## **B.S. in Data Science**

Data science is the study and practice of extracting information and structure from data that can then be used for reasoning and adding value to the solution of a problem. It has growing applications in health and medicine, finance, marketing, economics, genomics, social networks, cyber-security, journalism, and other fields where data is collected. It spans academic fields in computer science and mathematics such as machine learning and statistical inference, probability, linear algebra, computer programming, software engineering, high performance computing, and cloud computing. The B.S. in Data Science program has two options, Computing (in the Ying Wu College of Computing) and Statistics (in the Department of Mathematical Sciences in the Jordan Hu College of Science and Liberal Arts).

## **B.S. in Data Science (Computing Option)**

(120 credits)

First Year		
1st Semester		Credits
CS 100	Roadmap to Computing	3
MATH 111	Calculus I	4
PHYS 111	Physics I <sup>1</sup>	3
PHYS 111A	Physics I Lab <sup>1</sup>	1
ENGL 101	English Composition: Introduction to Academic Writing	3
FYS SEM	First-Year Student Seminar	0
	Term Credits	14
2nd Semester		
CS 113	Introduction to Computer Science I	3
MATH 112	Calculus II	4
PHYS 121	Physics II <sup>1</sup>	3
PHYS 121A	Physics II Lab <sup>1</sup>	1
ENGL 102	English Composition: Introduction to Writing for Research	3
	Term Credits	14
Second Year		
1st Semester		
CS 114	Introduction to Computer Science II	3
MATH 244	Introduction to Probability Theory	3
MATH 337	Linear Algebra	3
History and Huma requirements/ger-	nities GER 200 level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education- 200-level/)	3
Social Sciences G social-science-ger	ER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/	3
	Term Credits	15
2nd Semester		
CS 241	Foundations of Computer Science I	3
CS 280	Programming Language Concepts	3
IS 350	Computers, Society and Ethics	3
MATH 341	Statistical Methods II	3
YWCC 207	Computing & Effective Com	1
Data Science Elec	tive 1	3
	Term Credits	16
Third Year		
1st Semester		
CS 288	Intensive Programming in Linux	3
DS 340	Fundamentals and Principles of Data Science	3
CS 331	Database System Design & Mgmt	3
CS 370	Introduction to Artificial Intelligence	3

Term Credits         15           2nd Semester         204         Advanced Data Structures and Algorithm Design         3           C5 482         Data Mining         3         3           C5 375         Introduction to Machine Learning         3         3           Hebrory and Humanites CER 2004- level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-2004-level)         1           YVCC 307         Profossional Dev in Computing         1         1           Fourth Year         1         16         6           Fourth Year         1         1         6           Fourth Year         1         1         6           54 440         Big Data Systems         3         3           DS 492         Data Solence Capatrone I         3         3           MATH 478         Stat Methods in Data Sci         3         3           ADA Somester         1         3         3           Humanities and Social Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ perclad-ducation-requirements/hss-capatrone/i         3         3           54 435         Data Science Elective 1*         3         3           54 493         Data Science Elective 1* <t< th=""><th>COM 312 or COM 313</th><th>Oral Presentations or Technical Writing</th><th>3</th></t<>	COM 312 or COM 313	Oral Presentations or Technical Writing	3
65 48.5         Abrance Data Science Elective 2         3           C8 48.2         Data Mining         3           C8 37.5         Introduction to Machine Learning         3           History and Humanities GER 300-bewl (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-300-bewl)         1           Fourth Year         Term Credits         16           Fourth Year         1           Term Credits         16           Fourth Year           Term Credits         3           C8 446         Big Data Systems         3           D8 482         Data Science Capatone I         3           Term Credits         16           Term Credits         16           Term Credits         16           Term Credits         3           Humanities and Social Science Senior Se		Term Credits	15
Data Science Elective 2         Data Mining         3           CS 472         Data Mining         3           S375         Introduction to Machine Learning         3           History and Humanities GER 300+ level (http://ctatalog.njit.edu/undergraduate/cacdemic-policies-procedures/general-education-requirements/gen-300-level)         1           YMCC 307         Professional Dev in Computing         1           Fourth Year         Tem Credit         16           Fourth Year         Tem Credits         3           CS 440         Big Data Systems         3           CS 441         Big Data Systems         3           S4 922         Data Science Capatone I         3           MATH 478         Stat Merhods in Data Sci         3           S4 922         Data Science Capatone I         15           Intermedits         15         3           Semester         15         3           Humanities and Social Science Senior Senioral GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/s         3           S4 932         Data Science Capatone II         3           S4 933         Data Science Senioral GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/s         3           S4 943         Data Science Capatone II         6	2nd Semester		
CS 482         Data Mining         3           CS 375         Introduction to Machine Learning         3           History and Humanilles GER 300-level (http://citatlog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/gen-300-level)         1           Term Credits         nd           Term Credits         nd           Term Credits         nd           Term Credits         nd           CS 450         Data Visualization         3           Status Selection of Part Status Systems         3           Status Marthad Systems         3           Status Selectic Elective Term Credits         7           Term Credits         15           Term Credits         15           Term Credits         16           Term Credits         16           Status Selected Capation Electives         16 <td< td=""><td>CS 435</td><td>Advanced Data Structures and Algorithm Design</td><td>3</td></td<>	CS 435	Advanced Data Structures and Algorithm Design	3
GS 375         Introduction to Machine Learning         3           History and Humanities         GER 300+ level (http://citatlog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/spc-300-level/)         7           YMC 307         Professional Dev in Computing         1           Fourth Year         Term Gredits         16           Fuer Senseter         18           CS 444         Big Data Systems         3           S4 422         Data Science Capatone I         3           S4 432         Data Science Capatone I         3           D8 432         Data Science Capatone I         3           D8 432         Data Science Samior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ ageneral-education-requiremental-hss-capatone/)         15           Term Credits         15           Data Science Samior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ ageneral-education-requiremental-hss-capatone/)         3           Term Credits         15           Data Science Samior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ ageneral-education-requiremental-hss-capatone/)         3           Term Credits         15           Data Science Samior Seminar GER (http://catalog.njit.edu/undergraduate/academic-polic	Data Science Elect	ive 2	3
GS 376         Introduction to Machine Learning         3           History and Humanities CER 300+ level (http://catalog.nijt.edu/undergraduate/academic-policies-procedures/general-education-requires/sensor-level)         3           Term Credit         16           Term Credit         16           For Broad Sensor Present	CS 482	Data Mining	3
History and Humanities CRR 3004- level (http://catalog.njit.edu/undergraduate/academic-policies-procedures/general-education-requirements/ger-3004-level)   YWCC 307	CS 375	-	
requirements/gen/301   Professional Dev in Computing   16 Fourty Year Fats Semester  CS 450   Data Visualization   3   3   3   3   3   3   3   3   3	History and Human	-	
Term Credits			
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CS 4450         Data Visualization         3           CS 4444         Big Data Systems         3           MS 4922         Data Science Capstone I         3           MATH 478         Stat Methods in Data Sci         3           Data Science Elective 3         15           Term Credits         15           Term Credits         15           Data Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ general-education-requirematishs-sc-apstone/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ general-education-requirematishs-sc-apstone/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ general-education-requirematishs-sc-apstone/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ general-education-requirematishs-capstone/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/)         3           Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/)         3           Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures	Fourth Year		
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MATH 478         Stat Methods in Data Sci         3           Data Science Elective 3         3           Term Credits         15           Not Semistral Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/)         3           generale-ductainor-requirements/hss-capstone/)         3           Free Elective 1 2         3           DS 493         Data Science Capstone II         3           MATH 344         Regression Analysis         3           Torm Credits         15	CS 444	Big Data Systems	3
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And Semester           Humanities and Social Science Senior Seminar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/)         3           general-education-requirements/hss-capstone/)         3           SP 493         Data Science Capstone II         3           MATH 344         Regression Analysis         3           Ata Science Elective 4         3           Total Credits         15           Total Credits         15           Total Credits         15           Data Science (Computure) Option) Electives         7           WCC 310         Co-op Work Experience I         3           DS 400         Scientific Foundation of Machine Learning         3           DS 410         Federated Machine Learning and Applications         3           DS 480         Fundamentals and Applications of Graph Neural Networks         3           DS 480         Interpretated Machine Learning and Applications         3           SS 352         Principles of Operating Systems         3           SS 353         Intro to Computer Systems         3           SS 356         Introduction to Cybersecurity         3           SS 357         Fundamentals of Network Security         3           SS 485         Introduction	Data Science Elect	ive 3	3
Humanities and Social Science Senior Seninar GER (http://catalog.njit.edu/undergraduate/academic-policies-procedures/ senior-requirements/hss-capstone/)         3           Free Elective 12		Term Credits	15
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DS 410         Federated Machine Learning and Applications         3           DS 480         Fundamentals and Applications of Graph Neural Networks         3           DS 488         Independent Study in Data Science         3           CS 332         Principles of Operating Systems         3           CS 350         Intro to Computer Systems         3           CS 351         Introduction to Cybersecurity         3           CS 356         Introduction to Computer Networks         3           CS 357         Fundamentals of Network Security         3           CS 408         Cryptography and Internet Security         3           CS 434         Advanced Database Systems         3           CS 485         Selected Topics In CS         3           MGMT 316         Business Research Methods         3           MGMT 416         Artificial Intelligence for Business Decisions         3           MRKT 378         Marketing Analytics         3           MRKT 430         Marketing Research         3           MATH 345         Multivariate Distributions         3           MATH 388         Introduction to Chaos Theory         3           MATH 391         Numerical Linear Algebra         3	Code Data Science (Com	Term Credits  Total Credits  Title  aputing Option) Electives	15 120 Credits
DS 480         Fundamentals and Applications of Graph Neural Networks         3           DS 488         Independent Study in Data Science         3           CS 332         Principles of Operating Systems         3           CS 350         Intro to Computer Systems         3           CS 351         Introduction to Cybersecurity         3           CS 356         Introduction to Computer Networks         3           CS 357         Fundamentals of Network Security         3           CS 408         Cryptography and Internet Security         3           CS 434         Advanced Database Systems         3           CS 485         Selected Topics In CS         3           MGMT 316         Business Research Methods         3           MGMT 416         Artificial Intelligence for Business Decisions         3           MRKT 378         Marketing Analytics         3           MRKT 430         Marketing Research         3           MATH 345         Multivariate Distributions         3           MATH 388         Introduction to Chaos Theory         3           MATH 391         Numerical Linear Algebra         3	Code Data Science (Com	Term Credits  Total Credits  Title  sputing Option) Electives  Co-op Work Experience I	15 120 Credits
DS 488         Independent Study in Data Science         3           CS 332         Principles of Operating Systems         3           CS 350         Intro to Computer Systems         3           CS 351         Introduction to Cybersecurity         3           CS 356         Introduction to Computer Networks         3           CS 357         Fundamentals of Network Security         3           CS 408         Cryptography and Internet Security         3           CS 434         Advanced Database Systems         3           CS 485         Selected Topics In CS         3           MGMT 316         Business Research Methods         3           MGMT 416         Artificial Intelligence for Business Decisions         3           MRKT 378         Marketing Analytics         3           MRKT 430         Marketing Research         3           MATH 345         Multivariate Distributions         3           MATH 388         Introduction to Chaos Theory         3           MATH 391         Numerical Linear Algebra         3	Code Data Science (Com YWCC 310 DS 400	Term Credits  Total Credits  Title  Aputing Option) Electives  Co-op Work Experience I  Scientific Foundation of Machine Learning	15 120 Credits 3 3
CS 332       Principles of Operating Systems       3         CS 350       Intro to Computer Systems       3         CS 351       Introduction to Cybersecurity       3         CS 356       Introduction to Computer Networks       3         CS 357       Fundamentals of Network Security       3         CS 408       Cryptography and Internet Security       3         CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410	Term Credits  Total Credits  Title  Aputing Option) Electives  Co-op Work Experience I  Scientific Foundation of Machine Learning Federated Machine Learning and Applications	15 120 Credits 3 3 3
CS 350       Intro to Computer Systems       3         CS 351       Introduction to Cybersecurity       3         CS 356       Introduction to Computer Networks       3         CS 357       Fundamentals of Network Security       3         CS 408       Cryptography and Internet Security       3         CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480	Term Credits  Total Credits  Title  Inputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks	15 120 Credits 3 3 3
CS 351       Introduction to Cybersecurity       3         CS 356       Introduction to Computer Networks       3         CS 357       Fundamentals of Network Security       3         CS 408       Cryptography and Internet Security       3         CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488	Term Credits  Total Credits  Title  Inputing Option) Electives  Co-op Work Experience I  Scientific Foundation of Machine Learning  Federated Machine Learning and Applications  Fundamentals and Applications of Graph Neural Networks  Independent Study in Data Science	15 120 Credits 3 3 3 3 3
CS 356       Introduction to Computer Networks       3         CS 357       Fundamentals of Network Security       3         CS 408       Cryptography and Internet Security       3         CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332	Term Credits  Total Credits  Title  Inputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems	15 120 Credits 3 3 3 3 3 3
CS 357       Fundamentals of Network Security       3         CS 408       Cryptography and Internet Security       3         CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350	Term Credits  Total Credits  Title  Inputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems	15 120 Credits 3 3 3 3 3 3 3 3
CS 408 Cryptography and Internet Security  S 434 Advanced Database Systems  S Selected Topics In CS  MGMT 316 Business Research Methods  MGMT 416 Artificial Intelligence for Business Decisions  MRKT 378 Marketing Analytics  MRKT 430 Marketing Research  MATH 345 Multivariate Distributions  MATH 388 Introduction to Chaos Theory  MATH 391 Numerical Linear Algebra	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351	Total Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning  Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3
CS 434       Advanced Database Systems       3         CS 485       Selected Topics In CS       3         MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356	Total Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3
CS 485         Selected Topics In CS         3           MGMT 316         Business Research Methods         3           MGMT 416         Artificial Intelligence for Business Decisions         3           MRKT 378         Marketing Analytics         3           MRKT 430         Marketing Research         3           MATH 345         Multivariate Distributions         3           MATH 388         Introduction to Chaos Theory         3           MATH 391         Numerical Linear Algebra         3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357	Total Credits  Title  Inputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Introduction to Computer Systems Introduction to Computer Networks Fundamentals of Network Security	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MGMT 316       Business Research Methods       3         MGMT 416       Artificial Intelligence for Business Decisions       3         MRKT 378       Marketing Analytics       3         MRKT 430       Marketing Research       3         MATH 345       Multivariate Distributions       3         MATH 388       Introduction to Chaos Theory       3         MATH 391       Numerical Linear Algebra       3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408	Title Inputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MGMT 416 Artificial Intelligence for Business Decisions 3 MRKT 378 Marketing Analytics 3 MRKT 430 Marketing Research 3 MATH 345 Multivariate Distributions 3 MATH 388 Introduction to Chaos Theory 3 MATH 391 Numerical Linear Algebra 3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434	Title  Iputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MRKT 378Marketing Analytics3MRKT 430Marketing Research3MATH 345Multivariate Distributions3MATH 388Introduction to Chaos Theory3MATH 391Numerical Linear Algebra3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485	Term Credits  Total Credits  Title  Aputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MRKT 430Marketing Research3MATH 345Multivariate Distributions3MATH 388Introduction to Chaos Theory3MATH 391Numerical Linear Algebra3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316	Term Credits  Total Credits  Title  Iputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MATH 345 Multivariate Distributions 3 MATH 388 Introduction to Chaos Theory 3 MATH 391 Numerical Linear Algebra 3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MATH 388 Introduction to Chaos Theory 3 MATH 391 Numerical Linear Algebra 3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416 MRKT 378	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MATH 391 Numerical Linear Algebra 3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416 MRKT 378 MRKT 430	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions Marketing Analytics Marketing Research	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416 MRKT 378 MRKT 430	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions Marketing Analytics Marketing Research	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
MATH 430 Analytical and Computational Neuroscience 3	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416 MRKT 378 MRKT 430 MATH 345	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions Marketing Research Multivariate Distributions	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3
	Code Data Science (Com YWCC 310 DS 400 DS 410 DS 480 DS 488 CS 332 CS 350 CS 351 CS 356 CS 357 CS 408 CS 434 CS 485 MGMT 316 MGMT 416 MRKT 378 MRKT 430 MATH 345 MATH 388	Term Credits  Title  sputing Option) Electives  Co-op Work Experience I Scientific Foundation of Machine Learning Federated Machine Learning and Applications Fundamentals and Applications of Graph Neural Networks Independent Study in Data Science Principles of Operating Systems Intro to Computer Systems Introduction to Cybersecurity Introduction to Computer Networks Fundamentals of Network Security Cryptography and Internet Security Advanced Database Systems Selected Topics In CS Business Research Methods Artificial Intelligence for Business Decisions Marketing Analytics Marketing Research Multivariate Distributions Introduction to Chaos Theory	15 120 Credits  3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3

MATH 447	Applied Time Series Analysis	3
MATH 448	Stochastic Simulation	3
MATH 461	Introduction to Statistical Computing with SAS and R	3
IS 333	Social Network Analysis	3
IS 392	Web Mining and Information Retrieval	3
FIN 218	Financial Markets and Institutions	3
FIN 306	Blockchain Technology for Business	3
FIN 310	Data-Driven Financial Modeling	3
FIN 320	Fin Data Analytics	3
IT 430	Ethical Hacking for System Administrators	3
IT 485	Special Topics in Information Technology I	3

Students considering switching to Data Science should take PHYS 111/111A and 121/121A. PHYS 102/102A will not receive credit.

A free elective is any 3 credit course except a course that is already required for your program or any course covering prerequisite material for first semester courses in your program. MATH 333 cannot be used as a free elective. Free electives should be chosen in consultation with your advisor.

Students cannot obtain credit for both CS 301 and DS 340.