, along with participation in cocurricular professional development elements, earn the Graduate Certificate in Engineering Business.

Program Requirements

- Concentrations and course offerings may vary by campus and/or by program modality. Please consult with your advisor or admissions coach for the course availability each term at your campus or within your program modality.
- Certain options within the program may be *required* at certain campuses or for certain program modalities. Please consult with your advisor or admissions coach for requirements at your campus or for your program modality.

Complete all courses and requirements listed below unless otherwise indicated.

Core Requirements

Code	Title	Hours
IE 6400	Foundations for Data Analytics Engineering	4
or IE 6200	Engineering Probability and Statistics	
IE 6600	Computation and Visualization for Analytics	4
IE 6700	Data Management for Analytics	4
or DAMG 6210	Data Management and Database Design	
IE 7275	Data Mining in Engineering	4
OR 6205	Deterministic Operations Research	4
or CS 5800	Algorithms	
Note: IE 6200, IE 6700, and OR 6205 are required for students in Vancouver.		

Options

Complete one of the following options:

COURSEWORK OPTION [1]

Code	Title	Hours
Complete 12 semester hours from the elective course list below.		12

PROJECT OPTION

Code	Title	Hours
IE 7945	Master's Project	4
Complete 8 semester hours from the elective course list below.*		8
*Students in Vancouver complete IE 7280 and 4 semester hours from the approved electives below.		

THESIS OPTION [2]

Code	Title	Hours
IE 7945	Master's Project [*]	4
IE 7990	Thesis	4
Complete 4 semester hours from the elective course list below.**		4
In addition to completing the thesis course, students must successfully complete the thesis submission process, including securing committee and Graduate School of Engineering signatures and submission of an electronic copy of their MS thesis to ProQuest.		
*Students in Vancouver complete IE 7990 twice for a total of 8 semester hours.		
**Students in Vancouver complete IE 7280 in lieu of an elective.		

Optional Co-op Experience

Code	Title	Hours
Complete the following. Students must complete ENCP 6100 to qualify for co-op experience:		
ENCP 6100	Introduction to Cooperative Education	1
ENCP 6964	Co-op Work Experience	0
or ENCP 6954	Co-op Work Experience - Half-Time	
or ENCP 6955	Co-op Work Experience Abroad - Half-Time	
or ENCP 6965	Co-op Work Experience Abroad	

Elective Course List

Any course in the following list will serve as an elective course, provided the course is offered and the student satisfied prerequisites and program requirements. Students can take electives outside this list with a prior approval from the faculty advisor.

Code	Title	Hours
General Engineering		
GE 5100	Product Development for Engineers	
Civil Engineering and Environmental Engineering		
CIVE 7100	Time Series and Geospatial Data Sciences	

Computer Science	
CS 5100	Foundations of Artificial Intelligence
CS 5150	Game Artificial Intelligence
CS 5200	Database Management Systems
CS 5310	Computer Graphics
CS 5330	Pattern Recognition and Computer Vision
CS 5335	Robotic Science and Systems
CS 5800	Algorithms
CS 6120	Natural Language Processing
CS 6140	Machine Learning
CS 6200	Information Retrieval
CS 6620	Fundamentals of Cloud Computing
Data Science	
DS 5010	Introduction to Programming for Data Science
DS 5110	Introduction to Data Management and Processing
DS 5220	Supervised Machine Learning and Learning Theory
DS 5230	Unsupervised Machine Learning and Data Mining
Electrical and Computer Engineering	
EECE 5644	Introduction to Machine Learning and Pattern Recognition
EECE 7397	Advanced Machine Learning
Engineering Management	
EMGT 5220	Engineering Project Management [3]
EMGT 6225	Economic Decision Making [3]
EMGT 6305	Financial Management for Engineers [3]
Health Informatics	
HINF 5101	Introduction to Health Informatics and Health Information Systems
HINF 5102	Data Management in Healthcare
HINF 5200	Theoretical Foundations in Personal Health Informatics
HINF 5301	Evaluating Health Technologies
HINF 6202	Business of Healthcare Informatics
HINF 6240	Improving the Patient Experience through Informatics
HINF 6335	Management Issues in Healthcare Information Technology
HINF 6400	Introduction to Health Data Analytics
Industrial Engineering	
IE 5400	Healthcare Systems Modeling and Analysis
IE 6300	Manufacturing Methods and Processes
IE 6500	Human Performance
IE 7200	Supply Chain Engineering [3]
IE 7215	Simulation Analysis [3]
IE 7270	Intelligent Manufacturing
IE 7280	Statistical Methods in Engineering
IE 7285	Statistical Quality Control
IE 7290	Reliability Analysis and Risk Assessment
IE 7295	Applied Reinforcement Learning in Engineering [3]
IE 7300	Statistical Learning for Engineering
IE 7350	Sociotechnical Systems: Computational Models for Design and Policy
IE 7500	Applied Natural Language Processing in Engineering [3]
IE 7615	Neural Networks and Deep Learning [3]
Information Systems	
INFO 7390	Advances in Data Sciences and Architecture
Mathematics	
MATH 5131	Introduction to Mathematical Methods and Modeling
MATH 7234	Optimization and Complexity
MATH 7243	Machine Learning and Statistical Learning Theory 1

MATH 7340	Statistics for Bioinformatics
MATH 7342	Mathematical Statistics
MATH 7343	Applied Statistics
MATH 7344	Regression, ANOVA, and Design
Network Science	
NETS 6116	Network Science 2
NETS 7341	Network Economics
NETS 7350	Bayesian and Network Statistics
Operations Research	
OR 6500	Metaheuristics and Applications [3]
OR 7230	Probabilistic Operation Research [3]
OR 7240	Integer and Nonlinear Optimization
OR 7245	Network Analysis and Advanced Optimization
OR 7270	Convex Optimization and Applications
OR 7310	Logistics, Warehousing, and Scheduling
Physics	
PHYS 5116	Network Science 1
Public Policy and Urban Affairs	
PPUA 5261	Dynamic Modeling for Environmental Decision Making
PPUA 5262	Big Data for Cities
PPUA 5263	Geographic Information Systems for Urban and Regional Policy
PPUA 7237	Advanced Spatial Analysis of Urban Systems

Program Credit/GPA Requirements

32 total semester hours required (33 with optional co-op)
Minimum 3.000 GPA required

1 Coursework option is not available to students in Vancouver.

2 A thesis is required for all students who receive financial support from the university in the form of a research, teaching, or tuition assistantship. The thesis topic should cover one or more of the areas from statistics, mathematics, optimization, data mining, machine learning, database design, Big Data, visualization tools, or forecasting methods. The thesis should train students for research in data and operations analytics and/or prepare them for a doctoral program.

3 Approved elective for students in Vancouver.