

# DATA SCIENCE/ECONOMICS

(Concurrent degree with the College of Engineering and Computer Science)

Students with an interest in both areas of Data Science and Economics can pursue a concurrent BS program to earn two BS degrees at the same time:

- BS degree in Data Science (<http://catalog.umd.umich.edu/undergraduate/college-engineering-computer-science/data-science/>)
- BS degree in Economics (<http://catalog.umd.umich.edu/undergraduate/college-arts-sciences-letters/economics/>)

The concurrent degree program requires specified coursework with a minimum of 15 additional credit hours beyond the 120 credit hours required for the BS-DATA or the BS-ECON alone.

Data scientists, empowered by economic theories and methodologies, can refine their models, make more accurate predictions, inform policy decisions, and contribute to a deeper understanding of complex economic systems. Economists, empowered by data science, can construct complex models and analyze and interpret Big data.

## Dearborn Discovery Core (General Education)

All students must satisfy the University's Dearborn Discovery Core requirements ([http://catalog.umd.umich.edu/undergraduate/gen\\_ed\\_ddc/](http://catalog.umd.umich.edu/undergraduate/gen_ed_ddc/)), in addition to the requirements for the major. Students must also complete all CASL Degree Requirements. (<http://catalog.umd.umich.edu/undergraduate/college-arts-sciences-letters/>)

A candidate for the Bachelor of Science in Data Science and the Bachelor of Science in Economics concurrently is required to fulfill the requirements for the Dearborn Discovery Core, as well as CASL requirements (two-semester sequence of foreign language).

## Major Requirements

| Code   | Title   | Credit Hours |
|--|---|--------------|
| <b>Data Science Prerequisites</b>                          |   |              |
| COMP 105   | Writing & Rhetoric I                            | 3            |
| COMP 270   | Tech Writing for Engineers                      | 3            |
| MATH 115   | Calculus I                                      | 4            |
| MATH 116   | Calculus II                                     | 4            |
| MATH 215   | Calculus III                                    | 4            |
| MATH 227   | Introduction to Linear Algebra                  | 3            |
| CIS 1501   | CS I for Data Scientists                        | 4            |
| CIS 2001   | CS II for Data Scientists                       | 4            |
| One course from the following:                             |   | 3-4          |
| CIS 275  | Discrete Structures I                           |              |
| MATH 276   | Discrete Math Meth Compnr Engr                  |              |
| MATH 315   | Applied Combinatorics                           |              |
| Select one laboratory science sequence from the following: |   | 8            |
| BIOL 130 & BIOL 320  | Intro Org and Environ Biology and Field Biology |              |
| CHEM 134 & CHEM 136  | General Chemistry IA and General Chemistry IIA  |              |

|  |   |     |
|--|---|-----|
| GEOL 118 & GEOL 218  | Physical Geology and Historical Geology   |     |
| PHYS 125 & PHYS 126  | Introductory Physics I and Introductory Physics II  |     |
| PHYS 150 & PHYS 151  | General Physics I and General Physics II  |     |
| <b>Economics Prerequisites</b>   |   |     |
| ECON 201   | Prin: Macroeconomics  | 3   |
| ECON 202   | Prin: Microeconomics  | 3   |
| <b>CASL Requirements</b>   |   |     |
| Foundations - any one FNDS or CPBL 101, 102, 103, 104  |   | 4   |
| Foreign Language - Select a two course sequence from the following:  |   | 8   |
| ARBC 101 & ARBC 102  | Introduction to Arabic Language and Culture 1 and Introduction to Arabic Language and Culture 2 |     |
| FREN 101 & FREN 102  | French Language & Culture I and French Language & Culture II                                    |     |
| GER 101 & GER 102  | Beginning German I and German Language and Culture II   |     |
| SPAN 101 & SPAN 102  | Spanish Language & Culture I and Spanish Language & Culture II                                  |     |
| <b>Data Science Core</b>   |   |     |
| CIS 350  | Data Struc and Algorithm Anlys  | 4   |
| CIS 375  | Software Engineering I  | 4   |
| ECE 3100   | Data Science I  | 4   |
| CIS 3200   | Data Science II   | 4   |
| CIS 422  | Massive Data Management   | 4   |
| ENGR 400 or ENT 400  | Appl Business Tech for Engr Entrepreneurial Thinking&Behav                                      | 3   |
| HHS 470  | Information Science and Ethics  | 3   |
| STAT 305   | Introduction to Data Science for All  | 3   |
| STAT 325 or IMSE 317   | Applied Statistics I Eng Probability and Statistics   | 4   |
| STAT 430   | Applied Regression Analysis   | 3   |
| CIS 4971   | Cap Sem for Data Sci I  | 2   |
| CIS 4972   | Cap Proj for Data Sci II  | 2   |
| <b>Economics Core <sup>1</sup></b>   |   |     |
| ECON 301   | Intermediate Macroeconomics <sup>2,3,4</sup>  | 4   |
| ECON 302   | Intermediate Microeconomics <sup>2,3,4</sup>  | 4   |
| <b>Data Science Applications - Economics Electives</b>   |   |     |
| Students should complete 20 credit hours of ECON 300/400/4000  |   | 20  |
| electives, not counting the core classes ECON 301, ECON 302, ECON 305. <sup>5</sup>  |   |     |
| <b>Data Science Electives</b>  |   |     |
| Choose one course from the list below. It is recommended that students take CIS 479 that also fulfills DDC Intersection requirement. |   | 3-4 |
| CIS 306  | Discrete Structures II  |     |
| CIS 411  | Introduction to Natural Language Processing   |     |
| CIS 423  | Dec Support and Exp Systems   |     |
| CIS 425  | Information Systems   |     |
| CIS 439  | Text Mining and Information Retrieval   |     |
| CIS 446  | Wireless & Mobi Comp Security   |     |
| CIS 449  | Intro to Software Security  |     |
| CIS 479  | Intro to Artificial Intel   |     |

|           |   |
|-----------|---|
| CIS 481   | Computational Learning                        |
| CIS 483   | Deep Learning                                 |
| CIS 489   | Edge Computing                                |
| CIS 4851  | Data Security and Privacy                     |
| DS 426    | Introduction to Simulation                    |
| ECE 428   | Cloud Computing                               |
| ECE 434   | Introduction to Machine Learning              |
| ENGR 399  | Experiential Honors Prof. Prac                |
| ENGR 492  | Exper Honors Directed Research                |
| ENGR 493  | Exper Hnrs Dir Dsgn                           |
| IMSE 3005 | Intro to Operations Research                  |
| IMSE 421  | Eng Economy and Dec Anlys                     |
| IMSE 440  | Applied stat models in engin                  |
| IMSE 4585 | Simulation in Systems Design                  |
| IMSE 4795 | Prod, Inven Control & Lean Mfg                |
| MATH 325  | Probability                                   |
| MATH 420  | Stochastic Processes                          |
| MATH 425  | Statistical Inference                         |
| MATH 435  | Mathematics of Finance                        |
| MATH 462  | Mathematical Modeling                         |
| MATH 472  | Introduction to Numerical Analysis            |
| MATH 473  | Matrix Computation                            |
| STAT 327  | Statistical Computing                         |
| STAT 431  | Machine Learning and Computational Statistics |
| STAT 440  | Design and Analysis of Experiments            |
| STAT 450  | Multivariate Stat Analysis                    |
| STAT 460  | Time Series Analysis                          |

**General Electives**

Any 100 to 400 level course, (that is, courses not on the No Credit list, 6 which is found at the end of the CECS Student Handbook), as needed to get a minimum of 135 credits for graduation.

**Total Credit Hours** **135-137**

- <sup>1</sup> ECON 305 requirement for Economics major is fulfilled by taking IMSE 317 or STAT 325.
- <sup>2</sup> MATH 104, MATH 105, MATH 113, MATH 115, or equivalent are prerequisites to these courses.
- <sup>3</sup> Core courses ECON 301 and ECON 302 should be taken no later than the junior year.
- <sup>4</sup> Only one of the two courses may be transferred to UM-D.
- <sup>5</sup> Only 4 credits of economics internship (ECON 398), can be applied to the major requirement.
- <sup>6</sup> The foreign language requirement can be met by:
  - Successfully completing a two-semester beginning language sequence at UM-Dearborn, or
  - Transferring the equivalent of 8 semester hours of a beginning language sequence from another college or university, or
  - Successfully completing a 3- or 4-semester hour foreign language course (this course cannot be taught in English) at the 102 level or higher, or
  - Having completed at least 3 years (in the same language) of foreign language in high school with a grade of C or better in the final course, or
  - Having completed the equivalent of a high school diploma at a school that used a language other than English for instruction.

(Appropriate documentation attesting to the language of instruction and graduation from the high school program is necessary, and official English translations of foreign transcripts must be provided), or

- Passing an oral and written proficiency exam.

A student with prior knowledge of Arabic, French, German or Spanish should take a placement examination before registering for a course in that language. Placement/proficiency exams in Arabic, French, German, and Spanish are scheduled through the Office of Admissions and Orientation; call 313-593-5100. A student wishing to take a proficiency exam in a language not mentioned above or not taught at UM-Dearborn should consult a CASL advisor; call 313-593-5293 for more information. Proficiency exams for a language other than those taught at UM-Dearborn must be administered at another four-year institution. A student wishing to waive the foreign language requirement must officially submit a request via petition. Please note that when the requirement is waived, or proficiency is demonstrated by exam, credit will not be awarded for courses not taken.