



Master of Science in Business Analytics (BSAN) Fall 2020 & Spring 2021 Course Descriptions

Required Professional Development & Career Workshops:

- **MGMT 7770 Prof. Development Workshop 1**

The PDW sequence is designed to develop the professional skills of students in the MS Programs that are needed to be a successful contributor in a business setting. PDW I follows a framework of Leadership, Followership, and Membership in a professional community. Students will gain practical experience through exposure to experts in specific skill areas, role-play and practice sessions, and exercise completions. The fall semester concentrates on individual skills development in presentation, communication and networking. Additionally, membership in one's professional community will be emphasized through engagement in two activities specific to the student's MS Program. Building on the skills and abilities obtained earlier in your career, this PDW is geared toward a higher level of professionalism inherent in a successful business environment.

- **MGMT 7780 Prof. Development Workshop 2**

The PDW sequence is designed to develop the professional skills of students in the MS Programs that are needed to be a successful contributor in a business setting. The PDW II will continue to follow a framework of Leadership, Followership and Membership in a professional community. Students will gain practical experience through exposure to experts in specific skill areas, role-play and practice sessions, and exercise completions. The second semester emphasizes developing influence skills, understanding and shaping group dynamics, and navigating organizational politics. Additionally, membership in one's professional community will be emphasized through engagement in four hours of activities specific to the student's M.S. program.

Required Business Core:

- **MGMT 6100 Foundations of Data Science**

* Cannot be waived

* Pre-requisites: none

Every dataset tells a unique story, and in this course, students learn to elicit these stories from data. The course develops students' ability to ask critical questions about their data in order to better understand it. Students will run tests to identify data problems and will learn how to take corrective actions. In addition, the course covers important parametric and non-parametric tests, and discusses their benefits and limitations in a big data world.

- **MGMT 6140 Managing Digitization and Transformation**

* Cannot be waived

Understanding technology-enabled changes in contemporary business environments, and how insightful executives leverage IT, is key to creating value and winning

competitive advantage. This course develops an understanding of cutting-edge technological trends and their potential business impact. The course also explores the business drivers of technology-related decisions in firms and stimulates thought on new applications of technology for commerce, including new products, processes, and business models. Topics covered include: how different business models necessitate different kinds of IT investments; how IT coupled with big data analytics impacts different industries; whether and how IT hastens and aids the growth of disruptive innovations; and how organizations should adapt to the digital economy.

- **MGMT 6190 Intro to Accounting and Financial Management**

* Can be waived by approval of adviser and replaced with an elective course listed below, not necessarily one from the finance area.

* Can be waived and replaced with advanced finance such as MGMT6020, MGMT 6510, MGMT 6520, MGMT7760 or an advanced management class by approval. *

This course introduces accounting and financial management to first-semester M.S. students. The interpretation and preparation of basic financial statements such as the balance sheet and income statement are introduced along with relevant regulation and practice. In addition, the course introduces the student to basic financial concepts and techniques such as time value, risk, equilibrium asset pricing models, capital budgeting, cost of capital, and capital structure and discusses their applications in practice.

Required Analytics Core:

- **MGMT 6460 Modeling and Optimization**

This graduate level course is designed to provide the student with an understanding of the applications of quantitative models, methods, algorithms, and computational techniques across business functions. You will investigate how to apply optimization methods using a hands-on implementation approach.

- **MGMT 6560 Introduction to Machine Learning Applications**

The widespread proliferation of IT-influenced economic activity leaves behind a rich trail of micro-level data, enabling organizations to use analytics and experimentation in both strategy and operations. This course provides a hands-on introduction to the concepts, methods and processes of business analytics. Students will learn how to obtain data and draw business inferences from data by asking the right questions and using the appropriate tools.

- **MGMT 6570 Advanced Data Resource Management**

The primary objective of this course is to introduce the multifaceted role of data as a resource of the organization, in three ways. First, it examines the role of data at the operational, tactical, and strategic levels of the organization. Second, it provides students with knowledge and hands on training of technologies that manipulate data, including structured query language (SQL), extraction transformation and loading tools (ETL), data warehousing (DW), online analytical processing (OLAP), and data mining (DM). The course exposes students to big data management techniques. Finally, the course provides students the theory and hands on training to understand the transformation of data to information.



- **MGMT 6160 Applied Analytics and Predictive Modeling**

Business analytics enables organizations to leverage large volumes of data in order to make more informed decisions. It encompasses a range of approaches to integrating, organizing, and applying data in various settings. This course develops an understanding of concepts in business analytics and data manipulation. In particular, through hands-on experience with a range of techniques students will learn to work with large data sets, analyze trends and segments and develop models for prediction and forecasting. This course is part of the Masters program in Business Analytics and builds on foundations learned in the Fall semester.

- **MGMT 6790 Business Analytics Capstone**

This course provides students with an opportunity to work on real business analytics problems with a company. Students work in small consultant teams with a client and adviser(s) to develop solutions that will be put to use by the client to achieve significant business benefits. Student teams develop their analysis and recommendations and complete the project with the delivery of a final report and presentation to the client senior management.

Electives

Choose any two of the following courses. Non-MGMT courses (e.g. CSCI, ITWS) may require using this authorization form to register:

<https://www.rpi.edu/dept/srfs/AuthorizationFrm.pdf>

Advanced Analytics and Data Classes:

Fall

- **CSCI 6100 Machine Learning from Data** (4 credits)

Introduction to the theory, algorithms, and applications of machine learning (supervised, reinforcement, and unsupervised) from data: What is learning? Is learning feasible? How can we do it? How can we do it well? The course offers a mix of theory, technique, and application with additional selected topics chosen from Pattern Recognition, Decision Trees, Neural Networks, RBF's, Bayesian Learning, PAC Learning, Support Vector Machines, Gaussian processes, and Hidden Markov Models. Students cannot receive credit for both CSCI 4100 and CSCI 6100.

- **CSCI 6250 Frontiers of Network Science** (4 credits)

This course will offer an introduction to network science and a review of current research in this area. Classes will interchangeably present chapters from the textbook and related current research. The emphasis will be on the mathematical background of network science: graphs and networks; random networks and various types of scale-free networks; network properties such as assortativity, mobility, robustness, social networks, and communities; and dynamics of spreading in networks. Students cannot receive credit for both CSCI 4250 and CSCI 6250.

- **CSCI 6390 Data Mining** (4 credits)

This course will provide an introductory survey of the main topics in data mining and knowledge discovery in databases (KDD), including classification, clustering, association rules, sequence mining, similarity search, deviation detection, and so on. Emphasis will be on the algorithmic and system issues in KDD, as well as on applications such as Web mining, multimedia mining, bioinformatics, geographical information systems, etc. Students cannot receive credit for both CSCI 4390 and CSCI 6390.

- **MGMT 6962 Data Analytics:**

The world at-large is confronted with increasingly larger and complex sets of structured/unstructured information; from cyber and human sources. Traditional enterprises are moving toward analytics-driven approaches for core business functions. Data and information analytics extends analysis (descriptive models of data) by using data mining and machine learning methods, with optimization and validation, to recommend action or guide and communicate decision-making. Thus, analytics is an entire methodology rather than individual analyses of analysis steps.

Spring

- **ITWS 6600 Data Analytics**

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Summer

- **COMM 6880 Interactive Data Visualization**

This course covers interactive, multimedia interface design (for Websites and apps) for data visualization or other forms of interactive information design. Innovative designs that explore new directions in interactive data design are highlighted. Topics include multisensory information design using graphics, sound, touch and large scale data projection. Interface design topics include user-centered design, information architecture, rapid prototyping, cross-cultural design, and intellectual property. Students may choose the applications they want to design for the class project.



Policy and Management Classes:

Fall

▪ **ITWS 6440 Big Data Policy**

Although the term 'big data' is relatively new on the scene, the idea of collecting, protecting and sharing large data sets has been around since before computers were a major player. Similarly, the concept of a 'policy' high-level guidelines providing a general course of action (or inaction) in a given area, is not new. Putting those two concepts together, however, is a recent phenomenon which has created a set of intriguing challenges. What is 'open data?' What does it mean to 'share' data? Who makes such policies and how are they implemented? Do data policies look the same all over the world? What are the economic, cultural, and technological implications/impacts of/on a given data policy? How would one even go about understanding and evaluating a data policy? This course takes the basics of policy design and analysis, blends in critical thinking skills, ethics, group dynamics, national perspectives, and international perspectives, and applies it all to the world of big data.

▪ **MGMT 7030 Strategy, Technology and Competition**

*Pre-requisites: MGMT6040 and MGMT7730 or permission of the instructor.

This course covers the fundamentals of business and corporate strategy, integrating these concepts into an environment of technological change, competition, and entrepreneurship. The course includes the following areas of emphasis: concepts of strategy, industry environment, resources and capabilities of the firm, organization and systems of the firm, the dynamics of competitive advantage, strategic alternative analysis, and strategies in different contexts. The course uses business cases and a project to enrich the theoretical concepts.

Spring

▪ **ITWS 6360 Data and Society**

Data and Society provides a broad overview of how society is leveraging and responding to the social, organizational, policy, and technical opportunities and challenges of a data-driven world. Course themes focus on various aspects of the data ecosystem, data and innovation, and data and the broader community. Assignments build writing, presentation and critical thinking and assessment skills, all of which are important for professional success. This is a communication-intensive course.

▪ **MGMT 7030 Strategy, Technology and Competition**

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analysis, and strategies in different contexts. The course uses business cases and a project to enrich the theoretical concepts.

Summer

- **MGMT 7030 Strategy, Technology and Competition**

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This course covers the fundamentals of business and corporate strategy, integrating these concepts into an environment of technological change, competition, and entrepreneurship. The course includes the following areas of emphasis: concepts of strategy, industry environment, resources and capabilities of the firm, organization and systems of the firm, the dynamics of competitive advantage, strategic alternative analysis, and strategies in different contexts. The course uses business cases and a project to enrich the theoretical concepts.

Finance Classes:

Fall

- **MGMT 6020 Financial Management I:**

The purpose of this course is to develop a working understanding of the major investment and financial decisions of the firm. Emphasis will be placed upon identifying and solving the problems commonly faced by financial managers. The course presents the needed theory and develops financial problem solving skills through individualized problem solving, structured case analysis, and industry and company analysis using Internet sources.

- **MGMT 6520 Financial Modeling & Optimization:**

* Pre-requisite: MGMT 6020 or permission of instructor

This course introduces quantitative analysis for financial markets and instruments. The course covers applications of mathematical tools and optimization modeling to portfolio selection and fund management, risk analysis, hedging and valuation of financial assets, and financial planning under uncertainty. The course introduces applications of calculus, differential equations, and introduces stochastic processes within a financial markets context to address arbitrage pricing and equilibrium asset pricing models.

- **ECON 6560 Introduction to Econometrics**

This course is an introduction to econometric data analysis. The statistical methods covered enable analysis of relationships between variables in data, with special attention to identification of true causal effects. Topics covered include linear and simple nonlinear regression models, internal and external validity, methods for panel data and binary dependent variables, instrumental variables methods, use of experimental and quasi-experimental data, and basic time series methods. The course includes hands-on data analysis and report writing.

- **MGMT 6370 Options Futures & Derivatives Markets**

* Pre-requisite: MGMT 6020 or permission of instructor

The purpose of this course is to provide an introduction to second generation financial instruments including forward and future contracts, options, future options and swaps on



a variety of underlying instruments including fixed income securities. The fixed income markets will be integrated with the discussion of IRDs (interest rate derivatives.)

Spring

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▪ **MGMT 6410 Quantitative Asset Management**

* Pre-requisite: MGMT 6020 or permission of instructor

The course begins by providing students with a theoretical and practical background in the field of investments. This includes comparison of asset classes characteristics and returns as well as discussion of relevant models, financial institutions, and behavioral issues facing investors. These principles are then quantitatively applied in areas including portfolio construction, index-linked strategies, smart beta/factor portfolios, portfolio risk management, and dynamic portfolio management.

▪ **MGMT 6400 Financial Econometric Modeling**

This course addresses financial modeling as an empirical activity. Several key issues and assumptions of finance are addressed through empirical modeling. Topics may include asset pricing, event studies, exchange rate movements, term structure of interest rates, and international linkages among financial markets. Computers are used extensively both in and out of class.

▪ **MGMT 6240 Financial Trading and Investing**

* Pre-requisite: MGMT 6020 or permission of instructor

This course introduces interactive trading in financial instruments. Students learn the principles of asset price discovery and trading methods in a variety of markets, including equities, bonds, options, and other derivatives. Investing topics addressed include the application of quantitative methods in asset valuation, portfolio design, alternative investments, and risk management. Students work in teams of two in programming assignments involving foreign exchange markets, equities trading, and portfolio construction.

▪ **MGMT 6400 Financial Econometrics Modeling**

This course addresses financial modeling as an empirical activity. Several key issues and assumptions of finance are addressed through empirical modeling. Topics may include asset pricing, event studies, exchange rate movements, term structure of

interest rates, and international linkages among financial markets. Computers are used extensively both in and out of class.

- **MGMT 6510 Financial Simulation & Computation**

* Pre-requisite: MGMT 6520 or permission of instructor

This course introduces computational techniques for financial analysis, with foci on risk hedging and portfolio techniques, fixed income instruments, and derivatives analysis. The course covers computational techniques for portfolio optimization, plain vanilla and exotic derivatives valuation and replication, along with interest rate and fixed income instruments. This course will introduce numerical analysis, interpolation, Monte Carlo and finite difference methods, lattices, linear and dynamic programming, optimization and MATLAB, all in a financial computational context.

- **MGMT 6250 Fixed Income Securities**

This course develops the concepts and tools that will provide students with an understanding of the forces driving the valuation, risk and return of fixed income securities. These include instruments such as futures, options, callable bonds, credit default swaps and mortgage-backed securities. The size of these markets makes their pricing, hedging, and risk management invaluable to traders, risk managers, regulators or anyone interested in the functioning of the modern financial system.

- **MGMT 6962 Adv. Artificial Intelligence and Machine Learning for Finance**

The primary objective of this course is to provide the first or second semester financial engineering or business analytics student with applied quantitative skills in the areas of artificial intelligence and machine learning for finance applications. The course material will involve hands on use of real data and focus on various AI/ML algorithms common in the finance industry. The course will cover supervised learning and unsupervised algorithms and applications including natural language processing. R will be the primary computing language used in this course.

- **MGMT 7760 Risk Analytics & Management**

*Pre-requisites: MGMT6520 or permission of the instructor.

Overview of risk management, concepts and measurement of risk; types of risks (market, credit, liquidity, operational, business, strategic). Clustering, classification and optimization tools applied to risk management. Frameworks and instruments available for risk management. Specific issues related with managing specific risk types — credit, liquidity and operational risk, with emphasis on current challenges. Securitization, asset-liability management, and role of insurance for risk management.

Marketing and Operations Classes:

Spring

- **MGMT 6720 Internet Marketing**

Technology is a vital link in how modern corporations identify, acquire, transact with, and keep their customers. This course provides an introduction to both the technology infrastructure most relevant to the customer relationship as well as marketing issues that result from the application of computers and communication networks. Topics



include issues related to social media, search, online advertising, blogging, customer relationship management, online market segmentation, and marketing of IT products.

- **MGMT 6350 Supply Chain Analytics**

This is a hands on course where students learn a mix of theoretical and practical tools and use them to solve a variety of supply chain problems, both analytically and numerically. Time series, Markov chain, optimal control, linear programming, statistical analysis, and other mathematical tools are used to examine data to understand supply, demand and inventory levels and develop insights for managerial recommendations.

- **MGMT 6965 Marketing Analytics**

With the development of technology, the amount of available information that can help organizations make decisions grows exponentially over the past decades. These information could be structured data such as online transaction data or highly unstructured data such as blogs, tweets and video clips. With the abundant data, firms can extract customer purchasing pattern, identify potential market and forecast sales trends, gain competitive advantage and create substantial value for the company. This class introduces some fundamental statistical models which are very effective in explaining and predicting marketing patterns using new forms of information emerging from the technology advances. These models can significantly improve the decisions by practitioners as they also offer intuitively sounds descriptions on various observed data patterns. Meanwhile, as more and more firms adopt sophisticated toolkit to conduct business analysis (Excel toolkit, SPSS and etc.), understanding these statistical models can become an essential part of regular business. The contents we covered in this course will be helpful for managers to get the greatest business value in today's data intensive business environment. We will also apply these statistical models to real marketing problems using real marketing data. Students are expected to finish a final project by applying techniques covered in this class on a real world dataset. This is because the core of developing the quantitative skills in this class is through hands-on exercises. This project is designed to enhance students' understanding of the concepts introduced in this class, and to allow students to have the opportunity to absorb the skills rather than just get exposed to them.