

# INTEGRATED DATA SCIENCE CERTIFICATE

The following requirements are in addition to, or further elaborate upon, those requirements outlined in The Graduate School Policy Guide (<https://catalogs.northwestern.edu/tgs/academic-policies-procedures/>).

## Certificate

**Total Units Required: 5**

### Course Requirements:

To complete the Integrated Data Science (IDS) Certificate requirements, students will take five courses including at least one course from group A, at least two courses from group B, at least one course from group C, and a fifth course from any group. The courses currently available in each curriculum group are described below, developed in connection to the NSF IDEAS traineeship (<https://www.ideas.ciera.northwestern.edu/>).

### Group A. Data Challenges in Domain Disciplines

Course	Title
DATA_SCI 401-1	Data-Driven Research in Physics, Geophysics, and Astronomy
DATA_SCI 401-2	Data-Driven Research in Physics, Geophysics, and Astronomy
BIOL_SCI 354-0	Quantitative Analysis of Biology

### Group B. Core Data Analytics

Course	Title
DATA_SCI 421-0	Integrated Data Analytics I
DATA_SCI 422-0	Mathematical Inverse Methods in Earth and Environmental Sciences
DATA_SCI 423-0	Machine Learning: Foundations, Applications, and Algorithms

### Group C. Electives in Data Analytics

Course	Title
CHEM_ENG 379-0	Computational Biology: Analysis and Design of Living Systems
COMP_ENG 495-0	Special Topics in Computer Engineering
COMP_ENG 510-0	Seminar
COMP_SCI 336-0	Design & Analysis of Algorithms
COMP_SCI 496-0	Special Topics in Computer Science
EARTH 327-0	Geophysical Time Series Analysis
ELEC_ENG 420-0	Digital Image Processing
ELEC_ENG 435-0	Deep Learning: Foundations, Applications, and Algorithms
ELEC_ENG 495-0	Special Topics in Electrical Engineering
ELEC_ENG 433-0	Statistical Pattern Recognition
ELEC_ENG 473-0	Deep Reinforcement Learning
ES_APPM 421-1	Models in Applied Mathematics
ES_APPM 448-0	Numerical Methods for Random Processes
IEMS 304-0	Statistical Learning for Data Analysis
MAT_SCI 458-0	Atomic Scale Computational Materials Science
STAT 350-0	Regression Analysis
STAT 365-0	Introduction to the Analysis of Financial Data
STAT 454-0	Time Series Analysis

STAT 457-0	Applied Bayesian Inference
STAT 461-0	Advanced Topics in Statistics

*Please note Machine Learning (COMP\_SCI 349-0) will still count as an elective if taken before spring 2020. Data Management and Information Processing (COMP\_SCI 317-0) is no longer offered; however it will still count as an elective if taken before Fall 2019.*