[ARCHIVED CATALOG]

## Data Science, B.S.

Program Learning Outcomes and Educational Effectiveness Evaluation Plans for B.S. in Data Science.

Students pursuing the B.S. in Data Science are required to:

- Earn an overall GPA of 2.500 for all required lower-division major courses.
- Earn an overall GPA of 2.000 for all required major courses.
- Complete all courses in the major for a letter grade of "C-" or higher, except those where the default grading option is P/NP.
- Complete a minimum of 21 credits from upper division courses in the major.

Majors are required to enroll in FFC 100B - First Year Foundations: Grand Challenges in Science and Engineering to satisfy their General Education requirement.

## Grand Challenges Initiative (3 credits)

SCI 150 - Grand Challenges in Science and Engineering I

### SCI 150 - Grand Challenges in Science and Engineering I

This research seminar is a continuation of the Grand Challenges FFC. It is designed to provide a mentored experience for teams as they pursue possible solutions to their grand challenges. Faculty serving as team mentors will use evidence-based approaches to improve students' critical thinking, problem-solving and communication skills. Faculty are joined by a number of external experts who provide students with additional insights into their challenges, introduce them to a diversity of careers in science, and serve as the foundation of a professional network. In this phase, teams are encouraged to grow, evolve, and even recruit new members across campus, as it becomes clearer what skills are needed to advance towards their goals. This course may not be taken concurrently with SCI 200 or SCI 250. Letter grade. (Offered every semester.) **1 credit**

SCI 200 - Grand Challenges in Science and Engineering II

### SCI 200 - Grand Challenges in Science and Engineering II

Prerequisite, SCI 150. This seminar is a continuation of the Grand Challenges in Science and Engineering series. It is designed to provide a mentored experience for teams as

they pursue possible solutions to their grand challenges. Faculty serving as team mentors will use evidence-based approaches to improve students' critical thinking, problem-solving and communication skills. Faculty are joined by a number of external experts who provide students with additional insights into their challenges, introduce them to a diversity of careers in science, and serve as the foundation of a professional network. In this phase, teams are encouraged to grow, evolve, and even recruit new members across campus, as it becomes clearer what skills are needed to advance towards their goals. This course may not be taken concurrently with SCI 150 or SCI 250. Letter grade. (Offered every semester.) **1 credit**

SCI 250 - Grand Challenges in Science and Engineering III

### SCI 250 - Grand Challenges in Science and Engineering III

Prerequisite, SCI 200. This seminar is a continuation of the Grand Challenges in Science and Engineering series. It is designed to provide a mentored experience for teams as they pursue possible solutions to their grand challenges. Faculty serving as team mentors will use evidence-based approaches to improve students' critical thinking, problem-solving and communication skills. Faculty are joined by a number of external experts who provide students with additional insights into their challenges, introduce them to a diversity of careers in science, and serve as the foundation of a professional network. In this phase, teams are encouraged to grow, evolve, and even recruit new members across campus, as it becomes clearer what skills are needed to advance towards their goals. This course may not be taken concurrently with SCI 150 or SCI 200. Letter grade. (Offered every semester.) **1 credit**

## lower-division requirements (27 credits)

ENGR 101 - Foundations of Design and Fabrication

### ENGR 101 - Foundations of Design and Fabrication

Students gain first-hand experience with design and fabrication as a foundation of engineering. Using technologies such as additive manufacturing (eg. 3D printing), embedded systems and software, and electronics, students will work together to develop innovative solutions to interesting problems. This course is offered in a hybrid format only. Pass/No Pass. (Offered every semester.) **3 credits**

MATH 110 - Single Variable Calculus I

### MATH 110 - Single Variable Calculus I

Prerequisite, MATH 101 or equivalent. Students study single variable functions, limits and continuity, differentiation, applications of derivatives (approximations, curve plotting, optimization), antiderivatives, the definite integral, and applications of integration. Students who take MATH 109 or MATH 110 may not also receive credit for MATH 115. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

ECON 200 - Principles of Microeconomics

## ECON 200 - Principles of Microeconomics

Prerequisites, MATH 100, or equivalent. Decision-making with scarce resources, supply and demand concepts, pricing in competitive and non-competitive markets, capital theory, resource pricing, public choice, environmental economics, international trade, and comparative economic systems. Letter grade. (Offered every semester.) **3 credits**

MATH 203 - Introduction to Statistics

## MATH 203 - Introduction to Statistics

Prerequisite, MATH 100 or equivalent. This course provides a progressive, detailed, and practical introduction to essential topics in classical statistics. The main concepts covered in this class include the following: design of experiments and sampling, descriptive statistics methods, correlation and regression analysis, probability and probability distribution, sampling distributions, and inferential statistics methods. This course is intended for students in a wide variety of areas of study so a variety of examples from different fields are used to illustrate the concepts. The course is taught in an interactive setting where students will learn how to use statistical software while learning introductory statistics concepts. Some sections of this course may be offered as hybrid courses or online only. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

MGSC 220 - Foundations of Business Analytics

## MGSC 220 - Foundations of Business Analytics

Prerequisite, MGSC 209 or MATH 203 or PSY 203, with a minimum grade of C-. This course focuses on building models and describing data in spreadsheets to solve business problems. Topics in descriptive, predictive and prescriptive analytics are covered including data visualization, multiple regression, simulation and linear optimization. Emphasis is placed on theory, application of theory using appropriate software and on managerial interpretation of results. Letter grade. (Offered every semester.) **3 credits**

CPSC 230 - Computer Science I

## CPSC 230 - Computer Science I

Students are introduced to problem-solving methods and algorithm development through an interactive and easy-to-learn programming language, Python. (Offered every semester.) **3 credits**

CPSC 231 - Computer Science II

## CPSC 231 - Computer Science II

Prerequisite, CPSC 230, or equivalent. This course is a comprehensive study of object-oriented computing with a mainstream programming language, Java. The course

introduces the principal features of the language with a focus on object-oriented development, code reuse, and large program structure. The course also covers advance topics such as concurrency and graphical user interfaces. (Offered every semester.) **3 credits**

CPSC 285 - Social and Ethical Issues in Computing

## CPSC 285 - Social and Ethical Issues in Computing

This course considers a range of ethical and social issues related to the effects of computers on how we live, focusing on broad social issues as well as individual responsibilities. Privacy and intellectual property (e.g. P2P downloading), software licenses, software reliability, and risks. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

CPSC 293 - Mathematical Foundations of Machine Learning

## CPSC 293 - Mathematical Foundations of Machine Learning

Prerequisites, CPSC 230, MATH 203 and MATH 110 or MATH 115. A concise overview of the mathematical foundations of machine learning, including key intermediate concepts from calculus, linear algebra, probability, statistics, and optimization. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

## colloquium requirement (6 credits)

Students must complete six 1-credit sections of CPSC 298 - Computer Science Colloquium.

## upper-division requirements (30 credits)

MGSC 310 - Statistical Models in Business Analytics

## MGSC 310 - Statistical Models in Business Analytics

Prerequisite, MGSC 220 with a minimum grade of C-. A rigorous introduction to descriptive and inferential statistics in analytics with applications in accounting, finance, marketing and operations. The course focuses on data mining: logistic regression, nearest neighbor, decision trees, naïve Bayes and others, following a review of basic introductory statistical methods. The course introduces theories and concepts in estimation including choice of technique, model choice and false discovery. Students are required to implement and interpret modeling scripts in using R statistical software. Letter grade. (Offered every year.) **3 credits**

CPSC 349 - Human Factors

## CPSC 349 - Human Factors

Prerequisite, CENG 231 or CPSC 231. Students study the foundations of human factors, with emphasis on user interface design and user experience. Topics include engineering psychology, design constraints, memory models, visual and auditory processing, and human-centered design. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

CPSC 350 - Data Structures and Algorithms

## CPSC 350 - Data Structures and Algorithms

Prerequisite, CPSC 231 or CENG 231. Students study core data structures and algorithms, such as arrays, stacks, lists, queues, trees, hash tables, graphs; search and sort. Students engage on projects that involve individually chosen advanced data structures and algorithms. The focus is on applications of data structures and algorithms, utilization of existing practical data sets, and performance trade-offs. Letter grade. (Offered every semester.) **3 credits**

CPSC 353 - Data Communications and Computer Networks

## CPSC 353 - Data Communications and Computer Networks

Prerequisite, CENG 231 or CPSC 231. Students explore the principles and techniques of data communications and give special emphasis to networks and distributed systems. The I.S.O. Reference Model for open systems interconnection will be investigated and the function and operation of each protocol layer analyzed in detail. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

CPSC 355 - Human Computer Interaction

## CPSC 355 - Human Computer Interaction

Prerequisite, CPSC 349. Students study the foundations of human-interaction, with emphasis on user-centered design methodologies. Topics such as usability, human factors, user studies, and multi-model interfaces will be explored, and the theory put into practice through programming projects that develop graphical user interfaces and applications for the Android or iPhone/iPad. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

CPSC 390 - Artificial Intelligence

## CPSC 390 - Artificial Intelligence

Prerequisite, CPSC 350. Students study the tools, techniques, and applications of artificial intelligence. Students will be introduced to the programming techniques utilized in artificial intelligence applications. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

CPSC 392 - Introduction to Data Science

## CPSC 392 - Introduction to Data Science

Prerequisites, CPSC 230, and MATH 203 or MATH 303 or MGSC 209. This course provides a survey of algorithms, tools, and techniques for computing with Big Data. Students will be exposed to fundamental concepts in data mining, machine learning, and information retrieval systems, with special emphasis on statistical techniques for data visualization and analysis. Recent advances in high performance computing, such as map-reduce, will be presented in the context of Big Data. Students will apply data mining algorithms to data sets from biology, chemistry, social media, and industry. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

CPSC 393 - Machine Learning

## CPSC 393 - Machine Learning

Prerequisite, CPSC 392. This course provides a survey of algorithmic techniques for machine learning, including statistical techniques for pattern recognition. Topics include neural networks, deep learning, support vector machines, and kernel methods. (Offered as needed.) **3 credits**

CPSC 408 - Database Management

## CPSC 408 - Database Management

Prerequisite, CPSC 350. Students learn data management concepts and the representation and structure of data in the context of applications and system software. The emphasis is on design of databases and developing applications in a client-server environment using SQL as the query language. Letter grade with Pass/No Pass option. (Offered every semester.) **3 credits**

MGSC 410 - Applied Business Analytics

## MGSC 410 - Applied Business Analytics

Prerequisites, MGSC 310, CPSC 392, with a minimum grade of C- in each prerequisite. This course provides a hands-on opportunity for students to integrate and apply the analytics skills and knowledge learned throughout the course to real world data. The course will reinforce the methods and techniques typically used in analytics including data preparation, building and evaluating wide variety of models and interpreting and presenting the results. Students work in teams on a large scale analytics project. At the end of the course, students submit a report summarizing their analyses and study outcomes, and present their results to the class. Letter grade. (Offered every year.) **3 credits**

## electives (9 credits)

three of the following

## MATH 303 - Biostatistics

Prerequisite, MATH 101, MATH 110, MATH 111, MATH 210, or MATH 210. MATH 109 should have a grade C or above. This course will provide a comprehensive introduction to various statistical methods, emphasizing applications in biology, medicine, and public health. Main concepts such as descriptive statistics, estimation of statistical parameters, statistical tests of significance, analysis of variance, and regression analysis will be studied. Examples and real-life data sets will be provided to clarify the concepts and underline connections with related topics and current research. Computations will be done using the statistical software, R. Letter grade. (Offered every semester.) **3 credits**

## ENV 310 - Geographic Information Systems, Lecture and Laboratory

Structure, concepts, and application of geographic information systems (GIS): computer-based systems designed to process large spatial databases. Productive use of GIS in physical and social sciences, environmental management, and regional planning is investigated through applied exercises and problems. This course includes a lecture and required laboratory component held at different times. (Offered spring semester.) **4 credits**

## CPSC 358 - Assistive Technology

Recommended preparation, CPSC 230. An introduction to assistive technologies (AT). In particular, students will study social, cultural, and economic factors of disability as they pertain to AT. This will be accomplished by studying existing practices and challenges, designing new user experiences, and integrating new technologies into the AT space. (Offered fall semester.) **3 credits**

## CPSC 359 - Computer-Supported Cooperative Work

Prerequisite, CPSC 355. Computer-supported cooperative work explores the technical, organizational, and social issues involved in designing, developing, deploying, and evaluating computational and communication tools to support groups, organizations, communities, and networks. This course will provide an initial survey of CSCW research and practices in the past 25 years and give students hands-on experience through a group design project aimed at orienting students to design for cooperative activities. (Offered every year.) **3 credits**

## MATH 360 - Probability Theory

Prerequisite, MATH 116 or MATH 210. This course introduces the fundamental concepts of probability theory. Topics include counting techniques, probability, conditional probability, Bayes theorem, multivariate distributions, discrete and continuous probability distributions, functions of random variables, marginal distributions, Central Limit Theorem and sampling distributions. This course is a prerequisite for Mathematical Statistics. Letter grade. (Offered fall semester, alternate years.) **3 credits**

MATH 361 - Mathematical Statistics

## MATH 361 - Mathematical Statistics

Prerequisite, MATH 360. This course introduces the fundamental concepts in statistics. Topics include modes of convergence, maximum likelihood, UMVUE, Rao-Kramer theorem, sufficiency and completeness, Lehmann-Scheffe theorem, confidence intervals, hypothesis testing, generalized likelihood ratio test, tests for genetic association, contingency tables, linear models. (Offered spring semester, alternate years.) **3 credits**

ISP 363 - Cybersecurity 1

## ISP 363 - Cybersecurity 1

Prerequisite, CPSC 353. Students are exposed to the world of cybersecurity. Emphasis is placed on understanding, recognizing, and patching security exploits. Students will use standard industry tools and techniques to gain hands-on experience in this rapidly-growing field. Note that students majoring in computer science, computer engineering, software engineering, or data analytics may not use ISP 363 as an elective in the major if they are also minoring in Information Security and Policy. Letter grade with Pass/No Pass option. (Offered every year.) **3 credits**

MGSC 406 - Advanced Experimental Design and Statistics

## MGSC 406 - Advanced Experimental Design and Statistics

Prerequisites, MATH 203 or MGSC 209 or equivalent, with a minimum grade of C-. Advanced statistics as employed in the construction and optimization of experimental designs and subsequent analysis of data. Between-designs and one- and two-way ANOVA in detail from a linear modeling and least squares perspective (to match basic econometrics); power planning; general tests of contrasts; within-designs and repeated measures designs. Letter grade. (Offered spring semester.) **3 credits**

CPSC 430 - Computational Economics

## CPSC 430 - Computational Economics

Prerequisites, MATH 110 and CPSC 230 or CPSC 236 or consent of instructor. This course will introduce students to the computational tools required to understand electronic

exchange systems and implement economic experiments. Students will be required to become familiar with numerical analysis, computer simulation and programming of experiments. Letter grade. (Offered as reading and conference only.) **4 credits**

CPSC 435 - BioMedical Informatics

## CPSC 435 - BioMedical Informatics

Prerequisite, CPSC 230. Students are introduced to contemporary research topics in medical informatics, including computational techniques for the collection, management, retrieval, and analysis of biomedical data. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

CPSC 445 - High Performance Computing

## CPSC 445 - High Performance Computing

Prerequisite, CPSC 350, or consent of instructor. The course introduces students to parallel computing architectures and programming models. Students learn and practice parallel programming techniques using shared memory and message passing. Course topics include parallel computing fundamentals, Unix and C, shared memory parallel computing (with OpenMP), message passing parallel computing (with MPI), parallel performance evaluation, and multilevel parallel computing (with OpenMP and MPI combined). (Offered alternate years.) **3 credits**

ECON 452 - Econometrics

## ECON 452 - Econometrics

Prerequisites, ECON 200, ECON 201 and MATH 109 or MATH 110, and MGSC 209 or MATH 203, with a minimum grade of C- in each prerequisite and business administration, or economics major, or computational science, or economics, or mathematics minor. Mathematical and statistical tools to measure economic phenomena. This will involve mathematical formulation of economic theories and statistical inference relating economic theory to empirical analysis. Letter grade. (Offered spring semester.) **3 credits**

CPSC 458 - Web Engineering

## CPSC 458 - Web Engineering

Prerequisites, CPSC 350. Students explore the principles and techniques for developing and managing web applications using HTML5, CSS and JavaScript, as well as other web development frameworks such as Ruby on Rails. Students will acquire skills to develop, install, configure, customize, optimize, and troubleshoot web applications. Letter grade with Pass/No Pass option. (Offered as needed.) **3 credits**

[MGSC 496 - Special Topics in Management Science](#) (Applied Analytics and Decision Making)

**MGSC 496 - Special Topics in Management Science**

In-depth study of a specific area, content of course changes every semester. May be repeated once. (Offered as needed.) **3 credits**

**total credits 75**