

ChBE 6745 – Data Analytics for Chemical Engineers (Core Course)

This course will establish a foundation for handling data and understanding the difficulties that arise in trying to curate and learn from manufacturing systems data. It will introduce different classes of data that are commonly encountered such as time series and property data. It will introduce different classes of learning problems and the techniques for learning from the data. Students will learn basic programming skills in Python and be introduced to key libraries for machine learning and optimization. It will provide a map for students to connect the problem they are trying to address to the class of learning techniques that could be appropriate to use.

ChBE 6746 – Data-driven Process Systems Engineering (Core Course) [Course Preview](#)

In chemical process engineering and manufacturing, decision-making requires the formulation and solution of complex optimization problems. This course first introduces students to the basics of optimization, such as formulations, linear, nonlinear and mixed-integer programming. The second and main part of the course focuses on case-studies where the optimization needs to rely on data (from experiments, historical databases or simulations). In this part, the course introduces key concepts with respect to sampling and design of experiments, data-driven modeling and regression, model validation and optimization using data-driven models. Data-driven decision making is discussed in the context of applications from the chemical manufacturing and processing industry, such as: process operation and control, process design, process and material design, multiscale process modeling, monitoring, planning, scheduling and supply chain optimization. Overall, by the end of the course the students will have a good understanding of how to couple data-analysis with optimization for decision-making in the chemical process

CS 6035 – Introduction to Information Security (Elective Course) [Course Preview](#)

This course teaches the basic concepts and principles of information security, and the fundamental approaches to secure computers and networks. Its main topics include: security basics, security management and risk assessment, software security, operating systems security, database security, cryptography algorithms and protocols, network authentication and secure network applications, malicious malware, network threats and defenses, web security, mobile security, legal and ethical issues, and privacy.

CS 6400 – Database Systems Concepts and Design (Elective Course) [Course Preview](#)

This course presents an example of applying a database application development methodology to a major real-world project. All the database concepts, techniques, and tools that are needed to develop a database application from scratch are introduced. In parallel, learners in the course will apply the database application development methodology, techniques, and tools to their own major class team project. In addition, this course will include instruction in the Extended Entity Relationship Model, the Relational Model, Relational algebra, calculus and SQL, database normalization, efficiency and indexing. Finally, techniques and tools for metadata management and archival will be presented. The prerequisites for this course are as follows: first-order predicate calculus, algebraic expressions, and familiarity with at least one scripting or programming language such as PHP, Python, Java.

CSE 6040 – Computing for Data Analysis (Elective Course) [Course Preview](#)

This course is your hands-on introduction to basic programming techniques relevant to data analysis and machine learning. Beyond programming languages and best practices, you'll learn elementary data processing algorithms, numerical linear algebra, and numerical optimization. You will build the basic components of a data analysis pipeline: collection, preprocessing, storage, analysis, and visualization. You will program in some subset of Python, R, MATLAB, and SQL, Analytical Tools the faculty's discretion. This course aims to fill in gaps in your programming background, in preparation for other programming-intensive courses in the OMS Analytics program. If you come to the program with a significant programming background already, you may be eligible for exemption from this course. Prerequisites for this course are as follows: Python programming, basic linear algebra, probability, calculus.

ISYE 6501 – Introduction to Analytics Modeling (Elective Course) [Course Preview](#)

This course gives a basic introduction to a wide variety of analytics models and techniques, including the basic ideas behind the models, experience using software to solve/analyze them, and case studies dealing with combining models to find a complete solution. Modeling approaches covered include classification, clustering, change detection, time series modeling, regression models, design of experiments, probability distributions, probability-based models and simulation, PCA, and optimization. Cross-cutting topics like data preparation, model validation, and variable selection are also covered. Prerequisites for this course are as follows: programming in some language, probability/statistics, some linear algebra and calculus.

ISYE 6740 – Computational Data Analysis (Elective Course) [Course Preview](#)

Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. The course is designed to answer the most fundamental questions about machine learning: What are the most important methods to know about, and why? How can we answer the question 'is this method better than that one' using asymptotic theory? How can we answer the question 'is this method better than that one' for a specific dataset of interest? What can we say about the errors our method will make on future data? What's the 'right' objective function? What does it mean to be statistically rigorous? This course is designed to give graduate students a thorough grounding in the methods, theory, mathematics and algorithms needed to do research and applications in machine learning. The course covers topics from machine learning, classical statistics, and data mining. Prerequisites for this course are as follows: linear algebra, probability/statistics, programming in some language (e.g. MATLAB or Python), but the class has been designed so that anyone with a strong numerate background can catch up and fully participate.

ISYE 7406 – Data Mining and Statistical Learning (Elective Course) [Course Preview](#)

An introduction to some commonly used data mining and statistical learning algorithms such as K-nearest neighbor (KNN) algorithm, linear methods for regression and classification, tree-based methods, ensemble methods, support vector machine, neural networks, and K means clustering algorithm. This course focuses on the understanding of methodology, motivation, and assumptions of different algorithms as well as implementation of these algorithms with data examples using the R statistical software. Prerequisites for this course are as follows: probability/statistics, some linear algebra and calculus.

ISYE 8803 – Topics on High-Dimensional Data Analytics (Elective Course) [Course Preview](#)

This course focuses on analysis of high-dimensional structured data including profiles, images, and other types of functional data using statistical machine learning. A variety of topics such as functional data analysis, image processing, multilinear algebra and tensor analysis, and regularization in high-dimensional regression and its applications including low rank and sparse learning is covered. Optimization methods commonly used in statistical modeling and machine learning and their computational aspects are also discussed - convex conic optimization, which is a significant generalization of linear optimization. The fourth and final module is on integer optimization, which augments the previously covered optimization models with the flexibility of integer decision variables. The course blends optimization theory and computation with various applications to modern data analytics. Prerequisites include regression, linear algebra, basic knowledge of R and MATLAB.

MGT 6203 – Data Analytics in Business (Elective Course) [Course Preview](#)

Teaches the scientific process of transforming data into insights for making better business decisions. It covers the methodologies, algorithms, and challenges related to analyzing business data. The prerequisites for this course are as follows: at least one semester of calculus, probability/statistics (basics up to linear regression), and some computer programming in any language, preferably R or Python. A suggested prerequisite is ISYE 6501: Introduction to Analytics Modeling.

MGT 8823 – Data Analysis for Continuous Improvement (Elective Course) [Course Preview](#)

Because it is one thing to know how to analyze data and another thing to actually use it to solve problems, the purpose of this course is to show how mastery of data analysis can be applied to the real world. In doing so, we will explore the development of key performance indicators (KPIs) and how to use KPIs to drive improvement in an organization. We will also discuss the four methods of continuous improvement and how data analysis can be leveraged in each method. Because the course weaves examples from both industry and everyday life, what is learned can be directly applied to both your personal and professional lives. In addition to the practical knowledge gained, students will also be shown tools that are outside of the typical analytics course and provided with the knowledge of how to use these tools on their own and in conjunction with the data analysis. Because one must know not only how to analyze data but also how to determine from where the actual data should come, the tools chosen will assist the student in coming up with what to analyze in the first place.

PUBP 6501 – Information Policy and Management (Elective Course) [Course Preview](#)

The course is an introduction to the role of information and knowledge in modern private and public organizations. It covers theoretical aspects of information seeking, gathering and use in organizations as well as knowledge creation and its role in management. The course also addresses the practical implementation of organization information strategies using information technology. Information security and cybersecurity are integrated into the framework of a learning and knowledge-oriented organization and general information policy rather than considered a separate concern. The first part of the course introduces the issues of organization strategy and its relation to information. The second part focuses on the notion of organizational learning. The third part focuses on the applications of information technology in government, especially related to various aspects of e-government. The final section focuses on new approaches to knowledge management in the public sector.