Data Science, B.S.

Degree Offered

- Bachelor of Science

Nature of the Program

Data science is an interdisciplinary field with roots in applied mathematics, statistics and computer science. The Bachelor of Science in Data Science seeks to meet the increased employment demands across many industries and research fields.

Data Science majors will develop quantitative and computational skills to solve real-world problems. For example, data scientists are responsible for creating and maintaining dashboards in a pandemic, predicting traffic patterns to improve driver safety and helping apps like Uber Eats optimize food delivery. Students can customize the degree to fit their interests by selecting a focus area of their choice to create a degree with practical applications.

Working with their academic advisers, data science students will take classes in a discipline related to their interests and career goals. Students can choose their area of emphasis among a variety of areas including the social sciences, humanities, and sciences. Examples, include astronomy, biology, criminology, geography, geology, GIS, physics, public health, psychology, and sociology.

FACULTY

DIRECTOR OF THE SCHOOL OF MATHEMATICAL AND DATA SCIENCES
- Jessica Deshler - Ph.D. (University of New Mexico)

ASSOCIATE DIRECTOR FOR MATHEMATICS
- Adrian Tudorascu - Ph.D. (Carnegie Mellon University)
  Regular Graduate Faculty, Partial Differential Equations, Optimal Transport

ASSOCIATE DIRECTOR FOR STATISTICS
- Kenneth Ryan - Ph.D. (Iowa State University)
  Regular Graduate Faculty, Semi-supervised learning and design of experiments

ASSISTANT DIRECTOR FOR UNDERGRADUATE STUDIES
- David Miller - Ph.D. (Oklahoma State University)
  Regular Graduate Faculty, Undergraduate Math Education, Cognitive Science, STEM Education

PROFESSORS
- Kenneth Ryan - Ph.D. (Iowa State University)
  Regular Graduate Faculty, Semi-supervised learning and design of experiments
- Krzysztof Ciesielski - Ph.D. (Warsaw University)
  Regular Graduate Faculty, Topology, Set Theory, MRI Imaging
- Marjorie Darrah - Ph.D. (West Virginia University)
  Regular Graduate Faculty, Applied Mathematics, Mathematics Education
- Jessica Deshler - Ph.D. (University of New Mexico)
  Regular Graduate Faculty, Undergraduate Mathematics Education, Equity, Graduate Student Development
- Harvey Diamond - Ph.D. (Massachusetts Institute of Technology)
  Regular Graduate Faculty, Approximation theory, Applied Mathematics
- Harry Gingold - D.Sc. (Israel Institute of Technology)
  Regular Graduate Faculty, Discrete Finite Difference systems of Equations, Factorization of Power Series, Foundation (Geometry), Mathematical Cryptography, Optimization, Compactification, Ordinary Differential Systems of Equations, Asymptotics, Approximations, Turning point theory, Celestial Mechanics
- Erin Goodykoontz - Ed.D (West Virginia University)
  Associate Graduate Faculty, Introductory Concepts of Mathematics
- Rong Luo - Ph.D. (West Virginia University)
  Regular Graduate Faculty, Graph Theory, Discrete Math
- David Miller - Ph.D. (Oklahoma State University)
  Regular Graduate Faculty, Undergraduate math Education, Cognitive Science, STEM Education
- Robert Mnatsakanov - Ph.D. (Tbilisi State University)
Data Science, B.S.

Regular Graduate Faculty, Applied Probability, Approximation of functions from moments, Risk Models

- Laura Pyzdrowski - Ed.D. (West Virginia University)
  Regular Graduate Faculty, Undergraduate Math Education, Cognitive Science, STEM Education, K-12 Outreach, Distance Learning, Instructional Technology
- Adrian Tudorascu - Ph.D. (Carnegie Mellon University)
  Regular Graduate Faculty, Partial Differential Equations, Optimal Transport
- Jerzy Wojciechowski - Ph.D. (University of Cambridge)
  Regular Graduate Faculty, Combinatorics, Graph Theory

ASSOCIATE PROFESSORS

- Olgur Celikbas - Ph.D. (University of Nebraska)
  Regular Graduate Faculty, Commutative Algebra, Homologic Algebra
- Vito D’Orazio - Ph.D. (Pennsylvania State University)
  Regular Graduate Faculty, Data Sciences
- Adam Halasz - Ph.D. (State University of New York at Stony Brook)
  Regular Graduate Faculty, Molecular systems biology, Monte Carlo methods, Mathematical Physics
- Renee LaRue - Ph.D. (West Virginia University)
  Associate Graduate Faculty, Undergraduate Mathematics Education
- Kevin Milans - Ph.D. (University of Illinois)
  Regular Graduate Faculty, Combinatorics, Graph Theory, Partially Ordered Sets
- Lori Ogden - Ph.D. (West Virginia University)
  Associate Graduate Faculty, Undergraduate Mathematics Education, Associate Director for the Institute for Math Learning
- Casian Pantea - Ph.D. (University of Wisconsin - Madison)
  Regular Graduate Faculty, Mathematical Biology, Dynamical Systems
- Vicki Sealey - Ph.D. (Arizona State University)
  Regular Graduate Faculty, Undergraduate Mathematics Education, Calculus student learning
- Charis Tsikkou - Ph.D. (Brown University)
  Regular Graduate Faculty, Hyperbolic and Mixed Type Partial Differential Equations

ASSISTANT PROFESSORS

- Krista Bresock - Ph.D. (West Virginia University)
  Undergraduate Mathematics Education
- Ela Celikbas - Ph.D. (University of Nebraska)
  Regular Graduate Faculty, Commutative Algebra, Representation Theory
- Srinjoy Das - Ph.D. (University of California, San Diego)
  Regular Graduate Faculty, Data Sciences
- Ignacio Segovia Dominguez - Ph.D. (Centro de Investigación en Matemáticas)
  Regular Graduate Faculty, Applied Mathematics, Statistical Modeling and Computer Science
- Ryan Hansen - Ph.D. (West Virginia University)
  Combinatorics
- Cody Hood - Ph.D. (West Virginia University)
  Undergraduate Mathematics Education
- Josh Karr - Ph.D. (West Virginia University)
  Mathematics Education
- Mihyun Kim - Ph.D. (Colorado State University)
  Regular Graduate Faculty, Statistics
- Matthew Schraeder - Ph.D. (West Virginia University)
  Undergraduate Mathematics Education
- Youngseok Song - Ph.D. (Colorado State University)
  Regular Graduate Faculty, High-dimensional Statistics, Graphical Model, Large-scale Inferences, Network Analyses

INSTRUCTORS

- Galyna Voitiuk - Ph.D. (West Virginia University)
- Joelleen Bidwell - M.A. (West Virginia University)
- Jennifer Kearns - M.S. (West Virginia University)
- Clark Metz - M.S. (West Virginia University)
- Gabriel Tapia - M.S. (West Virginia University)
• Sylvanus Waibogha - M.S. (West Virginia University)
• Iwona Wojciechowska - Ph.D. (West Virginia University)

PROFESSORS EMERITI
• Gary Ganser - Ph.D. (Rensselaer Polytechnic Institute)
  Modeling, Data Analysis
• John Goldwasser - Ph.D. (University of Wisconsin-Madison)
  Combinatorics, Graph Theory
• Jack T. Goodykoontz - Ph.D. (University of Kentucky)
  Topology
• Henry W. Gould - M.A. (University of Virginia)
  Number Theory, Combinatorics, Special Functions
• Harumi Hattori - Ph.D. (Rensselaer Polytechnic Institute)
  Differential Equations, Continuum Mechanics
• Caulton L. Irwin - Ph.D. (Emory University)
  Associate Director NRCCE, Variational Methods, Optimization, Applied Mathematics
• Hong-Jian Lai - Ph.D. (Wayne State University)
  Graph Theory, Matroid Theory
• Dining Li - Ph.D. (Fudan University)
  Partial Differential Equations
• Michael E. Mays - Ph.D. (Pennsylvania State University)
  Number Theory
• Sherman Riemenschneider - Ph.D. (Syracuse University)
  Approximation Theory, Wavelets, Signal Processing
• Cun-Quan Zhang - Ph.D. (Simon Fraser University)
  Graph Theory, Combinatorics, Algorithms, Bioinformatics, Data mining

Admissions for 2025-2026

The Admissions Requirements will be as follows for the 2025-2026 Academic Year.

• First Time Freshmen are admitted to the major directly. For the timely completion of the degree, it is recommended that students have a minimum MATH ACT of 22, a MATH SAT of 540, or an ALEKS score of 45.
• Students transferring from another WVU major with fewer than 29 credits must have completed MATH 126 with a grade of C- or higher; students who have completed 30 or more credits must have completed or MATH 155 with C- or higher and have earned a 2.0 overall GPA.
• Students transferring from another institution with fewer than 29 credits must have completed MATH 126 with a grade of C- or higher; students who have completed 30 or more credits must have completed or MATH 155 with C- or higher and have earned a 2.0 overall GPA.

Major Code: 14E7

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. (http://registrar.wvu.edu/gef/)

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 - Composition &amp; Rhetoric</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGL 101 &amp; ENGL 102 or ENGL 103</td>
<td>3-6</td>
<td></td>
</tr>
<tr>
<td>F2A/F2B - Science &amp; Technology</td>
<td>4-6</td>
<td></td>
</tr>
<tr>
<td>F3 - Math &amp; Quantitative Reasoning</td>
<td>3-4</td>
<td></td>
</tr>
<tr>
<td>F4 - Society &amp; Connections</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>F5 - Human Inquiry &amp; the Past</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>F6 - The Arts &amp; Creativity</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>F7 - Global Studies &amp; Diversity</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

Student must complete the WVU General Education Foundations requirements, College B.S. requirements, major requirements, and electives to total a minimum of 120 hours. For complete details on these requirements, visit the B.S. Degrees tab on the Eberly College of Arts and Sciences (http://catalog.wvu.edu/undergraduate/eberlycollegeofartsandsciences/#bachelorofsciencetext).

Departmental Requirements for the B.S. in Data Science

- **Capstone Requirement**: The university requires the successful completion of a Capstone course. Data Science majors must complete DSCI 480.
- **Writing and Communication Skills Requirements**: Data Science Bachelor of Science students fulfill the Writing and Communication Skills requirement by completing ENGL 101 and ENGL 102 (or ENGL 103), and two additional SpeakWrite Certified Courses™.
- **Calculation of Major GPA**: A minimum GPA of a 2.0 is required in all courses applied to major requirements. If a course is repeated, all attempts will be included in the calculation of the GPA, unless the course is eligible for a D/F repeat.
- **Advanced Coursework**: As part of the major requirements, and in connection with their advisor, students will complete additional upper division coursework in a concentration of their choosing. Nine of the twelve credit hours must be at the 300-level or above.
- **Benchmark Expectations**: For details, for the Data Science Degree Progress tab.

Curriculum Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>University Requirements</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>ECAS B.S. Requirements</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Data Science Major Requirements</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Total Hours</td>
<td>120</td>
</tr>
</tbody>
</table>

University Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Outstanding GEF Requirements 1, 4, 5, 6, and 7</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>DSCI 191 First-Year Seminar</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Total Hours</td>
<td>34</td>
</tr>
</tbody>
</table>

ECAS Bachelor of Science Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COLLEGE REQUIREMENTS</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Global Studies &amp; Diversity Requirement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATHEMATICS REQUIREMENT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 153 Calculus 1a with Precalculus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; MATH 154 and Calculus 1b with Precalculus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or MATH 155 Calculus 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SCIENCE REQUIREMENT Fulfilled by major requirement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Hours</td>
<td>4</td>
</tr>
</tbody>
</table>

Data Science Major Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STEM FOUNDATIONS</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>CS 110 Introduction to Computer Science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&amp; CS 111 and Introduction to Data Structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 156 Calculus 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Hours</td>
<td></td>
</tr>
</tbody>
</table>
### Data Science, B.S.

#### STAT 215
Introduction to Probability and Statistics

Select one pair of science courses

| BIOL 115 & 115L & BIOL 117 & BIOL 117L | Principles of Biology and Introductory Physiology and Introductory Physiology Laboratory |
| PHYS 101 & 101L & PHYS 102 & PHYS 102L | Introductory Physics 1 and Introductory Physics 2 and Introductory Physics 2 Laboratory |
| PHYS 111 & 111L & PHYS 112 & PHYS 112L | General Physics 1 and General Physics 1 Laboratory and General Physics 2 and General Physics 2 Laboratory |

#### CORE COURSES

**Mathematics Core**
- MATH 251: Multivariable Calculus
- MATH 303: Introduction to the Concepts of Mathematics
- MATH 378: Discrete Mathematics
- or MATH 420: Numerical Analysis 1
- MATH 441: Applied Linear Algebra
- STAT 312: Intermediate Statistical Methods
- STAT 445: Introductory Regression Analysis

**Computer Science Core:**
- CS 320: Analysis of Algorithms
- DSCI 301: Databases for Data Science

**Data Science Core**
- DSCI 101: Introduction to Data Science
- DSCI 221: Reproducible Data Science using R
- DSCI 222: Data Science Workflows using Python
- DSCI 310: Statistical Machine Learning 1
- DSCI 311: Statistical Machine Learning 2
- DSCI 410: Big Data in Practice: Cloud and Parallel Computing
- DSCI 450: Current Topics in Data Science

#### UPPER-DIVISION ELECTIVES

In consultation with an advisor, students will complete a concentration in a discipline of their choice such as Sociology, Geography, Biology or others. Students are welcome to propose concentrations that draw on their interests from the humanities, social sciences, or STEM fields where big data are collected and analyzed to provide new insights

**CAPSTONE EXPERIENCE**
- DSCI 480: Capstone in Data Science

Total Hours: 82

### Suggested Plan of Study

#### First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCI 101</td>
<td>3 DSCI 221</td>
<td>DSCI 222</td>
<td>1 CS 111 (B.S. First Area 2)</td>
</tr>
<tr>
<td>DSCI 191</td>
<td>3 MATH 156 (B.S. Second Area 1 Course 1; F8)</td>
<td>MATH 155 (F3)</td>
<td>F4</td>
</tr>
<tr>
<td>CS 110 (B.S. First Area 1)</td>
<td></td>
<td></td>
<td>4 F5</td>
</tr>
<tr>
<td>F4</td>
<td></td>
<td></td>
<td>3 General Elective</td>
</tr>
</tbody>
</table>

Total: 3
### Data Science, B.S.

<table>
<thead>
<tr>
<th>General Elective</th>
<th>1</th>
</tr>
</thead>
</table>

#### Second Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCI 222</td>
<td>3 DSCI 301</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 215 (F8 course 2)</td>
<td>3 MATH 441</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MATH 303</td>
<td>3 STAT 312</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MATH 251 (B.S. Second Area 2)</td>
<td>4 GEF 6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DSCI Foundational Science Elective (B.S. Third Area 1; F2)</td>
<td>4 DSCI Foundational Science Elective 1 (B.S. Third Area 2; F8 course 3)</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

- **Total credit hours:** 15

#### Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCI 310</td>
<td>3 DSCI 311</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>STAT 445</td>
<td>3 MATH 378</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CS 320</td>
<td>3 ECAS Global Studies and Diversity Requirement (F 7)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>ENGL 101 (GEF 1)</td>
<td>3 ENGL 102 (GEF 1)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DSCI Advanced Science Elective 1</td>
<td>3 DSCI Advanced Science Elective 2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

- **Total credit hours:** 15

#### Fourth Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Hours</th>
<th>Spring</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSCI 410</td>
<td>3 DSCI 480</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DSCI 450</td>
<td>3 Advanced Data Science Elective 4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>DSCI Advanced Science Elective 3</td>
<td>3 General Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>General Elective</td>
<td>3 General Elective</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>General Elective</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Total credit hours:** 15

**Total credit hours:** 120

### Degree Progress
- By the beginning of a student's third regular semester (fall or spring), they should have completed either MATH 154 or MATH 155 with a C- or better.
- During the first four regular semesters (fall and spring) in the major, student must complete their foundational mathematics courses through MATH 441, CS 110 and CS 111, and DSCI 101, DSCI 221, and DSCI 222.
- A minimum cumulative and major GPA of a 2.0 must be maintained. Students who do not meet this benchmark will be removed from the major.

### Major Learning Outcomes

#### DATA SCIENCE

**Learning Outcome 1:** Students will communicate data science workflows in both written and oral forms.

**Outcome 1.1** Students will demonstrate their ability to develop and use appropriate data science techniques to address ‘science’ (subject matter) topics and questions.

**Outcome 1.2** Students will communicate the biases and other implications of the data and analysis.

**Outcome 1.3** Students will prepare a clear and concise written project and orally present a data science workflow and analysis effectively and professionally.

**Learning Outcome 2:** Students will understand and demonstrate the programming and technological aspects of a data science workflow

**Outcome 2.1** Students will develop workflows using the languages and platforms common in data science practice (eg. R and Python, Rstudio and JupyterLab)

**Outcome 2.2** Students will demonstrate their ability to acquire and manipulate data via a variety of platforms (eg. databases to cloud computing)

**Outcome 2.3** Students will demonstrate their ability to use technologies for collaboration (eg. Git and GitHub)
Learning Outcome 3: Students will demonstrate their ability to visualize and model data

Outcome 3.1 Students will demonstrate visualization of data from simple plots for smaller data sets to visualizations for big data

Outcome 3.2 Students will demonstrate their ability to use current machine learning and other data science modeling methods appropriately and understand the underlying statistical and mathematical concepts.