Analytics - CPS (ALY)

ALY 1990. Elective. (1-4 Hours)
Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

ALY 2010. Probability Theory and Introductory Statistics. (3 Hours)
Introduces statistics for data analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion; variance; graphic presentation; elementary probability; populations and samples; sampling distributions; categorical data; regression and correlation; and analysis of variance. Explores the use of statistical software in data analysis. Emphasizes hands-on application of probability and statistics in SPSS.

Prerequisite(s): MTH 1100 with a minimum grade of D- or MTH 1200 with a minimum grade of D- or MTH 2100 with a minimum grade of D-

ALY 2100. Introduction to Programming for Data Analytics. (3 Hours)
Offers a hands-on first programming course for those with no prior programming experience. Covers basic programming logic and syntax with Python. Students apply Python packages mostly used on data analytics. Offers students an opportunity to learn how to code on the most used language in the job market.

Prerequisite(s): (MTH 2400 with a minimum grade of D- or PHL 2310 with a minimum grade of D-); ITC 2300 with a minimum grade of D-

ALY 2550. Generative AI. (3 Hours)
Presents the evolving landscape of generative AI, exploring foundational concepts, key technologies, and the mysteries inside AI's black box. Provides insights into cutting-edge models, explores platforms like ChatGPT and Claude, and studies the craft of prompt engineering to refine AI-generated results. Explores the ethical challenges of AI, addressing bias, transparency, and limitations. Offers professionals across analytics, information technology, engineering, biology, healthcare, management, business, and the humanities an opportunity to study powerful tools to make informed decisions and create impactful deliverables in an AI-driven future.

ALY 2983. Topics. (1-4 Hours)
Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

ALY 3015. Intermediate Statistics for Data Analytics. (3 Hours)
Expands upon the earlier introduced statistical approaches. Emphasizes more advanced analysis and multivariate methods. The goal is to provide students with the fundamental data management, review, reengineering, and exploration skills as necessary data analytical competencies.

Prerequisite(s): ALY 2010 with a minimum grade of D-

ALY 3040. Data Mining. (3 Hours)
Introduces the theories and tools for data mining techniques such as rule-based learning, decision trees, clustering, and association-rule mining. Also covers interpretation of the mined patterns using visualization techniques. Offers students an opportunity to gain the knowledge and experience to apply modern data-mining techniques for effective large-scale data pattern recognition and insight discovery. Introduces data analysis software—student teams evaluate, analyze, and report data for the methods used and insights discovered during case studies.

Prerequisite(s): ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-

ALY 3070. Communication and Visualization for Data Analytics. (3 Hours)
Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R and Python visualization packages.

Prerequisite(s): ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-

ALY 3110. Big Data and Web Mining. (3 Hours)
Offers students an opportunity to work with very large data sets and to learn how to write code to search the World Wide Web for publicly available data in a methodical and automated manner.

Prerequisite(s): ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-
Attribute(s): NUpath Analyzing/Using Data

ALY 3510. AI Foundations: An Interdisciplinary Approach. (3 Hours)
Introduces artificial intelligence, serving as an excellent starting point for exploring various aspects of AI or understanding its broader societal implications. Designed to help students from all academic backgrounds understand AI's principles and applications. Examines core concepts while exploring the field's true potential and limitations. Covers various AI paradigms, including machine learning, natural language processing, computer vision, and robotics, without requiring prior programming experience. Emphasizes AI's societal impact, discussing its ethical implications, potential benefits, and challenges across different sectors. Employs hands-on projects, interactive sessions, and real-world case studies to offer a critical perspective on AI's evolving role in shaping our future.

ALY 3983. Topics. (1-4 Hours)
Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

ALY 4000. Analytics Using R. (3 Hours)
Offers an overview of analytics concepts and practices across a diverse range of organizational contexts. Introduces data structure and management using R and SQL R packages. Leverages big data using Hadoop, Spark, and R scripting. Engages students in discussions on analytics careers and their ethical considerations. Introduces the basics of business strategies for big data analytics through a final project.

Prerequisite(s): ALY 2010 with a minimum grade of D- ; ITC 2300 with a minimum grade of D-

ALY 4020. Predictive Analytics Using R and Python. (3 Hours)
Introduces the end-to-end data-driven predictive modeling approach in R, Python, KNIME and WEKA with applications and case studies. Includes all the data and modeling steps in a full modeling cycle (training, validation and testing), exploratory data analysis and data cleansing, commonly applied modeling techniques such as SVM, random forest and ensemble models; introduces neural networks using TensorFlow.

Prerequisite(s): (ALY 2100 with a minimum grade of D- ; ALY 3015 with a minimum grade of D-) or ALY 3040 with a minimum grade of D-

ALY 4520. MLOps: Operationalizing AI. (3 Hours)
Examines the machine learning operations, or MLOps, life cycle for designing, deploying, and managing scalable machine learning systems. Surveys emerging trends, such as serverless computing and edge deployments, to illuminate future directions in MLOps. Highlights foundational methods for data ingestion, pipeline orchestration, and performance monitoring while addressing ethical and security considerations. Emphasizes cross-functional collaboration between data science and engineering for production-ready solutions that prioritize reliability and reproducibility. Demonstrates how automation strategies and best practices accelerate feedback loops and streamline model updates. Encourages a practice-based approach that integrates experimental results with continuous delivery to align with organizational goals.

Prerequisite(s): ALY 4020 with a minimum grade of B

ALY 4570. Social Impacts and Issues of AI. (3 Hours)
Presents a comprehensive overview of AI's fundamental concepts, techniques, and applications. Addresses core components—such as problem-solving and search algorithms, knowledge representation and reasoning, machine learning principles and algorithms, computer vision, and natural language processing—while highlighting practical considerations, ethical issues, and the societal implications of AI. Reinforces understanding and aims to develop practical skills through hands-on programming assignments and projects in Python. Offers students an opportunity to establish a solid foundation for mastering AI principles and techniques, preparing them for further study or careers in the field.

Prerequisite(s): ALY 2100 with a minimum grade of D-

ALY 4850. Analytics Capstone. (3 Hours)
Offers an advanced practicum in the development and delivery of data analysis for strategic decision making in organizations. Students apply the principles and tools of analytics to a comprehensive real-world problem or project within a sponsoring organization. Expects students to present analytical insights and recommendations for successful implementation of their capstone project.

Prerequisite(s): ALY 3040 with a minimum grade of D- ; ALY 3070 with a minimum grade of D- ; ALY 4000 with a minimum grade of D-
Attribute(s): NUpath Capstone Experience, NUpath Writing Intensive

ALY 4955. Project. (1-4 Hours)
Focuses on an in-depth project where the student conducts research or creates a product related to their major field. May be repeated twice for a maximum of 12 semester hours.

ALY 4983. Topics. (1-4 Hours)
Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for profit). Employs a mix of lectures, cases, and projects. Instructor determines the topics. May be repeated three times for a maximum of 16 semester hours.

ALY 5000. Introduction to Analytics. (2.25 Hours)
Offers an overview of analytics concepts and practices across a diverse range of industries and organizational contexts. Provides a hands-on introduction to statistics, data management, and the R scripting language. Technical projects based on introductory statistics and the R language offer students an opportunity to understand and apply the theories, practices, and application of analytics to real-world problems. An initial exploration of data sets illustrates how fundamental data analysis can impact decision making at both the strategic and operational level. Students research case studies to examine careers and professional opportunities in both for-profit and nonprofit industry segments.

ALY 5010. Probability Theory and Introductory Statistics. (2.25 Hours)
Introduces statistics for business analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion, variance, graphic presentation; elementary probability; populations and samples; sampling distributions; and categorical data. Includes a preliminary introduction to regression and correlation. Uses statistical software (for data analysis during analytic project assignments) to provide a hands-on experience to observe how probability and statistics, scripting, and basic data management impact decision making at all levels within a corporation.

ALY 5015. Intermediate Analytics. (2.25 Hours)
Builds on the foundation provided in ALY 6000 and ALY 6010 by exploring at greater depth the tools of data correction and recoding, as well as those of statistics and R. Offers students an opportunity to learn to discern and validate meaningful and statistically significant patterns in data through sound applications of the scientific method. Emphasizes initial mastery of correlation and regression, ANOVA, GLM, and logistic regression. Introduces the more advanced techniques of multivariable regression and nonparametric statistics and sampling. The goal of this course is to offer students an opportunity to master the fundamental skills of data management, analysis, and communication, which are the core data analytical competencies required of today's analytic professionals.

ALY 5030. Data Warehousing and SQL. (2.25 Hours)
Focuses on the management, mining, and interpretation of patterns in large databases. Offers students an opportunity to learn how organizations construct data warehouses from operational databases, about different data warehouse architectures, how to build a data warehouse, and how to structure databases for efficient data mining. Discusses relational databases and Structured Query Language (SQL) for the fundamentals in data modeling, database management, and SQL queries. Introduces other modern database systems such as NoSQL (non SQL) and column-based databases.

ALY 5050. Introduction to Enterprise Analytics. (2.25 Hours)
Introduces advanced specific analysis techniques—including forecasting, simulation, linear programming, regressive modeling, and optimization—as well as the Python programming language. The more advanced mathematical, statistical, and presentation functions within the R library packages are heavily utilized. Emphasizes enterprise data analytics, which is the extensive use of data, statistical, and quantitative analysis; exploratory and predictive models; and fact-based decision making to drive business strategies and actions. Course projects embrace marketing, retail, financial, and human resources analytics, as well as familiarize students with general industry practices. Emphasizes end-to-end analytic development skills, including data management, data engineering, analytics modeling, and strategy development. Offers students hands-on opportunities to apply quantitative techniques in strategic business decision making.

ALY 5070. Communication and Visualization for Data Analytics. (2.25 Hours)
Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R Shiny, Tableau and R in the lab sessions as the tool for data visualization.

ALY 5110. Data Management and Big Data. (2.25 Hours)
Designed to provide the student with the core concepts of data collection and management. Topics include systems for collecting data and implications for practice; types of data (textual, quantitative, qualitative, etc.); and storing data with privacy and security issues in mind. Offers students an opportunity to obtain a high-level understanding of big data technologies for data accessibility, efficiency, and security of data management at scale, including big data storage and computing technologies and big data analytics applications. Students create a working system for data acquisition and management using publicly available data sets and evaluate traditional data warehouse platforms as well as cloud-based big data storage and computing technologies. Azure is also introduced and used in the lab sessions.

ALY 6000. Introduction to Analytics. (3 Hours)
Offers an overview of analytics concepts and practices across a diverse range of industries and organizational contexts. Provides a hands-on introduction to statistics, data management, and the R scripting language. Technical projects based on introductory statistics and the R language offer students an opportunity to understand and apply the theories, practices, and application of analytics to real-world problems. An initial exploration of data sets illustrates how fundamental data analysis can impact decision making at both the strategic and operational level. Students research case studies to examine careers and professional opportunities in both for-profit and nonprofit industry segments.

ALY 6010. Probability Theory and Introductory Statistics. (3 Hours)
Introduces statistics for business analytics from an analysis-of-data viewpoint. Topics include frequency distributions; measures of location; mean, median, mode; measures of dispersion, variance, graphic presentation; elementary probability; populations and samples; sampling distributions; and categorical data. Includes a preliminary introduction to regression and correlation. Uses statistical software (for data analysis during analytic project assignments) to provide a hands-on experience to observe how probability and statistics, scripting, and basic data management impact decision making at all levels within a corporation.

Prerequisite(s): ALY 6000 (may be taken concurrently) with a minimum grade of C-

ALY 6015. Intermediate Analytics. (3 Hours)
Builds on the foundation provided in ALY 6000 and ALY 6010 by exploring at greater depth the tools of data correction and recoding, as well as those of statistics and R. Offers students an opportunity to learn to discern and validate meaningful and statistically significant patterns in data through sound applications of the scientific method. Emphasizes initial mastery of correlation and regression, ANOVA, GLM, and logistic regression. Introduces the more advanced techniques of multivariable regression and nonparametric statistics and sampling. The goal of this course is to offer students an opportunity to master the fundamental skills of data management, analysis, and communication, which are the core data analytical competencies required of today's analytic professionals.

Prerequisite(s): ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

ALY 6020. Predictive Analytics. (3 Hours)
Introduces the end-to-end, data-driven statistical and predictive modeling approach with applications and case studies. Includes all the data and modeling steps in a full modeling cycle, including data ETL process, exploratory data analysis, and data cleansing for outlier imputation and data normalization. Commonly applied modeling techniques such as k-nearest neighbors, GLM, random forest, neural networks, and Naive Bayes are heavily utilized and explained using advanced visualization techniques and simplified mathematical derivations to enhance understanding. Predictive analytic modeling steps such as model training, validation, and testing are widely utilized, as are tools and languages for data processing, analysis, and modeling.

Prerequisite(s): ALY 6015 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

ALY 6030. Data Warehousing and SQL. (3 Hours)
Focuses on the management, mining, and interpretation of patterns in large databases. Offers students an opportunity to learn how organizations construct data warehouses from operational databases, about different data warehouse architectures, how to build a data warehouse, and how to structure databases for efficient data mining. Discusses relational databases and Structured Query Language (SQL) for the fundamentals in data modeling, database management, and SQL queries. Introduces other modern database systems such as NoSQL (non SQL) and column-based databases.

Prerequisite(s): ALY 6000 with a minimum grade of C- ; ALY 6015 with a minimum grade of C-

ALY 6040. Data Mining Applications. (3 Hours)
Introduces the theories and tools for intensive data analysis methods and data mining techniques such as rule-based learning, decision trees, clustering, and association-rule mining. Also covers interpretation of the mined patterns using visualization techniques. Offers students an opportunity to gain the knowledge and experience to apply modern data-mining techniques for effective large-scale data pattern recognition and insight discovery. Introduces data analysis software; student teams evaluate, analyze, and report data for the methods used and insights discovered during case studies.

Prerequisite(s): (ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C-)

ALY 6050. Introduction to Enterprise Analytics. (3 Hours)
Introduces advanced specific analysis techniques—including forecasting, simulation, linear programming, regressive modeling, and optimization—as well as the Python programming language. The more advanced mathematical, statistical, and presentation functions within the R library packages are heavily utilized. Emphasizes enterprise data analytics, which is the extensive use of data, statistical, and quantitative analysis; exploratory and predictive models; and fact-based decision making to drive business strategies and actions. Course projects embrace marketing, retail, financial, and human resources analytics, as well as familiarize students with general industry practices. Emphasizes end-to-end analytic development skills, including data management, data engineering, analytics modeling, and strategy development. Offers students hands-on opportunities to apply quantitative techniques in strategic business decision making.

Prerequisite(s): ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

ALY 6060. Decision Support and Business Intelligence. (3 Hours)
Introduces current and emerging business analytical concepts and information technologies to support decision making and business intelligence. Commercial decision support systems in various application areas are introduced and discussed using case studies, including CRM (customer relationship management) for customer management, web analytics applications, sales force management systems, etc. Introduces business intelligence technology and applications, such as OLAP (Online Analytical Processing), OBIEE (Oracle Business Intelligence Enterprise Edition), and IBM Cognos. Offers students an opportunity to gain hands-on experience using business intelligence tools, including Tableau or QlikView.

ALY 6070. Communication and Visualization for Data Analytics. (3 Hours)
Offers an interdisciplinary examination of design concepts and cognitive and communication theories that support effective practices for data visualization and communication. Considers the relationship between information and audience and studies effective techniques in the written, spoken, and visual communication of complex quantitative information. Project-based activities offer students opportunities to apply these techniques in a manner that makes data understandable, compelling, and actionable. Introduces R Shiny, Tableau and R in the lab sessions as the tool for data visualization.

Prerequisite(s): ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

ALY 6080. Integrated Experiential Learning. (3 Hours)
Offers a practicum in the development and delivery of predictive data analysis for strategic decision making in organizations. Offers students an opportunity to apply the principles and tools of analytics to real-world problems in business organizations and to develop and present analytical insights and recommendations for successful implementation of their capstone project.

Prerequisite(s): ALY 6015 with a minimum grade of C- ; ALY 6050 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

ALY 6110. Data Management and Big Data. (3 Hours)
Designed to provide the student with the core concepts of data collection and management. Topics include systems for collecting data and implications for practice; types of data (textual, quantitative, qualitative, etc.); and storing data with privacy and security issues in mind. Offers students an opportunity to obtain a high-level understanding of big data technologies for data accessibility, efficiency, and security of data management at scale, including big data storage and computing technologies and big data analytics applications. Students create a working system for data acquisition and management using publicly available data sets and evaluate traditional data warehouse platforms as well as cloud-based big data storage and computing technologies. Azure is also introduced and used in the lab sessions.

Prerequisite(s): (ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C-)

ALY 6120. Leadership in Analytics. (3 Hours)
Covers analytical leadership principles for the structure and dynamics of organizations, combining relevant research to offer students an opportunity to deepen their understanding of effective change in business analytical decision making.

ALY 6130. Risk Management for Analytics. (3 Hours)
Seeks to provide a conceptual overview of analytic risk management. Offers students an opportunity to evaluate and analyze financial, technical, and other business risk-assessment and risk-modeling techniques and tools.

ALY 6140. Python and Analytics Systems Technology. (3 Hours)
Presents a selection of analytics systems technologies that are deployed in lab sessions throughout the course. A multitude of analytics systems technologies are used for different purposes to describe data numerically and graphically, for data visualization, file systems (HFS) for a large data mart, applications of structured query language, and filtering and transforming to ingest the data through scripting languages. Focused primarily on Python, topics covered include the differences between R and Python, data ingestion, data manipulation, visualization, and predictive analytics using common Python libraries.

ALY 6150. Healthcare/Pharmaceutical Data and Applications. (3 Hours)
Introduces a selection of healthcare/pharmaceutical data used for a variety of purposes, and its specific application in data-driven business decision making. Healthcare/Pharmaceutical data is collected as part of Medicare and Medicaid databases and as mandated by the PPACA (Patient and Affordable Care Act) and the PPSA (Physicians Payment Sunshine Act). Data is available in the form of medical records, social networks, outcomes databases, syndicated data reports, epidemiological data, demographic data, analyst information, RD Pipeline Database, market data, and online journals and newsletters. Organizations, corporations, and companies use these varieties of data for a host of different reasons - to better profile and segment customers, to answer performance questions, and to identify and capture key opportunities.

Prerequisite(s): (ALY 6000 (may be taken concurrently) with a minimum grade of C- ; ALY 6010 with a minimum grade of C-) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C-)

ALY 6980. Capstone. (3 Hours)
Offers an advanced practicum in the development and delivery of predictive data analysis for strategic decision making in organizations. Students apply the principles and tools of analytics to a comprehensive real-world problem or project within a sponsoring organization. Expects students to present analytical insights and recommendations for successful implementation of their capstone project and their individual project proposal.

Prerequisite(s): ALY 6080 with a minimum grade of C- ; ALY 6135 with a minimum grade of C- ; ((ALY 6110 with a minimum grade of C- ; ALY 6020 with a minimum grade of C-) or (ALY 6060 with a minimum grade of C- ; ALY 6120 with a minimum grade of C-) or (EAI 6000 with a minimum grade of C- ; EAI 6010 with a minimum grade of C-)); ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C- ; ALY 6015 with a minimum grade of C- ; ALY 6050 with a minimum grade of C- ; ALY 6070 with a minimum grade of C-

ALY 6983. Topics. (3 Hours)
Discusses contemporary topics in analytics for a rotating variety of industries (nonprofit and for-profit).

Prerequisite(s): ALY 6000 with a minimum grade of C- ; ALY 6010 with a minimum grade of C-

ALY 6995. Project. (1-4 Hours)
Focuses on an in-depth project in which a student conducts research or produces a product related to the student's major field.