

# Master of Science in Applied Data Science

## CURRICULUM DESIGN

The University of San Diego's 100% online Master of Science in Applied Data Science (MS-ADS) is designed to equip graduate students with the technical strategies and skills they will use to apply powerful and modern analytical tools to real-world applications.

This 30-unit program provides asynchronous coursework and can be completed in five terms where students will complete six units per term, focusing on one course at a time. Applications are accepted all year round and students may start the program in either the Fall, Spring or Summer. Program courses will cover technical aspects essential to the field of data science and will prepare graduates to serve as active leaders and managers of multiple functions within various organizations.

Below is a visual that represents the course schedule journey that graduate students will follow. The program begins with two prerequisite and foundational courses, then students will move forward to the core courses and then will conclude with a collaborative, analytical capstone project.

### FROM THE ACADEMIC DIRECTOR

*The goal of the USD MS-ADS online program is to prepare prospective data scientists with in-depth analytical knowledge tied to real-world applications, relevant programming ability, and critical professional skills to both succeed in their career and to create meaningful social impact.*

- Dr. Ebrahim Tarshizi

### CONTACT US

Learn more at

[SanDiego.edu/datascience](http://SanDiego.edu/datascience)

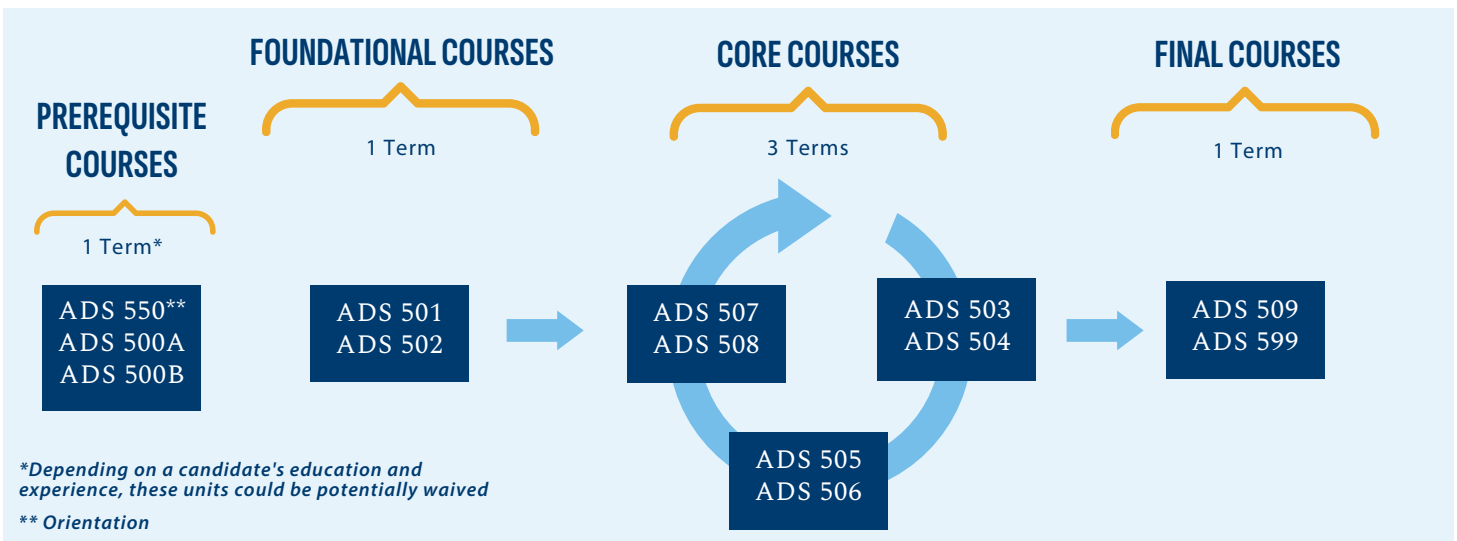
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## ORIENTATION COURSE

### ADS 550 - New Student Orientation

This orientation course introduces students to the University of San Diego and provides important information about the MS-ADS program and the technologies that will be used throughout the program. In the orientation, students will learn to successfully navigate through the learning environment and locate helpful resources. Students will practice completing tasks as preparation for success in their online graduate courses. This orientation course will be available to students as a reference tool throughout the entirety of the program.

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## PREREQUISITE COURSES

### ADS 500A - Probability and Statistics for Data Science

This course is an introduction to probability and statistical concepts and their applications in solving real-world problems. This prerequisite course provides a solid background in the application of probability and statistics that will form the basis for advanced data science methods. Statistical concepts, probability theory, random and multivariate variables, data and sampling distributions, descriptive statistics, and hypothesis testing will be covered. The use of computer-based applications for the performance of basic statistics will be utilized. Covered topics include the numerical and graphical description of data, elements of probability, sampling distributions, probability distribution functions, estimation of population parameters, and hypothesis tests. This course will combine the learnings from texts, case studies, and standard organizational processes with practical problem-solving skills to present, structure, and plan the problem as it would be presented in large enterprises and execute the steps in a structured analytics process.

### ADS 500B - Data Science Programming

This course is an introduction to fundamental concepts of programming and problem-solving techniques for data science. Python and R are the languages used to analyze and deliver insights from real-world datasets. Topics include the basics of Python and R, data acquisition, integration and transformation, problem understanding, data preparation, standardization, and exploratory data analysis. In addition, command line tools and editors are explored in UNIX, and methods to access and analyze (relational database management systems) (RDBMS) are examined. The course ends with introducing students to the basics of machine learning models.

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## FOUNDATIONAL COURSES

### ADS 501 - Foundations of Data Science and Ethics

This course covers an introduction to the methods, theoretical concepts, and ethical considerations found and practiced in the field of professional data science. Topics include defining and structuring the business problem, aligning a data science solution, managing the business, the CRISP-DM methodology, ensuring the science in data science using the scientific method, project management, managing ethical concerns, and the importance of performing exploratory data analysis. This course will combine the learnings from the textbook, case studies, and standard organizational processes where students exercise their leadership skills, practice stakeholder mapping, project management, ethical risk assessment, and practice clear communication of findings for non-technical audiences. Prerequisites: ADS 500A and ADS 500B. Both ADS 500A and ADS 500B can be waived by the Academic Director based on an evaluation of the student's professional background and academic history.

### ADS 502 - Applied Data Mining

This course covers a comprehensive introduction to data mining techniques and applications with a variety of integrated theoretical and practical examples in data exploration, preprocessing, modeling, classification, association analysis, cluster analysis, and anomaly detection. This course also includes a wide variety of applied problems associated with each topic in data mining using both Python and R code examples. Students will also conduct a broad and hands-on final project from the covered data mining principles, present, and report the technical results. Prerequisites: ADS 500A and ADS 500B. Both ADS 500A and ADS 500B can be waived by the Academic Director based on an evaluation of the student's professional background and academic history.

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## CORE COURSES

### ADS 503 - Applied Predictive Modeling

This course provides a working knowledge of applied predictive modeling. Students will obtain a broad understanding of model training and development procedures, applications to real-world business problems, and the differences between predictive model types and uses. This course introduces best practices to manage data science projects, create web applications, and present results to technical and non-technical audiences. Course topics include linear and non-linear regression modeling methods, linear and non-linear classification modeling methods, model selection, variable importance, variable selection and model applications, code and R package management, and web application development using R Studio and R Shiny. Prerequisites: ADS 501 and ADS 502

## ADS 504 - Machine Learning and Deep Learning for Data Science

This course covers the study of supervised and unsupervised algorithms in the Machine Learning context. Emphasis on formulating, choosing, applying, implementing, and evaluating machine learning models to capture key patterns exhibited in cross-sectional data and longitudinal data. This course also discusses the considerations of model complexity interpretations and implementation in real-world applications using Python and associated packages. An introduction to Deep Learning is provided in this course. Prerequisites: ADS 501 and ADS 502

## ADS 505 - Applied Data Science for Business

Data science skills are in high demand across a wide variety of industries. This course focuses on real-world use cases of data mining applications, including predicting consumer purchase behavior, brand loyalty, product prices, sales up-lift, basis of purchase, direct marketing campaign cost-effectiveness, rideshare cancellations, competitive online auctions, recommendation engines, and segmenting and identifying important customers. This course covers practical, business-oriented examples and use cases associated with each topic in data mining using Python. Data visualization, effective data storytelling, and analytical communication are being taught. Tableau, one of the most popular business analytics and dashboard tools, is practiced in this course. Prerequisites: ADS 501 and ADS 502

## ADS 506 - Applied Time Series Analysis

Many datasets naturally have a time series component: records collected over time, financial data, biological data signals such as brain waves or blood glucose levels, weather, and seasonal information. Practicing data scientists need to identify when they encounter time series data and when to apply suitable techniques. This course introduces the major topics in time series analysis and forecasting, including decomposition, exponential smoothing, regression, ARIMA models, and advanced machine learning approaches. Students will learn to analyze and forecast time series using R, evaluate model performance, and communicate results effectively. Real-world datasets will be used throughout, culminating in a complete end-to-end analysis project. Prerequisites: ADS 501 and ADS 502

## ADS 507 - Practical Data Engineering

In this course, students will learn about the discipline of data engineering. They will learn what data engineers are, what they do and how it relates to the field of data science. Topics will include data architecture, relational databases, SQL, data pipelines (ETL and ELT), ethical data engineering (data security and privacy), and data engineering best practices. Prerequisites: ADS 501 and ADS 502

## ADS 508 - MLOps for Data Science

This course covers the fundamental concepts of cloud computing as it impacts the field of data science. Course topics include cloud economics, distributed storage, SageMaker ecosystem, distributed processing, model tuning, natural language processing, and model deployment considerations in the cloud. This course will combine the learnings from texts and relevant technical articles with practical hands-on skills to design, implement, and recommend solutions for the business problem as it would be presented in the business world, and execute the steps in a structured model development process. Prerequisites: ADS 501 and ADS 502

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## FINAL CORE AND CAPSTONE

### ADS 509 - Applied Large Language Models for Data Science

This course focuses on the application of large language models (LLMs) for data science using Python. Topics include the collection, preparation, and analysis of textual data, the application of pre-trained LLMs to textual data analysis and classification problems, and the application of generative AI models for use in data science pipelines and products. Prerequisites: ADS 501, ADS 502, ADS 503, ADS 504, ADS 505, ADS 506, ADS 507, and ADS 508

### ADS 599 - Capstone Project

The purpose of this Capstone Project is for students to apply their acquired theoretical knowledge obtained during the Applied Data Science Program to a research-based, code-oriented data science project. During the project, students lead the entirety of the end-to-end process that involves the collection and processing of the data while utilizing the appropriate analytical methods. The project will be documented in an academic journal-style article, orally presented as a recorded technical presentation, and delivered as a working artifact (i.e., a Tableau dashboard, Streamlit app, or equivalent productionized output.) Students will work in teams and are encouraged to find project topics that originate from real-world domains in order to tackle unique problem statements that have real-world impact. Prerequisites: ADS 501, ADS 502, ADS 503, ADS 504, ADS 505, ADS 506, ADS 507, ADS 508, and ADS 509