Data Analytics Engineering, MS (Vancouver)

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

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 two tracks: 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 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 program 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 (Project or Thesis)

Students accepted into this program can choose one of two options: 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

Students enrolled in any of the MIE department programs may change their current program no sooner than the beginning of their second full-time semester of study. In order for the program 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.

Program Requirements

Complete all courses and requirements listed below unless otherwise indicated.

Core Requirements

Code	Title	Hours
IE 6400	Foundations for Data Analytics Engineering	4
IE 6600	Computation and Visualization for Analytics	4
IE 6700	Data Management for Analytics	4
IE 7275	Data Mining in Engineering	4
IE 7615	Neural Networks and Deep Learning	4

Options

Complete one of the following options:

PROJECT OPTION

Code	Title	Hours
IE 7945	Master's Project	4
Complete 8 semester hours from the elective course list below. (p. 3)		8

THESIS OPTION [1]

Code	Title	Hours
Complete the following course twice:		8
IE 7990	Thesis	
Complete 4 semester hours from the elective course list below. (p. 3)		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.		

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.

Code	Title	Hours
CS 5100	Foundations of Artificial Intelligence	
CS 5170	Artificial Intelligence for Human-Computer Interaction	
CS 5180	Reinforcement Learning and Sequential Decision Making	
CS 5330	Pattern Recognition and Computer Vision	
CS 6240	Large-Scale Parallel Data Processing	
CS 6620	Fundamentals of Cloud Computing	
CS 7240	Principles of Scalable Data Management: Theory, Algorithms, and Database Systems	
DAMG 7245	Big-Data Systems and Intelligence Analytics	
DAMG 7250	Big Data Architecture and Governance	
EECE 5645	Parallel Processing for Data Analytics	
EECE 7205	Fundamentals of Computer Engineering	
EMGT 5220	Engineering Project Management	
EMGT 6225	Economic Decision Making	
EMGT 6305	Financial Management for Engineers	
IE 5137	Computational Modeling in Industrial Engineering	
IE 5200	Mathematics for Machine Learning	
IE 5374	Special Topics in Industrial Engineering	
IE 5390	Structured Data Analytics for Industrial Engineering	
IE 5400	Healthcare Systems Modeling and Analysis	
IE 5630	Biosensor and Human Behavior Measurement	
IE 5640	Data Mining for Engineering Applications	
IE 6300	Manufacturing Systems Design	
IE 6750	Data Warehousing and Integration	
IE 7200	Supply Chain Engineering	
IE 7215	Simulation Analysis	
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	
IE 7300	Statistical Learning for Engineering	
IE 7374	Special Topics in Industrial Engineering	
IE 7500	Applied Natural Language Processing in Engineering	
INFO 6215	Business Analysis and Information Engineering	
INFO 7260	Business Process Engineering	
ME 6200	Mathematical Methods for Mechanical Engineers 1	
OR 6205	Deterministic Operations Research	
OR 7230	Probabilistic Operation Research	
OR 7235	Inventory Theory	
OR 7240	Integer and Nonlinear Optimization	
OR 7245	Network Analysis and Advanced Optimization	
OR 7310	Logistics, Warehousing, and Scheduling	

Program Credit/GPA Requirements

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

[1] 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.