OMS Analytics
Course Descriptions

CS 6400 – Database Systems Concepts and Design (COMPUTATIONAL DATA ANALYTICS Track Elective)
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. [Suggested prerequisite - CSE 6040]
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_mtu70w28/

CSE 6040 – Computing for Data Analysis (Foundational course)
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.
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_ft68abwz/

CSE 6242 – Data and Visual Analytics (Advanced Core)
This course introduces students to broad classes of techniques and tools for analyzing and visualizing data Analytical Tools scale. It emphasizes how to combine computation and visualization to perform effective analysis. The course covers methods from each side, and hybrid ones that combine the best of both worlds. Topics covered include big data analytics building blocks, data collection and storage, data cleaning and integration, data visualization, dimensionality reduction, data mining concepts, graph analytics, ensemble methods, etc. Students get experience completing significant computing assignments, and are exposed to a variety of programming languages and software. [Prerequisite - CSE 6040] {Practicum Prerequisite}
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_g56hu0iq/

CSE 6250 – Big Data Analytics in Healthcare (COMPUTATIONAL DATA ANALYTICS Track Elective)
In this course we introduce the characteristics of medical data and associated data mining challenges in dealing with such data. We cover various algorithms and systems for big data analytics. We focus on studying those big data techniques in the context of concrete healthcare analytic applications such as predictive modeling, computational phenotyping and patient similarity. We focus on studying those big data techniques in the context of concrete healthcare analytic applications such as: 1. Predictive modeling: e.g., how to predict disease risks on individual patients 2. Computational phenotyping: e.g., how to convert patient data from electronic health records into meaningful clinical concepts (phenotypes) 3. Patient similarity: e.g., how to measure similarity between patients within a specific context. We also study big data analytic technology: 1. Scalable machine learning algorithms such as online learning and fast similarity search; 2. Big data analytic systems: a. Hadoop family (MapReduce, Hive, Pig, HBase) b. Spark (SparkSQL, MLlib and GraphX). [Suggested prerequisite CSE 6040]
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_n6ughmt4/
ISYE 6402 – Time Series Analysis (ANALYTICAL TOOLS Track or Statistics Elective)
By the end of this class students will learn standard time series analysis topics such as univariate ARMA/ARIMA modeling, state-space models, (G) ARCH modeling, forecasting, model identification and diagnostics, and multivariate time series. Students will be given fundamental grounding in the use of some widely used tools, but much of the energy of the course is focused on individual investigation and learning. Assignments will include both theoretical and computer problems. Topics include trend, seasonality, autocorrelation and autocovariance, ARMA and ARIMA models, multivariate time series analysis (e.g., VAR), nonlinear models (e.g., GARCH), high-frequency data, and state-space models.
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_467dtfcp/1_2wptnawx

ISYE 6414 – Regression Analysis (ANALYTICAL TOOLS Track or Statistics Elective)
By the end of this class students will learn the basics of regression analysis, such as linear regression, model selection and logistic regression, as well as more advanced topics including generalized linear regression and nonparametric regression. Students will be given fundamental grounding in the use of some widely used tools, but much of the energy of the course is focused on individual investigation and learning. Assignments will include both theoretical and computer problems. Topics include simple linear regression, multiple linear regression, variance-bias decomposition and variable selection, logistic regression, generalized linear regression, and nonparametric regression.
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_qkmerd7v/

ISYE 6420 – Bayesian Statistics (ANALYTICAL TOOLS Track or Statistics Elective)
This course covers the fundamentals of Bayesian statistics, including both the underlying models and methods of Bayesian computation, and how they are applied. Modeling topics include conditional probability and Bayes’ formula, Bayesian inference, credible sets, conjugate and noninformative priors, hypothesis testing, Bayesian regression, empirical Bayes models, and hierarchical Bayesian models. Computational topics include Monte Carlo methods, MCMC, Metropolis-Hasting algorithms, Gibbs sampling, variational Bayes, and other methods for posterior approximation. Various applications of Bayesian statistics will be discussed. [Prerequisite - Calculus-based Introductory Statistics Course]
Course Preview: https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_lspdp6zv/1_09l10hy2

ISYE 6501 – Introduction to Analytics Modeling (Foundational course)
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.
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_wpk373kv/

ISYE 6644 – Simulation (ANALYTICAL TOOLS Track or Operations Research Elective)
The course has three main topics: (a) Introduction to discrete-event simulation models and simulation studies; (b) Organization of simulation languages, and modeling with Arena, a comprehensive simulation package with animation capabilities; and (c) Statistical aspects of simulation, including input analysis, random variate generation, output analysis, and variance reduction techniques. The course will include a small probability/statistics review; hand simulation, spreadsheet simulation, and Arena simulation; general modeling concepts and examples; random variate generation including single random variable generation and random processes, input and output analysis, comparisons of systems, and variance reduction.
Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_eqix11kx/

ISYE 6669 – Deterministic Optimization (ANALYTICAL TOOLS Track or Operations Research Elective)
The course will teach basic concepts, models, and algorithms in linear optimization, integer optimization, and convex optimization. The first module of the course is a general overview of key concepts in linear algebra, calculus, and optimization. The second module of the course is on linear optimization, covering modeling techniques, basic polyhedral theory, simplex method, and duality theory. The third module is on
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. [Suggested prerequisite ISYE 6501]
Course preview - [https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_4plxs726/](https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_4plxs726/)

**CSE/ISYE 6740 – Computational Data Analysis**  
(Analytical Tools Track, Computational Data Analytics Track or Statistics Elective)
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. Students entering the class with a pre-existing working knowledge of probability, statistics and algorithms will be Analytical Tools an advantage, but the class has been designed so that anyone with a strong numerate background can catch up and fully participate. Some experience with coding are expected (Analytical Tools a language of your choice, e.g., MATLAB or Python.)

**ISYE 8803 – Topics on High-Dimensional Data Analytics** (ANALYTICAL TOOLS Track or Statistics Elective)
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.

**MGT 6203 – Data Analytics in Business** (Advanced Core)
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. [Suggested prerequisite ISYE 6501] {Practicum prerequisite}  
Course preview - [https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_4sa4v0bq/](https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_4sa4v0bq/)

**MGT 6311 - Digital Marketing** (BUSINESS ANALYTICS Elective)
Become familiar with the key concepts and techniques utilized in modern digital marketing. Understand the primary characteristics of various online channels including mobile marketing, email marketing, and social media marketing. Gain awareness of important concepts and best practices in the use of digital marketing tools (search engine optimization, pay-per-click advertising, etc.).  
Course preview - [https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_dozcuh95e/1_g3g4krap](https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_dozcuh95e/1_g3g4krap)

**MGT 6726 Privacy, Technology, Policy, and Law** (BUSINESS ANALYTICS Elective)
Big data has created numerous challenges in how to build private and public institutions to achieve the benefits of greater information flows while managing the risks to personal privacy and cybersecurity. This course seeks to equip students to understand the multiple perspectives relevant to managing privacy in an organization, both for private-sector companies and for government. (Preview forthcoming.)

**MGT 8803/6754 - Business Fundamentals for Analytics** (Foundational course)
The overall objective of the course is to provide an accelerated introduction to the basics of management and the language of business, and to provide a framework that will enhance the student’s effectiveness
as a manager in the business world. The course is taught as a series of business disciplinary modules and the professors who teach the modules represent a diversity of functional areas: Financial Accounting, which relates to financial reporting and the use of accounting data for internal-to-the-business and external-to-the-business purposes; Managerial Accounting, which is the use of accounting data for product costing and management decision-making purposes; Using Financial Analysis Techniques for Decision Making, which provides a general introduction to finance and capital structure; Entrepreneurial Finance, which includes various venture valuation methods and common sources for venture funding; Marketing, including strategy and the development of tactics to create and harvest demand for the business's products and services; and Business Strategy, including how businesses develop competitive advantage in the marketplace and innovation as a key strategic weapon for driving firm revenue growth and profitability.

Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_pnw4tn0/

**MGT 8813 – Financial Modeling (BUSINESS ANALYTICS Elective)**

Financial Modeling presents tools necessary to build advanced Excel spreadsheets for business decision making. Students will create spreadsheets using pivot tables, Excel functions, solver, goal seek, and VBA. The course will also include topics such as time value of money, stock and bond valuation, firm valuation, financial statements, cost of capital, option pricing models, and portfolio optimization. This course is intended to prepare students to build financial models. Therefore, two broad learning objectives exist for this course: Finance-based learning objectives and excel/modeling based learning objectives.

Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_dvqbctuu/1_sgwj23rp

**MGT 8823 – Data Analysis for Continuous Improvement (BUSINESS ANALYTICS Elective)**

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.

Course preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_4r51am5s/1_p7mdhy27

**CSE/ISYE/MGT 6748 - Applied Analytics Practicum (Degree Requirement)**

Practical analytics project experience applying ideas from the classroom to a significant project of interest to a business, government agency, or other organization. (Prerequisites – 8 courses including CSE 6242 and MGT 6203)

Course Preview - https://mediaspace.gatech.edu/playlist/dedicated/70573901/1_g8v5l9fv/1_1lrqenb3