

Plant Biology (BS)

The Bachelor of Science degree in Plant Biology provides classroom, laboratory, and field experience in the fundamental areas of the plant sciences. Undergraduates majoring in Plant Biology select major courses that are tailored to their interests within the discipline and are required to have a supervised research or internship experience. Majors, as pre-professionals in the plant sciences, are prepared for advanced study in plant biology and other biological fields, as well as in the applied plant sciences, such as horticulture, crop science, plant pathology, natural resource management, and conservation.

Students can choose to pursue a general major with courses in different areas of Plant Biology, or can specialize their study in one of the following areas: Ethnobotany, Plant Physiology and Molecular Biology, and Plant Systematics and Ecology. The Bachelor of Science in Plant Biology with a double major in another life science or applied plant science is possible, as is a double major in a humanities and social sciences discipline.

Accelerated Graduate Training Opportunities

Advanced, academically qualified undergraduate students have the opportunity to participate in the Accelerated Bachelor's/Master's (ABM) program in Plant Biology, which allows students to earn both the BS in Plant Biology and the non-thesis Master of Plant Biology (MR) (<https://cals.ncsu.edu/plant-and-microbial-biology/students/graduate/mr-plant-biology/>) degrees within five years. Students interested in the ABM should contact the Plant Biology Undergraduate Program Director for additional information.

For more information about the BS in Plant Biology, visit our program website (<https://cals.ncsu.edu/plant-and-microbial-biology/students/undergraduate/>).

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To see more about what you will learn in this program, visit the Learning Outcomes website (<https://apps.oirp.ncsu.edu/pgas/>)!

Plan Requirements

Code	Title	Hours	Counts towards
Orientation			
ALS 103	Freshman Transitions and Diversity in Agriculture & Life Sciences	1	
or ALS 303	Transfer Transitions and Diversity in Agriculture & Life Sciences		
or LSC 103	Exploring Opportunities in the Life Sciences		
or PB 103	Perspectives on Botany		

Communication

Communication Elective (p. 2) 3

Mathematics & Sciences

Select one of the following: 3

MA 121 Elements of Calculus

MA 131 Calculus for Life and Management Sciences A

MA 141 Calculus I

ST 101 Statistics by Example 3

or ST 311 Introduction to Statistics

CH 101 & CH 102 Chemistry - A Molecular Science and General Chemistry Laboratory ¹ 4

Select one of the following: 4

CH 220 & CH 222 Introductory Organic Chemistry and Organic Chemistry I Lab

CH 221 & CH 222 Organic Chemistry I and Organic Chemistry I Lab

PY 131 Conceptual Physics 4

or PY 211 College Physics I

GN 311 Principles of Genetics 4

Major Requirements

LSC 101 Critical and Creative Thinking in the Life Sciences ¹ 2

BIO 181 Introductory Biology: Ecology, Evolution, and Biodiversity ¹ 4

BIO 183 Introductory Biology: Cellular and Molecular Biology ¹ 4

PB 250 Plant Biology ¹ 4

Select one of the following: 3

ALS 498 Honors Research or Teaching I

PB 492 External Learning Experience

PB 493 Plant Biology Supervised Undergraduate Research Experience

PB 495	Special Topics in Plant Biology	
PB Electives 300-Level+ ¹ (p. 2)		6
PB Electives (p. 3) ¹		6
PB Elective Lab Credit Co-Requisites (verify requirement) (p. 4) ¹		
Applied Plant Science Elective (p.) ¹		3
Restricted Electives		
CALS Elective Groups A, B, & C (p.)		24
GEP Courses		
ENG 101	Academic Writing and Research ¹	4
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		6
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		2
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)		3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)		
Foreign Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/foreign-language-proficiency/) (verify requirement)		
Free Electives		
Free Electives (12 Hr S/U Lmt) ²		14
Total Hours		120

¹ A grade of C- or higher is required.

² Students should consult their academic advisors to determine which courses fill this requirement.

Communication Elective

Code	Title	Hours	Counts towards
COM 110	Public Speaking	3	
COM 211	Argumentation and Advocacy	3	
ENG 316	Introduction to News and Article Writing	3	
ENG 323	Writing in Rhetorical Traditions	3	
ENG 331	Communication for Engineering and Technology	3	
ENG 332	Communication for Business and Management	3	
ENG 333	Communication for Science and Research	3	

PB Electives 300-Level+

Code	Title	Hours	Counts towards
AEC 360	Ecology	4	
BIO 414	Cell Biology	3	
BIT 481	Plant Tissue Culture and Transformation	2	
ECE 488	Systems Biology Modeling of Plant Regulation	3	
ECE 588	Systems Biology Modeling of Plant Regulation	3	
FOR 565	Plant Community Ecology	4	
MB 501	Biology of Plant Pathogens	3	
MB 575	Introduction to Mycology	4	
PB 321	Introduction to Whole Plant Physiology	3	
PB 325	Culinary Botany	3	
PB 345	Economic Botany	3	
PB 346	Economic Botany Lab	1	
PB 360	Ecology	4	
PB 400	Plant Diversity and Evolution	4	
PB 403	Systematic Botany	4	
PB 413	Plant Anatomy	2	
PB 421	Plant Physiology	3	
PB 445	Paleobotany	4	

PB 464	Rare Plants of North Carolina	3
PB 480	Introduction to Plant Biotechnology	3
PB 481	Plant Tissue Culture and Transformation	2
PB 488	Systems Biology Modeling of Plant Regulation	3
PB 501	Biology of Plant Pathogens	3
PB 503	Systematic Botany	4
PB 513	Plant Anatomy	2
PB 545	Paleobotany	4
PB 559	Plant Water Relations	2
PB 564	Rare Plants of North Carolina	3
PB 570	Plant Functional Ecology	3
PB 575	Introduction to Mycology	4
PB 580	Introduction to Plant Biotechnology	3
PB 588	Systems Biology Modeling of Plant Regulation	3
PB 595	Special Topics in Plant Biology	1-6
PP 501	Biology of Plant Pathogens	3
PP 575	Introduction to Mycology	4

PB Electives

Code	Title	Hours	Counts towards
PB Electives			
PB 213	Plants and Civilization	3	
PB 215	Medicinal Plants	3	
PB 219	Plants in Folklore, Myth, and religion	3	
PB 220	Local Flora	3	
PB 277	Space Biology	3	
PP 222	Kingdom of Fungi	3	
PB Electives 300-Level+			
AEC 360	Ecology	4	
BIO 414	Cell Biology	3	
BIT 481	Plant Tissue Culture and Transformation	2	

ECE 488	Systems Biology Modeling of Plant Regulation	3
ECE 588	Systems Biology Modeling of Plant Regulation	3
FOR 565	Plant Community Ecology	4
MB 501	Biology of Plant Pathogens	3
MB 575	Introduction to Mycology	4
PB 321	Introduction to Whole Plant Physiology	3
PB 325	Culinary Botany	3
PB 345	Economic Botany	3
PB 346	Economic Botany Lab	1
PB 360	Ecology	4
PB 400	Plant Diversity and Evolution	4
PB 403	Systematic Botany	4
PB 413	Plant Anatomy	2
PB 421	Plant Physiology	3
PB 445	Paleobotany	4
PB 464	Rare Plants of North Carolina	3
PB 480	Introduction to Plant Biotechnology	3
PB 481	Plant Tissue Culture and Transformation	2
PB 488	Systems Biology Modeling of Plant Regulation	3
PB 501	Biology of Plant Pathogens	3
PB 503	Systematic Botany	4
PB 513	Plant Anatomy	2
PB 545	Paleobotany	4
PB 559	Plant Water Relations	2
PB 564	Rare Plants of North Carolina	3
PB 570	Plant Functional Ecology	3
PB 575	Introduction to Mycology	4
PB 580	Introduction to Plant Biotechnology	3

PB 588	Systems Biology Modeling of Plant Regulation	3
PB 595	Special Topics in Plant Biology	1-6
PP 501	Biology of Plant Pathogens	3
PP 575	Introduction to Mycology	4

PB Elective Lab Credit Co-Requisites

Code	Title	Hours	Counts towards
AEC 360	Ecology	4	
BIT 481	Plant Tissue Culture and Transformation	2	
FOR 565	Plant Community Ecology	4	
PB 220	Local Flora	3	
PB 346	Economic Botany Lab	1	
PB 360	Ecology	4	
PB 400	Plant Diversity and Evolution	4	
PB 403	Systematic Botany	4	
PB 413	Plant Anatomy	2	
PB 445	Paleobotany	4	
PB 481	Plant Tissue Culture and Transformation	2	
PB 503	Systematic Botany	4	
PB 513	Plant Anatomy	2	
PB 545	Paleobotany	4	

Applied Plant Science Elective

Code	Title	Hours	Counts towards
CS 312		3	
CS 411	Crop Ecology	3	
CS 413	Plant Breeding	2	
CS 414	Weed Science	4	
CS 415	Integrated Pest Management	3	
CS 424	Seed Physiology	3	
CS 430	Advanced Agroecology	4	
CS 524	Seed Physiology	3	
FOR 303	Silvics and Forest Tree Physiology	3	
FOR 318	Forest Pathology	3	
FOR 339	Dendrology	4	
FOR 411	Forest Tree Genetics and Biology	3	

FS 462	Postharvest Physiology	3
FS 562	Postharvest Physiology	3
HS 301	Plant Propagation	4
HS 411	Nursery Management	3
HS 421	Temperate- Zone Tree Fruits: Physiology and Culture	3
HS 422	Small Fruit Production	3
HS 431	Vegetable Production	4
HS 432	Introduction to Permaculture	3
HS 440	Greenhouse Management	3
HS 451	Plant Nutrition	3
HS 462	Postharvest Physiology	3
HS 521	Temperate- Zone Tree Fruits: Physiology and Culture	3
HS 532	Introduction to Permaculture	3
HS 551	Plant Nutrition	3
HS 562	Postharvest Physiology	3
MB 501	Biology of Plant Pathogens	3
PB 501	Biology of Plant Pathogens	3
PP 315	Principles of Plant Pathology	4
PP 318	Forest Pathology	3
PP 501	Biology of Plant Pathogens	3
PP 540		2

CALS Elective Groups A, B, & C

Code	Title	Hours	Counts towards
Group A - Biological Sciences			
AEC 360	Ecology	4	
AEC 420	Introduction to Fisheries Science	3	
AEC 423	Introduction to Fisheries Sciences Laboratory	1	

AEE 208	Agricultural Biotechnology: Issues and Implications	3	BCH 101	Introduction to Microbiology and Biochemistry Laboratory Practices	3
ANS 105	Introduction to Companion Animal Science	3	BCH 220	Role of Biotechnology in Society	3
ANS 110	Introduction to Equine Science	3	BCH 351	General Biochemistry	3
ANS 150	Introduction to Animal Science	3	BCH 451	Principles of Biochemistry	4
ANS 151	Introduction to Animal Science Lab	1	BCH 452	Introductory Biochemistry Laboratory	2
ANS 205	Physiology of Domestic Animals	3	BCH 453	Biochemistry of Gene Expression	3
ANS 206	Anatomy of Domestic Animals Lab	1	BCH 454	Advanced Biochemistry Laboratory	4
ANS 208	Agricultural Biotechnology: Issues and Implications	3	BCH 455	Proteins and Molecular Mechanisms	3
ANS 215	Agricultural Genetics	3	BCH 553	Biochemistry of Gene Expression	3
ANS 220	Reproductive Physiology	3	BCH 555	Proteins and Molecular Mechanisms	3
ANS 221	Reproductive Physiology Lab	1	BEC 463	Fermentation of Recombinant Microorganisms	2
ANS 230	Animal Nutrition	3	BEC 563	Fermentation of Recombinant Microorganisms	2
ANS 231	Animal Nutrition Lab	1	BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity	4
ANS 415	Comparative Nutrition	3	BIO 267	Research in the Life Sciences I: Research Skills	3
ANS 452	Comparative Reproductive Physiology and Biotechnology	3	BIO 414	Cell Biology	3
ANS 453	Physiology and Genetics of Growth and Development	3	BIO 434	Hormones and Behavior	3
ANS 454	Lactation, Milk and Nutrition	3	BIO 440	The Human Animal: An Evolutionary Perspective	3
ANS 515	Comparative Nutrition	3	BIT 410	Manipulation of Recombinant DNA	4
ANS 552	Comparative Reproductive Physiology and Biotechnology	3	BIT 462		2
ANS 553	Physiology and Genetics of Growth and Development	3	BIT 463	Fermentation of Recombinant Microorganisms	2
ANS 554	Lactation, Milk and Nutrition	3	BIT 464	Protein Purification	2

BIT 466	Animal Cell Culture Techniques	2	FS 403	Analytical Techniques in Food & Bioprocessing Science	4
BIT 467	PCR and DNA Fingerprinting	2	FS 405	Food Microbiology	3
BIT 468		2	FS 406	Food Microbiology Lab	1
BIT 476	Applied Bioinformatics	2	FS 501	Advanced Nutrition and Metabolism	3
BIT 481	Plant Tissue Culture and Transformation	2	FS 502	Chemistry of Food and Bioprocessed Materials	4
BIT 501	Ethical Issues in Biotechnology	1	FS 505	Food Microbiology	3
BIT 562		2	FS 506	Food Microbiology Lab	1
BIT 563	Fermentation of Recombinant Microorganisms	2	FW 313	Mountain Wildlife Ecology and Management	1
BIT 564	Protein Purification	2	FW 353	Wildlife Management	3
BIT 566	Animal Cell Culture Techniques	2	FW 403	Urban Wildlife Management	3
BIT 567	PCR and DNA Fingerprinting	2	FW 404	Wildlife Habitat Management	3
BIT 568		2	FW 453	Principles of Wildlife Science	4
CHE 463	Fermentation of Recombinant Microorganisms	2	HS 215	Agricultural Genetics	3
CHE 563	Fermentation of Recombinant Microorganisms	2	MB 101	Introduction to Microbiology and Biochemistry Laboratory Practices	3
ENT 201	Insects and People	3	MB 405	Food Microbiology	3
ENT 207	Insects and Human Disease	3	MB 406	Food Microbiology Lab	1
ENT 402	Forest Entomology	3	MB 505	Food Microbiology	3
ENT 425	General Entomology	3	MB 506	Food Microbiology Lab	1
FOR 402	Forest Entomology	3	NTR 301	Introduction to Human Nutrition	3
FS 231	Principles of Food and Bioprocess Engineering	4	NTR 401	Advanced Nutrition and Metabolism	3
FS 301	Introduction to Human Nutrition	3	NTR 415	Comparative Nutrition	3
FS 401	Advanced Nutrition and Metabolism	3	NTR 419	Human Nutrition and Chronic Disease	3
FS 402	Chemistry of Food and Bioprocessed Materials	4	NTR 454	Lactation, Milk and Nutrition	3

NTR 501	Advanced Nutrition and Metabolism	3	PHY 552	Comparative Reproductive Physiology and Biotechnology	3
NTR 515	Comparative Nutrition	3	PO 415	Comparative Nutrition	3
PB 103	Perspectives on Botany	1	PO 466	Animal Cell Culture Techniques	2
PB 200	Plant Life	4	PO 515	Comparative Nutrition	3
PB 205	Our Green World	3	PO 566	Animal Cell Culture Techniques	2
PB 208	Agricultural Biotechnology: Issues and Implications	3	PP 150	Introduction to Plant Molecular Biology	3
PB 213	Plants and Civilization	3	PP 222	Kingdom of Fungi	3
PB 215	Medicinal Plants	3	11PB 2147		
PB 219	Plants in Folklore, Myth, and religion	3	AEC 419	Freshwater Ecology	4
PB 220	Local Flora	3	AEC 420	Introduction to Fisheries Science	3
PB 250	Plant Biology	4	AEC 423	Introduction to Fisheries Sciences Laboratory	1
PB 277	Space Biology	3	AEC 441	Biology of Fishes	3
PB 321	Introduction to Whole Plant Physiology	3	AEC 442	Biology of Fishes Laboratory	1
PB 360	Ecology	4	AEC 460	Field Ecology and Methods	4
PB 400	Plant Diversity and Evolution	4	AEC 519	Freshwater Ecology	4
PB 403	Systematic Botany	4	ANS 515	Comparative Nutrition	3
PB 413	Plant Anatomy	2	BEC 463	Fermentation of Recombinant Microorganisms	2
PB 421	Plant Physiology	3	BEC 563	Fermentation of Recombinant Microorganisms	2
PB 445	Paleobotany	4	BIO 140	Survey of Animal Diversity	3
PB 464	Rare Plants of North Carolina	3	BIO 141	Animal Diversity Laboratory	1
PB 480	Introduction to Plant Biotechnology	3	BIO 227	Understanding Structural Diversity through Biological Illustration	3
PB 481	Plant Tissue Culture and Transformation	2	BIO 315	General Parasitology	3
PB 503	Systematic Botany	4	BIO 330	Evolutionary Biology	3
PB 513	Plant Anatomy	2	BIO 361	Developmental Biology	3
PB 545	Paleobotany	4			
PB 564	Rare Plants of North Carolina	3			
PB 580	Introduction to Plant Biotechnology	3			
PHY 452	Comparative Reproductive Physiology and Biotechnology	3			

BIO 370	Developmental Anatomy of the Vertebrates	3	FS 406	Food Microbiology Lab	1
BIO 375	Developmental Anatomy Laboratory	2	FS 505	Food Microbiology	3
BIO 405	Functional Histology	3	FS 506	Food Microbiology Lab	1
BIO 414	Cell Biology	3	FW 353	Wildlife Management	3
BIO 424	Endocrinology	3	GN 301	Genetics in Human Affairs	3
BIO 482	Capstone Course in Molecular, Cellular, and Developmental Biology	3	GN 311	Principles of Genetics	4
BIO 483	Capstone Course in Integrative Physiology and Neurobiology	3	GN 312	Elementary Genetics Laboratory	1
BIO 484	Capstone Course in Human Biology	3	GN 421	Molecular Genetics	3
BIO 485	Capstone Course in Ecology, Evolution, and Conservation Biology	3	GN 423	Population, Quantitative and Evolutionary Genetics	3
BIO 488	Neurobiology	3	GN 425	Advanced Genetics Laboratory	2
BIO 588	Neurobiology	3	GN 434	Genes and Development	3
BIT 210	Phage Hunters	3	GN 441	Human and Biomedical Genetics	3
BIT 211	Phage Genomics	2	GN 451	Genome Science	3
BIT 463	Fermentation of Recombinant Microorganisms	2	GN 490	Genetics Colloquium	1
BIT 563	Fermentation of Recombinant Microorganisms	2	GN 521	Molecular Genetics	3
BME 301	Human Physiology : Electrical Analysis	4	GN 541	Human and Biomedical Genetics	3
BME 302	Human Physiology: Mechanical Analysis	4	HS 215	Agricultural Genetics	3
CHE 463	Fermentation of Recombinant Microorganisms	2	HS 451	Plant Nutrition	3
CHE 563	Fermentation of Recombinant Microorganisms	2	HS 551	Plant Nutrition	3
CS 211	Plant Genetics	3	MB 180	Introduction to Microbial Bioprocessing	3
ENT 425	General Entomology	3	MB 200	The Fourth Horseman: Plagues that Changed the World	3
FS 301	Introduction to Human Nutrition	3	MB 210	Phage Hunters	3
FS 405	Food Microbiology	3	MB 211	Phage Genomics	2
			MB 351	General Microbiology	3
			MB 352	General Microbiology Laboratory	1

MB 354	Inquiry-Guided Microbiology Lab	1	NTR 420		3
MB 405	Food Microbiology	3	NTR 421	Life Cycle Nutrition	3
MB 406	Food Microbiology Lab	1	NTR 490	Senior Capstone Experience in Nutrition	4
MB 411	Medical Microbiology	3	NTR 515	Comparative Nutrition	3
MB 412	Medical Microbiology Laboratory	1	NTR 521	Life Cycle Nutrition	3
MB 414	Microbial Metabolic Regulation	3	PO 404	Avian Anatomy and Physiology	4
MB 420	Fundamentals of Microbial Cell Biotransformations	2	PO 415	Comparative Nutrition	3
MB 441	Immunology	3	PO 504	Avian Anatomy and Physiology	4
MB 451	Microbial Diversity	3	PO 515	Comparative Nutrition	3
MB 452	Microbial Diversity Lab	2	SSC 200	Soil Science	3
MB 455	Microbial Biotechnology	3	SSC 201	Soil Science Laboratory	1
MB 461	Molecular Virology	3	SSC 332	Environmental Soil Microbiology	3
MB 480	Current Issues in Microbiology	1	SSC 470	Wetland Soils	3
MB 505	Food Microbiology	3	SSC 570	Wetland Soils	3
MB 506	Food Microbiology Lab	1	ZO 233	Human-Animal Interactions	3
MB 520	Fundamentals of Microbial Cell Biotransformations	2	ZO 250	Animal Anatomy and Physiology	4
MEA 200	Introduction to Oceanography	3	ZO 317	Primate Ecology and Evolution	3
MEA 210	Oceanography Lab	1	ZO 333	Captive Animal Biology	3
MEA 220	Marine Biology	3	ZO 350	Animal Phylogeny and Diversity	4
MEA 250	Introduction to Coastal Environments	3	ZO 402	Invertebrate Biology	4
MEA 251	Introduction to Coastal Environments Laboratory	1	ZO 410	Introduction to Animal Behavior	3
MEA 369	Life on Earth: Principles of Paleontology	3	ZO 486	Capstone Course in Zoology	3
NTR 301	Introduction to Human Nutrition	3	11PB 2147		
NTR 415	Comparative Nutrition	3	ANS 225	Principles of Animal Nutrition	3
NTR 419	Human Nutrition and Chronic Disease	3	BIT 100	Current Topics in Biotechnology	4
			BIT 465	Real-time PCR Techniques	2
			BIT 471	RNA Interference and Model Organisms	2
			BIT 473	Protein Interactions	2
			BIT 474	Plant Genetic Engineering	2

BIT 565	Real-time PCR Techniques	2	CH 401	Systematic Inorganic Chemistry I	3
BIT 571	RNA Interference and Model Organisms	2	CH 403	Systematic Inorganic Chemistry II	3
BIT 573	Protein Interactions	2	CH 415	Analytical Chemistry II	3
BIT 574	Plant Genetic Engineering	2	CH 431	Physical Chemistry I	3
ENT 305	Introduction to Forensic Entomology	3	CH 433	Physical Chemistry II	3
11PB 2147			CH 435	Introduction to Quantum Chemistry	3
AEE 226	Computer Applications and Information Technology in Agricultural & Extension Ed	3	CH 437	Physical Chemistry for Engineers	4
BAE 200	Computer Methods in Biological Engineering	2	CH 441	Forensic Chemistry	3
BMA 573	Mathematical Modeling of Physical and Biological Processes I	3	CH 442	Advanced Synthetic Techniques	4
BMA 574	Mathematical Modeling of Physical and Biological Processes II	3	CH 444	Advanced Synthetic Techniques II	4
BUS 340	Information Systems Management	3	CH 452	Advanced Measurement Techniques I	4
BUS 350	Economics and Business Statistics	3	CH 454	Advanced Measurement Techniques II	4
CE 435	Engineering Geology	3	CH 463	Molecular Origins of Life	3
CE 479	Air Quality	3	CH 563	Molecular Origins of Life	3
CE 581	Fluid Mechanics in Natural Environments	3	CSC 110	Computer Science Principles - The Beauty and Joy of Computing	3
CH 230	Computational Chemistry Lab I	1	CSC 111	Introduction to Computing: Python	3
CH 232	Computational Chemistry Lab II	1	CSC 112	Introduction to Computing-FORTRAN	3
CH 315	Quantitative Analysis	3	CSC 113	Introduction to Computing - MATLAB	3
CH 316	Quantitative Analysis Laboratory	1	CSC 116	Introduction to Computing - Java	3
CH 331	Introductory Physical Chemistry	4	CSC 200		3
			CSC 216	Software Development Fundamentals	3

CSC 217	Software Development Fundamentals Lab	1	CSC 406	Architecture Of Parallel Computers	3
CSC 226	Discrete Mathematics for Computer Scientists	3	CSC 411	Introduction to Artificial Intelligence	3
CSC 230	C and Software Tools	3	CSC 412	Compiler Construction	3
CSC 236	Computer Organization and Assembly Language for Computer Scientists	3	CSC 415	Software Security	3
CSC 246	Concepts and Facilities of Operating Systems for Computer Scientists	3	CSC 416	Introduction to Combinatorics	3
CSC 251	Web Page Development	1	CSC 417	Theory of Programming Languages	3
CSC 255	String Processing Languages	1	CSC 422	Automated Learning and Data Analysis	3
CSC 281	Foundations of Interactive Game Design	3	CSC 427	Introduction to Numerical Analysis I	3
CSC 295	Special Topics in Computer Science	1-3	CSC 428	Introduction to Numerical Analysis II	3
CSC 302	Introduction to Numerical Methods	3	CSC 431	File Organization and Processing	3
CSC 316	Data Structures and Algorithms	3	CSC 440	Database Management Systems	3
CSC 326	Software Engineering	4	CSC 442	Introduction to Data Science	3
CSC 333	Automata, Grammars, and Computability	3	CSC 450	Web Services	3
CSC 342	Applied Web-based Client-Server Computing	3	CSC 453	Introduction to Internet of Things (IoT) Systems	3
CSC 379	Ethics in Computing	1	CSC 454	Human-Computer Interaction	3
CSC 401	Data and Computer Communications Networks	3	CSC 455	Social Computing and Decentralized Artificial Intelligence	3
CSC 402	Networking Projects	3	CSC 456	Computer Architecture and Multiprocessors	3
CSC 405	Computer Security	3	CSC 461	Computer Graphics	3
			CSC 462	Advanced Computer Graphics Projects	3
			CSC 467	Multimedia Technology	3
			CSC 474	Network Security	3
			CSC 481	Game Engine Foundations	3
			CSC 482	Advanced Computer Game Projects	3

CSC 484	Building Game AI	3	CSC 554	Human-Computer Interaction	3
CSC 492	Senior Design Project	3	CSC 555	Social Computing and Decentralized Artificial Intelligence	3
CSC 495	Special Topics in Computer Science	1-6	CSC 561	Principles of Computer Graphics	3
CSC 499	Independent Research in Computer Science	1-6	CSC 562	Introduction to Game Engine Design	3
CSC 501	Operating Systems Principles	3	CSC 563	Visual Interfaces for Mobile Devices	3
CSC 503	Computational Applied Logic	3	CSC 565	Graph Theory	3
CSC 505	Design and Analysis Of Algorithms	3	CSC 568	Enterprise Storage Architecture	3
CSC 506	Architecture Of Parallel Computers	3	CSC 570	Computer Networks	3
CSC 510	Software Engineering	3	CSC 573	Internet Protocols	3
CSC 512	Compiler Construction	3	CSC 574	Computer and Network Security	3
CSC 513	Electronic Commerce Technology	3	CSC 575	Introduction to Wireless Networking	3
CSC 515	Software Security	3	CSC 576	Networking Services: QoS, Signaling, Processes	3
CSC 517	Object-Oriented Design and Development	3	CSC 577	Switched Network Management	3
CSC 519	DevOps: Modern Software Engineering Practices	3	CSC 579	Introduction to Computer Performance Modeling	3
CSC 520	Artificial Intelligence I	3	CSC 580	Numerical Analysis I	3
CSC 522	Automated Learning and Data Analysis	3	CSC 582	Computer Models of Interactive Narrative	3
CSC 530	Computational Methods for Molecular Biology	3	CSC 583	Introduction to Parallel Computing	3
CSC 533	Privacy in the Digital Age	3	CSC 584	Building Game AI	3
CSC 540	Database Management concepts and Systems	3	CSC 591	Special Topics In Computer Science	1-6
CSC 541	Advanced Data Structures	3	E 531	Dynamic Systems and Multivariable Control I	3
CSC 546	Management Decision and Control Systems	3			
CSC 547	Cloud Computing Technology	3			
CSC 548	Parallel Systems	3			

ECE 406	Architecture Of Parallel Computers	3	ISE 546	Management Decision and Control Systems	3
ECE 460	Embedded System Architectures	3	LOG 201	Logic	3
ECE 506	Architecture Of Parallel Computers	3	LOG 335	Symbolic Logic	3
ECE 514	Random Processes	3	MA 105	Mathematics of Finance	3
ECE 517	Object-Oriented Design and Development	3	MA 205		3
ECE 547	Cloud Computing Technology	3	MA 225	Foundations of Advanced Mathematics	3
ECE 560	Embedded System Architectures	3	MA 242	Calculus III	4
ECE 570	Computer Networks	3	MA 302	Numerical Applications to Differential Equations	1
ECE 573	Internet Protocols	3	MA 303	Linear Analysis	3
ECE 574	Computer and Network Security	3	MA 305	Introductory Linear Algebra and Matrices	3
ECE 575	Introduction to Wireless Networking	3	MA 315	Mathematics Methods in Atmospheric Sciences	4
ECE 576	Networking Services: QoS, Signaling, Processes	3	MA 325	Introduction to Applied Mathematics	3
ECE 577	Switched Network Management	3	MA 331	Differential Equations for the Life Sciences	3
ECE 579	Introduction to Computer Performance Modeling	3	MA 335	Symbolic Logic	3
ECG 528	Options and Derivatives Pricing	3	MA 341	Applied Differential Equations I	3
ET 320	Fundamentals of Air Pollution	3	MA 351	Introduction to Discrete Mathematical Models	3
FIM 528	Options and Derivatives Pricing	3	MA 401	Applied Differential Equations II	3
FIM 548	Monte Carlo Methods for Financial Math	3	MA 402	Mathematics of Scientific Computing	3
FIM 549	Financial Risk Analysis	3	MA 403	Introduction to Modern Algebra	3
GIS 582	Geospatial Modeling	3	MA 405	Introduction to Linear Algebra	3
ISE 441	Introduction to Simulation	3	MA 407	Introduction to Modern Algebra for Mathematics Majors	3
ISE 505	Linear Programming	3	MA 408	Foundations of Euclidean Geometry	3
			MA 410	Theory of Numbers	3

MA 412	Long-Term Actuarial Models	3	MA 505	Linear Programming	3
MA 413	Short-Term Actuarial Models	3	MA 507	Survey of Real Analysis	3
MA 416	Introduction to Combinatorics	3	MA 508	Survey of Geometry	3
MA 421	Introduction to Probability	3	MA 509	Survey of Abstract Algebra	3
MA 425	Mathematical Analysis I	3	MA 510	Selected Topics In Mathematics For Secondary Teachers	1-6
MA 426	Mathematical Analysis II	3	MA 511	Advanced Calculus I	3
MA 427	Introduction to Numerical Analysis I	3	MA 512		3
MA 428	Introduction to Numerical Analysis II	3	MA 513	Introduction To Complex Variables	3
MA 430	Mathematical Models in the Physical Sciences	3	MA 515	Analysis I	3
MA 432	Mathematical Models in Life Sciences	3	MA 518	Geometry of Curves and Surfaces	3
MA 437	Applications of Algebra	3	MA 520	Linear Algebra	3
MA 440		3	MA 521	Abstract Algebra I	3
MA 444	Problem Solving Strategies for Competitions	1	MA 522	Computer Algebra	3
MA 450	Methods of Applied Mathematics I	3	MA 523	Linear Transformations and Matrix Theory	3
MA 451	Methods of Applied Mathematics II	3	MA 524	Combinatorics I	3
MA 491	Reading in Honors Mathematics	1-6	MA 526	Mathematical Analysis II	3
MA 493	Special Topics in Mathematics	1-6	MA 528	Options and Derivatives Pricing	3
MA 494	Major Paper in Math	1	MA 531	Dynamic Systems and Multivariable Control I	3
MA 499	Independent Research in Mathematics	1-6	MA 532	Ordinary Differential Equations I	3
MA 501	Advanced Mathematics for Engineers and Scientists I	3	MA 534	Introduction To Partial Differential Equations	3
MA 502	Advanced Mathematics for Engineers and Scientists II	3	MA 537	Nonlinear Dynamics and Chaos	3
MA 504	Introduction to Mathematical Programming	3	MA 540	Uncertainty Quantification for Physical and Biological Models	3
			MA 544	Computer Experiments In Mathematical Probability	3

MA 546	Probability and Stochastic Processes I	3	MEA 130	Introduction to Weather and Climate	3
MA 547	Stochastic Calculus for Finance	3	MEA 135	Introduction to Weather and Climate Laboratory	1
MA 548	Monte Carlo Methods for Financial Math	3	MEA 202	Geology II: Historical	3
MA 549	Financial Risk Analysis	3	MEA 211	Geology II Laboratory	1
MA 551	Introduction to Topology	3	MEA 300	Environmental Geology	4
MA 555	Introduction to Manifold Theory	3	MEA 312	Atmospheric Thermodynamics	4
MA 561	Set Theory and Foundations Of Mathematics	3	MEA 315	Mathematics Methods in Atmospheric Sciences	4
MA 565	Graph Theory	3	MEA 320	Fundamentals of Air Pollution	3
MA 573	Mathematical Modeling of Physical and Biological Processes I	3	MEA 321	Fundamentals of Air Quality and Climate Change	3
MA 574	Mathematical Modeling of Physical and Biological Processes II	3	MEA 323	Geochemistry of Natural Waters	3
MA 580	Numerical Analysis I	3	MEA 409	Watershed Forensics	3
MA 583	Introduction to Parallel Computing	3	MEA 410	Introduction to Mineralogy	4
MA 584	Numerical Solution of Partial Differential Equations--Finite Difference Methods	3	MEA 411	Marine Sediment Transport	3
MA 587	Numerical Solution of Partial Differential Equations--Finite Element Method	3	MEA 412	Atmospheric Physics	3
MA 591	Special Topics	1-6	MEA 415	Climate Dynamics	3
MBA 528	Options and Derivatives Pricing	3	MEA 421	Atmospheric Dynamics I	3
MEA 100	Earth System Science: Exploring the Connections	4	MEA 422	Atmospheric Dynamics II	3
MEA 101	Geology I: Physical	3	MEA 425	Introduction to Atmospheric Chemistry	3
MEA 110	Geology I Laboratory	1	MEA 440	Igneous and Metamorphic Petrology	4
			MEA 443	Synoptic Weather Analysis and Forecasting	4
			MEA 444	Mesoscale Analysis and Forecasting	4
			MEA 449	Principles of Biological Oceanography	3
			MEA 450	Introductory Sedimentology and Stratigraphy	4

MEA 451	Structural Geology	4	MEA 495	Junior Seminar in the Marine, Earth, and Atmospheric Sciences	1
MEA 454	Marine Physical-Biological Interactions	3	MEA 498	Internship in MEAS	1-6
MEA 455	Micrometeorology	3	MEA 507	Discipline-based Education Research in the Geosciences	3
MEA 458	Introduction to Tropical Meteorology	3	MEA 510	Air Pollution Meteorology	3
MEA 459	Field Investigation of Coastal Processes	5	MEA 511	Introduction to Meteorological Remote Sensing	3
MEA 460	Principles of Physical Oceanography	3	MEA 514	Advanced Physical Meteorology	3
MEA 462	Observational Methods and Data Analysis in Marine Physics	3	MEA 515	Climate Dynamics	3
MEA 463	Fluid Physics	3	MEA 517	Fundamentals of Climate Change Science	3
MEA 464	Ocean Circulation Systems	3	MEA 518	Adaptation to Climate Change	3
MEA 465	Geologic Field Camp	4	MEA 519	Barriers to Climate Change Literacy	3
MEA 466	Preparatory Course for Field Camp	1	MEA 525	Introduction to Atmospheric Chemistry	3
MEA 467	Marine Meteorology	3	MEA 540	Principles of Physical Oceanography	3
MEA 469	Ecology of coastal Resources	3	MEA 549	Principles of Biological Oceanography	3
MEA 470	Introduction to Geophysics	3	MEA 553	Estuarine Biogeochemistry	3
MEA 471	Exploration and Engineering Geophysics	3	MEA 554	Marine Physical-Biological Interactions	3
MEA 473	Principles of Chemical Oceanography	3	MEA 562	Marine Sediment Transport	3
MEA 476	Worldwide River and Delta Systems: Their Evolution and Human Impacts	3	MEA 570	Geological Oceanography	3
MEA 479	Air Quality	3	MEA 573	Principles of Chemical Oceanography	3
MEA 481	Geomorphology: Earth's Dynamic Surface	3	MEA 574	Advanced Igneous Petrology	3
MEA 485	Introduction to Hydrogeology	3	MEA 577	Electron Microprobe Analysis of Geologic Material	2
MEA 488	Meteorology for Media	3			
MEA 493	Special Topics in MEAS	1-6			

MEA 579	Principles of Air Quality Engineering	3	ST 350	Economics and Business Statistics	3
MEA 580	Air Quality Modeling and Forecasting	4	ST 412	Long-Term Actuarial Models	3
MEA 581	Fluid Mechanics in Natural Environments	3	ST 413	Short-Term Actuarial Models	3
MEA 582	Geospatial Modeling	3	ST 442	Introduction to Data Science	3
MEA 585	Physical Hydrogeology	3	ST 546	Probability and Stochastic Processes I	3
MEA 591	Special Topics in Marine Science	1-6	11PB 2147		
MEA 592	Special Topics in Earth Sciences	1-6	BME 201	Computer Methods in Biomedical Engineering	3
MEA 593	Special Topics in Atmospheric Science	1-6	CSC 442	Introduction to Data Science	3
MEA 599	Regional Geology of North America	1-6	EC 351	Econometrics I	3
OR 504	Introduction to Mathematical Programming	3	ECE 489	Solid State Solar and Thermal Energy Harvesting	3
OR 505	Linear Programming	3	ECE 589	Solid State Solar and Thermal Energy Harvesting	3
OR 531	Dynamic Systems and Multivariable Control I	3	ECG 561	Applied Econometrics I	3
OR 565	Graph Theory	3	EMS 519	Teaching and Learning of Statistical Thinking	3
OR 579	Introduction to Computer Performance Modeling	3	GPH 404	Epidemiology and Statistics in Global Public Health	3
PSY 240	Introduction to Behavioral Research I	3	MA 412	Long-Term Actuarial Models	3
PSY 241	Introduction to Behavioral Research I Lab	1	MA 413	Short-Term Actuarial Models	3
PSY 242	Introduction to Behavioral Research II	3	MA 546	Probability and Stochastic Processes I	3
PSY 243	Introduction to Behavioral Research II Lab	2	MA 555	Introduction to Manifold Theory	3
PY 414	Electromagnetism I	3	MEA 150	Environmental Issues in Water Resources	4
PY 415	Electromagnetism II	3	MEA 463	Fluid Physics	3
PY 514	Electromagnetism I	3	MSE 489	Solid State Solar and Thermal Energy Harvesting	3
PY 515	Electromagnetism II	3			

MSE 589	Solid State Solar and Thermal Energy Harvesting	3	PY 452	Advanced Physics Laboratory	3
NE 528	Introduction to Plasma Physics and Fusion Energy	3	PY 489	Solid State Solar and Thermal Energy Harvesting	3
NE 529	Plasma Physics and Fusion Energy II	3	PY 495	Special Topics in Physics	1-4
PSY 240	Introduction to Behavioral Research I	3	PY 499	Independent Research in Physics	1-6
PSY 241	Introduction to Behavioral Research I Lab	1	PY 501	Quantum Physics I	3
PSY 242	Introduction to Behavioral Research II	3	PY 502	Quantum Physics II	3
PSY 243	Introduction to Behavioral Research II Lab	2	PY 506	Nuclear and Subatomic Physics	3
PY 123	Stellar and Galactic Astronomy	3	PY 507	Elementary Particle Physics	3
PY 124	Solar System Astronomy	3	PY 509	General Relativity	3
PY 125	Astronomy Laboratory	1	PY 511	Mechanics I	3
PY 131	Conceptual Physics	4	PY 512	Mechanics II	3
PY 203	University Physics III	4	PY 514	Electromagnetism I	3
PY 301	Introduction to Quantum Mechanics	3	PY 515	Electromagnetism II	3
PY 328	Stellar and Galactic Astrophysics	3	PY 516	Physical Optics	3
PY 341	Relativity, Gravitation and Cosmology	3	PY 517	Atomic and Molecular Physics	3
PY 401	Quantum Physics I	3	PY 519	Biological Physics	3
PY 402	Quantum Physics II	3	PY 525	Computational Physics	3
PY 407	Introduction to Modern Physics	3	PY 528	Introduction to Plasma Physics and Fusion Energy	3
PY 411	Mechanics I	3	PY 529	Plasma Physics and Fusion Energy II	3
PY 412	Mechanics II	3	PY 543	Astrophysics	3
PY 413	Thermal Physics	3	PY 552	Condensed Matter Physics I	3
PY 414	Electromagnetism I	3	PY 570	Polymer Physics	3
PY 415	Electromagnetism II	3	PY 581	Matter & Interactions for Teachers I	3
			PY 582	Matter & Interactions for Teachers II	3
			PY 589	Solid State Solar and Thermal Energy Harvesting	3

PY 590	Special Topics In Physics	1-6	ST 435	Statistical Methods for Quality and Productivity Improvement	3
PY 599	Special Topics in Physics	1-6	ST 437	Applied Multivariate and Longitudinal Data Analysis	3
SSC 200	Soil Science	3	ST 440	Applied Bayesian Analysis	3
SSC 201	Soil Science Laboratory	1	ST 442	Introduction to Data Science	3
ST 311	Introduction to Statistics	3	ST 445	Introduction to Statistical Computing and Data Management	3
ST 312	Introduction to Statistics II	3	ST 446	Intermediate SAS Programming with Applications	3
ST 370	Probability and Statistics for Engineers	3	ST 491	Statistics in Practice	3
ST 371	Introduction to Probability and Distribution Theory	3	ST 495	Special Topics in Statistics	1-6
ST 372	Introduction to Statistical Inference and Regression	3	ST 497	Professional Experience in Statistics	1-3
ST 380	Probability and Statistics for the Physical Sciences	3	ST 498	Independent Study In Statistics	1-6
ST 401	Experiences in Data Analysis	4	ST 499	Research Experience in Statistics	1-3
ST 404	Epidemiology and Statistics in Global Public Health	3	ST 501	Fundamentals of Statistical Inference I	3
ST 405	Applied Nonparametric Statistics	3	ST 502	Fundamentals of Statistical Inference II	3
ST 412	Long-Term Actuarial Models	3	ST 503	Fundamentals of Linear Models and Regression	3
ST 413	Short-Term Actuarial Models	3	ST 505	Applied Nonparametric Statistics	3
ST 421	Introduction to Mathematical Statistics I	3	ST 506		3
ST 422	Introduction to Mathematical Statistics II	3	ST 507	Statistics For the Behavioral Sciences I	3
ST 430	Introduction to Regression Analysis	3	ST 508		3
ST 431	Introduction to Experimental Design	3	ST 511	Statistical Methods For Researchers I	3
ST 432	Introduction to Survey Sampling	3	ST 512	Statistical Methods For Researchers II	3
ST 433	Applied Spatial Statistics	3			
ST 434	Applied Time Series	3			

ST 513	Statistics for Management and Social Sciences I	3	ST 563	Introduction to Statistical Learning	3
ST 514	Statistics For Management and Social Sciences II	3	ST 590	Special Topics	1-6
ST 515	Experimental Statistics for Engineers I	3	TE 570	Polymer Physics	3
ST 516	Experimental Statistics For Engineers II	3	11PB 2147		
ST 517	Applied Statistical Methods I	3	ACC 210	Concepts of Financial Reporting	3
ST 519	Teaching and Learning of Statistical Thinking	3	ACC 220	Introduction to Managerial Accounting	3
ST 520	Statistical Principles of Clinical Trials	3	ACC 280	Survey of Financial and Managerial Accounting	3
ST 524		3	ACC 310	Intermediate Financial Accounting I	3
ST 533	Applied Spatial Statistics	3	ACC 311	Intermediate Financial Accounting II	3
ST 534	Applied Time Series	3	ACC 330	An Introduction To Income Taxation	3
ST 535	Statistical Methods for Quality and Productivity Improvement	3	ACC 340	Accounting Information Systems	3
ST 537	Applied Multivariate and Longitudinal Data Analysis	3	ACC 411	Business Valuation	3
ST 540	Applied Bayesian Analysis	3	ACC 420	Cost Accounting for Effective Management	3
ST 542	Statistical Practice	3	ACC 440	Enterprise Resource Planning Systems	3
ST 544	Applied Categorical Data Analysis	3	ACC 450	Auditing and Assurance Services	3
ST 546	Probability and Stochastic Processes I	3	ACC 451	Internal Auditing	3
ST 555	Statistical Programming I	3	ACC 460	Governmental and Nonprofit Accounting	3
ST 556	Statistical Programming II	3	ARE 215	Small Business Accounting	3
ST 557		3	ARE 301	Intermediate Microeconomics	3
ST 558	Data Science for Statisticians	3	ARE 303	Farm Management	3
ST 561	Applied Econometrics I	3	ARE 304	Agribusiness Management	3
ST 562	Data Mining with SAS Enterprise Miner	3	ARE 306	Agricultural Law	3
			ARE 309	Environmental Law & Economic Policy	3

ARE 311	Agricultural Markets	3	BUS 443	Web Development for Business Applications	3
ARE 312	Agribusiness Marketing	3	BUS 444	Systems Analysis and Design	3
ARE 321	Agricultural Financial Management	3	BUS 461	Channel and Retail Marketing	3
ARE 336	Introduction to Resource and Environmental Economics	3	BUS 462	Marketing Research	3
ARE 345	Global Agribusiness Management	3	BUS 464	International Marketing	3
ARE 404	Advanced Agribusiness Management	3	BUS 465	Traditional and Digital Brand Promotion	3
ARE 413	Applied Agribusiness Marketing	3	BUS 466	Personal Selling	3
ARE 433	U.S. Agricultural Policy	3	BUS 467	Product and Brand Management	3
ARE 490	Career Seminar in Agriculture & Resource Economics	1	BUS 468	Marketing Strategy	3
BUS 225	Personal Finance	3	BUS 469	Digital Marketing Practicum	3
BUS 320	Financial Management	3	BUS 470	Operations Modeling and Analysis	3
BUS 340	Information Systems Management	3	BUS 472	Operations Planning and Control Systems	3
BUS 360	Marketing Methods	3	BUS 473	Supply Chain Strategy	3
BUS 370	Operations and Supply Chain Management	3	BUS 475	Purchasing and Supply Management	3
BUS 420	Financial Management of Corporations	3	BUS 479	Supply Chain Management Undergraduate Practicum	3
BUS 422	Investments and Portfolio Management	3	EC 301	Intermediate Microeconomics	3
BUS 425	Advanced Personal Financial Management	3	EC 336	Introduction to Resource and Environmental Economics	3
BUS 426	International Financial Management	3	FTM 482	Global Brand Management in Textiles and Apparel	3
BUS 440	Database Management	3	M 100	Personal and Professional Identity Development	1
BUS 441	Business Data Communications and Networking	3	MIE 201	Introduction to Business Processes	3
BUS 442	Information Systems Development	3	MIE 305	Legal and Regulatory Environment	3

MIE 330	Human Resource Management	3	EC 348	Introduction to International Economics	3
MIE 335	Organizational Behavior	3	EC 351	Econometrics I	3
MIE 432	Labor and Employee Relations	3	EC 404	Money, Financial Markets, and the Economy	3
MIE 434	Compensation Systems	3	EC 410	Public Finance	3
MIE 435	Leadership and Management	3	EC 413	Industrial Organization	3
MIE 436	Training and Development	3	EC 431	Labor Economics	3
MIE 438	Staffing	3	EC 437		3
MIE 480	Business Policy and Strategy	3	EC 449	International Finance	3
PRT 406	Sports Law	3	EC 451	Econometrics II	3
11PB 2147			EC 474	Economics of Financial Institutions and Markets	3
ACC 220	Introduction to Managerial Accounting	3	EC 480		3
ACC 280	Survey of Financial and Managerial Accounting	3	EC 490	Research Seminar in Economics	3
ARE 301	Intermediate Microeconomics	3	FTM 482	Global Brand Management in Textiles and Apparel	3
ARE 332	Human Resource Management for Agribusiness	3	MIE 412	Finance and Accounting for Entrepreneurs	3
ARE 336	Introduction to Resource and Environmental Economics	3	MIE 413	New Venture Planning	3
ARE 412	Advanced Agribusiness Marketing	3	MIE 419	Entrepreneurship Practicum	3
BUS 340	Information Systems Management	3	PRT 406	Sports Law	3
BUS 449	Information Technology Capstone	3	11PB 2147		
BUS 474	Logistics Management	3	AEE 101	Introduction to Career and Technical Education	1
EC 202	Principles of Macroeconomics	3	AEE 208	Agricultural Biotechnology: Issues and Implications	3
EC 301	Intermediate Microeconomics	3	AEE 230	Introduction to Cooperative Extension	3
EC 302	Intermediate Macroeconomics	3	AEE 303	Administration and Supervision of Student Organizations	3
EC 305	A Closer Look at Capitalism	3	AEE 311	Communication Methods and Media	3
EC 336	Introduction to Resource and Environmental Economics	3	AEE 322	Experiential Learning in Agriculture	3

AEE 323	Leadership Development in Agriculture and Life Sciences	3	AEE 533	Leadership and Management of Volunteers in Agricultural and Extension Education	3
AEE 325	Planning and Delivering Non-Formal Education	3	BAET 201	Shop Processes and Management	3
AEE 326	Teaching Diverse Learners in AED	3	BAET 323	Water Management	3
AEE 327	Conducting Summer Programs in Agricultural Education	1	BAET 332	Management of Animal Environments	4
AEE 350	Personal Leadership Development in Agriculture and Life Sciences	3	BAET 333	Processing Agricultural Products	4
AEE 360	Developing Team Leadership in Agriculture and Life Sciences	3	BAET 343	Agricultural Electrification	4
AEE 423	Practicum in Agricultural Extension/ Industry	8	BAET 411	Agricultural Machinery and Power Units	4
AEE 424	Planning Agricultural Educational Programs	3	BAET 432	Agricultural and Environmental Safety and Health	3
AEE 426	Methods of Teaching Agriculture	3	BAET 443	Environmental Restoration Implementation	3
AEE 427	Student Teaching in Agriculture	8	ALS 110	Academic and Career Skills Seminar	1
AEE 433	Leadership and Management of Volunteers in Agricultural and Extension Education	3	ANS 105	Introduction to Companion Animal Science	3
AEE 435	Professional Presentations in Agricultural Organizations	3	ANS 110	Introduction to Equine Science	3
AEE 460	Organizational Leadership Development in Agriculture and Life Sciences	3	ANS 150	Introduction to Animal Science	3
AEE 478	Advanced Issues in Extension Education	3	ANS 151	Introduction to Animal Science Lab	1
AEE 490	Seminar in Agricultural and Extension Education	1	ANS 201	Techniques of Animal Care	2
			ANS 208	Agricultural Biotechnology: Issues and Implications	3
			ANS 225	Principles of Animal Nutrition	3
			ANS 303	Principles of Equine Evaluation	2
			ANS 304	Dairy Cattle Evaluation	2
			ANS 309	Livestock Evaluation	3
			ANS 322	Muscle Foods and Eggs	3

ANS 324	Milk and Dairy Products	3	BAE 371	Fundamentals of Hydrology for Engineers	3
ANS 400	Companion Animal Management	3	BAE 401	Sensors and Controls	3
ANS 402	Beef Cattle Management	3	BAE 435	Precision Agriculture Technology	3
ANS 403	Swine Management	3	BAE 451	Engineering Design I	2
ANS 404	Dairy Cattle Management	3	BAE 452	Engineering Design II	2
ANS 408	Small Ruminant Management	3	BAE 462	Machinery Design and Applications	3
ANS 410	Equine Breeding Farm Management	3	BAE 472	Irrigation and Drainage	3
ANS 425	Feed Manufacturing Technology	3	BAE 473	Introduction to Hydrologic and Water Quality Modeling	3
ANS 440	Animal Genetic Improvement	3	BAE 474	Principles and Applications of Ecological Engineering	3
ANS 453	Physiology and Genetics of Growth and Development	3	BAE 481	Structures & Environment	3
ANS 454	Lactation, Milk and Nutrition	3	BAE 501	Sensors and Controls	3
ANS 525	Feed Manufacturing Technology	3	BAE 535	Precision Agriculture Technology	3
ANS 540	Animal Genetic Improvement	3	BAE 572	Irrigation and Drainage	3
ANS 553	Physiology and Genetics of Growth and Development	3	BAE 573	Introduction to Hydrologic and Water Quality Modeling	3
ANS 554	Lactation, Milk and Nutrition	3	BEC 330	Principles and Applications of Bioseparations	2
BAE 100	Introduction to Biological and Agricultural Engineering and Technology	1	BEC 436	Introduction to Downstream Process Development	2
BAE 202	Introduction to Biological and Agricultural Engineering Methods	4	BEC 440		3
BAE 302	Transport Phenomena	3	BEC 536	Introduction to Downstream Process Development	2
BAE 322	Introduction to Food Process Engineering	3	BEC 540		3
BAE 361	Analytical Methods in Engineering Design	3	BME 203		3
			BME 207	Biomedical Electronics	4
			BME 342		3
			BME 365	Linear Systems in Biomedical Engineering	3

BME 385	Bioinstrumentation	3	SSC 440	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
BME 412	Biomedical Signal Processing	3	SSC 473	Introduction to Hydrologic and Water Quality Modeling	3
BME 425	Bioelectricity	3	SSC 540	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
BME 525	Bioelectricity	3	SSC 573	Introduction to Hydrologic and Water Quality Modeling	3
CS 470	Advanced Turfgrass Pest Management	2	USC 291	Service Learning Program Leader Development I	1
ECI 424	Student Teaching in Modern Foreign Languages	12	USC 292	Service Learning Program Leader Development II	2
ENT 470	Advanced Turfgrass Pest Management	2	11PB 2147		
FM 425	Feed Manufacturing Technology	3	AEC 420	Introduction to Fisheries Science	3
FM 525	Feed Manufacturing Technology	3	AEE 206	Introduction to Teaching Agriculture	3
FS 322	Muscle Foods and Eggs	3	AEE 303	Administration and Supervision of Student Organizations	3
FS 324	Milk and Dairy Products	3	AEE 322	Experiential Learning in Agriculture	3
FS 435	Food Safety Management Systems	3	AEE 327	Conducting Summer Programs in Agricultural Education	1
FS 535	Food Safety Management Systems	3	AEE 424	Planning Agricultural Educational Programs	3
MSE 203		3	AEE 426	Methods of Teaching Agriculture	3
NTR 425	Feed Manufacturing Technology	3	AEE 427	Student Teaching in Agriculture	8
NTR 454	Lactation, Milk and Nutrition	3	ANS 322	Muscle Foods and Eggs	3
NTR 525	Feed Manufacturing Technology	3	ANS 324	Milk and Dairy Products	3
PB 208	Agricultural Biotechnology: Issues and Implications	3	ANS 330	Laboratory Animal Science	3
PO 322	Muscle Foods and Eggs	3			
PO 425	Feed Manufacturing Technology	3			
PO 525	Feed Manufacturing Technology	3			
PP 470	Advanced Turfgrass Pest Management	2			

ANS 411	Management of Growing and Performance Horses	3	BME 451	BME Senior Design: Product Development	3
ANS 425	Feed Manufacturing Technology	3	BME 452	BME Senior Design: Product Implementation and Strategy	3
ANS 525	Feed Manufacturing Technology	3	BME 466	Polymeric Biomaterials Engineering	3
BAE 325	Introductory Geomatics	3	BME 467	Mechanics of Tissues & Implants Requirements	3
BAE 425	Industrial Microbiology and Bioprocessing	3	BME 483	Tissue Engineering Technologies	2
BAE 435	Precision Agriculture Technology	3	BME 484	Fundamentals of Tissue Engineering	3
BAE 525	Industrial Microbiology and Bioprocessing	3	BME 544	Orthopaedic Biomechanics	3
BAE 535	Precision Agriculture Technology	3	BME 566	Polymeric Biomaterials Engineering	3
BBS 201	Introduction to Biopharmaceutical Science	3	BME 583	Tissue Engineering Technologies	2
BBS 301	Process Validation Science	3	BME 584	Fundamentals of Tissue Engineering	3
BBS 426	Upstream Biomanufacturing Laboratory	2	CS 200	Introduction to Turfgrass Management	4
BBS 526	Upstream Biomanufacturing Laboratory	2	CS 210	Lawns and Sports Turf	3
BCH 220	Role of Biotechnology in Society	3	CS 213	Crop Science	3
BEC 426	Upstream Biomanufacturing Laboratory	2	CS 216	Southern Row Crop Production - Cotton, Peanuts, and Tobacco	3
BEC 483	Tissue Engineering Technologies	2	CS 218	Southern Row Crop Production - Corn, Small Grains and Soybeans	3
BEC 526	Upstream Biomanufacturing Laboratory	2	CS 230	Introduction to Agroecology	3
BEC 583	Tissue Engineering Technologies	2	CS 312		3
BME 375	Biomedical Microcontroller Applications	3	CS 400	Turf Cultural Systems	3
BME 444	Orthopaedic Biomechanics	3	CS 411	Crop Ecology	3
			CS 413	Plant Breeding	2
			CS 414	Weed Science	4
			CS 415	Integrated Pest Management	3
			CS 424	Seed Physiology	3

CS 430	Advanced Agroecology	4	FS 290	Careers in Food and Bioprocessing Sciences	1
CS 465	Turf Management Systems and Environmental Quality	3	FS 322	Muscle Foods and Eggs	3
CS 524	Seed Physiology	3	FS 324	Milk and Dairy Products	3
CS 565	Turf Management Systems and Environmental Quality	3	FS 330	Science of Food Preparation	3
CSSC 490	Senior Seminar in Crop Science and Soil Science	1	FS 352	Introduction to Microbiological Food Safety Hazards	3
ECI 424	Student Teaching in Modern Foreign Languages	12	FS 354	Food Sanitation	3
ENT 203	An Introduction to the Honey Bee and Beekeeping	3	FS 416	Quality Control in Food and Bioprocessing	3
ENT 401	Honey Bee Biology and Management	3	FS 421	Food Preservation	3
ES 100	Introduction to Environmental Sciences	3	FS 426	Upstream Biomanufacturing Laboratory	2
ES 200	Climate Change and Sustainability	3	FS 435	Food Safety Management Systems	3
ES 300	Energy and Environment	3	FS 453	Food Laws and Regulations	3
ES 400	Analysis of Environmental Issues	3	FS 462	Postharvest Physiology	3
FM 425	Feed Manufacturing Technology	3	FS 475	Problems and Design in Food and Bioprocessing Science	3
FM 460	Feed Mill Operations and Leadership	3	FS 516	Quality Control in Food and Bioprocessing	3
FM 480	Feed Quality Assurance & Formulation	3	FS 521	Food Preservation	3
FM 490	Feed Science Seminar	1	FS 526	Upstream Biomanufacturing Laboratory	2
FM 525	Feed Manufacturing Technology	3	FS 535	Food Safety Management Systems	3
FOR 318	Forest Pathology	3	FS 553	Food Laws and Regulations	3
FOR 420	Watershed and Wetlands Hydrology	4	FS 562	Postharvest Physiology	3
FOR 472	Forest Soils	4	FW 221	Conservation of Natural Resources	3
FOR 520	Watershed and Wetlands Hydrology	4	FW 311	Piedmont Wildlife Ecology and Management	3
FS 201	Introduction to Food Science	3			

FW 312	Fisheries Techniques and Management	1	NR 460	Renewable Natural Resource Management and Policy	3
FW 313	Mountain Wildlife Ecology and Management	1	NR 520	Watershed and Wetlands Hydrology	4
FW 314	Coastal Ecology and Management	1	NR 560	Renewable Natural Resource Management and Policy	3
FW 353	Wildlife Management	3	NTR 425	Feed Manufacturing Technology	3
FW 403	Urban Wildlife Management	3	NTR 525	Feed Manufacturing Technology	3
FW 411	Human Dimensions of Wildlife and Fisheries	3	PO 322	Muscle Foods and Eggs	3
FW 453	Principles of Wildlife Science	4	PO 424	Poultry Meat Production	3
FW 460	International Wildlife Management and Conservation	3	PO 425	Feed Manufacturing Technology	3
FW 465	African Ecology and Conservation	4	PO 435	Poultry Incubation & Breeding	4
FW 511	Human Dimensions of Wildlife and Fisheries	3	PO 525	Feed Manufacturing Technology	3
FW 560	International Wildlife Management and Conservation	3	PP 318	Forest Pathology	3
FW 565	African Ecology and Conservation	4	SSC 440	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
GPH 201	Fundamentals of Global Public Health	3	SSC 462	Soil-Crop Management Systems	3
HS 432	Introduction to Permaculture	3	SSC 540	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
HS 462	Postharvest Physiology	3	TE 466	Polymeric Biomaterials Engineering	3
HS 532	Introduction to Permaculture	3	TE 467	Mechanics of Tissues & Implants Requirements	3
HS 562	Postharvest Physiology	3	TE 566	Polymeric Biomaterials Engineering	3
IDS 303	Humans and the Environment	3	VMP 401	Poultry Diseases	4
NR 303	Humans and the Environment	3	VMP 420	Disease of Farm Animals	3
NR 350	International Sustainable Resource Use	4			
NR 406	Conservation of Biological Diversity	3			
NR 420	Watershed and Wetlands Hydrology	4			

AEC 419	Freshwater Ecology	4	FS 435	Food Safety Management Systems	3
AEC 423	Introduction to Fisheries Sciences Laboratory	1	FS 462	Postharvest Physiology	3
AEC 519	Freshwater Ecology	4	FS 535	Food Safety Management Systems	3
ANS 322	Muscle Foods and Eggs	3	FS 562	Postharvest Physiology	3
ANS 425/525	Feed Manufacturing Technology	3	FW 221	Conservation of Natural Resources	3
BAET 323	Water Management	3	FW 404	Wildlife Habitat Management	3
BIO 227	Understanding Structural Diversity through Biological Illustration	3	FW 460	International Wildlife Management and Conservation	3
BME 204		3	FW 560	International Wildlife Management and Conservation	3
BME 217	Biomedical Electronics Laboratory	1	HS 200	Home Horticulture	3
BME 298	Biomedical Engineering Design and Manufacturing I	2	HS 201	The World of Horticulture: Principles and Practices	3
BME 398	Biomedical Engineering Design and Manufacturing II	2	HS 203	Home Plant Propagation	3
CS 470	Advanced Turfgrass Pest Management	2	HS 242	Introduction to Small Scale Landscape Design	3
CSSC 490	Senior Seminar in Crop Science and Soil Science	1	HS 250	Home Landscape Design: Creating Garden Spaces	3
ENT 470	Advanced Turfgrass Pest Management	2	HS 252	Landscape Graphic Communication	2
FM 425	Feed Manufacturing Technology	3	HS 272	Landscape Design/Build	6
FM 525	Feed Manufacturing Technology	3	HS 290	Horticulture: Careers and Opportunities	1
FOR 318	Forest Pathology	3	HS 301	Plant Propagation	4
FOR 420	Watershed and Wetlands Hydrology	4	HS 302	Gardening with Herbaceous Perennials	3
FOR 472	Forest Soils	4	HS 303	Ornamental Plant Identification I	3
FOR 520	Watershed and Wetlands Hydrology	4	HS 304	Ornamental Plant Identification II	3
FS 322	Muscle Foods and Eggs	3	HS 357	Landscape Grading and Drainage	4

HS 400	Residential Landscaping	6	NR 521	Wetland Science and Management	3
HS 411	Nursery Management	3	NR 560	Renewable Natural Resource Management and Policy	3
HS 416	Planting Design	4	NTR 420		3
HS 421	Temperate-Zone Tree Fruits: Physiology and Culture	3	NTR 425	Feed Manufacturing Technology	3
HS 422	Small Fruit Production	3	NTR 525	Feed Manufacturing Technology	3
HS 423	Viticulture	3	PO 201	Poultry Science and Production	3
HS 431	Vegetable Production	4	PO 201A	Poultry Science and Production	3
HS 440	Greenhouse Management	3	PO 202	Poultry Science and Production Laboratory	1
HS 442	Floriculture Crop Production	3	PO 202A	Poultry Science and Production Laboratory	1
HS 462	Postharvest Physiology	3	PO 290	Poultry Seminar	1
HS 471	Landscape Ecosystem Management	4	PO 322	Muscle Foods and Eggs	3
HS 516	Planting Design	4	PO 340	Live Poultry and Poultry Product Evaluation, Grading, and Inspection	3
HS 521	Temperate-Zone Tree Fruits: Physiology and Culture	3	PO 410	Production and Management of Game Birds in Confinement	3
HS 523	Viticulture	3	PO 411	Agrosecurity	3
HS 562	Postharvest Physiology	3	PO 421	Commercial Egg Production	3
IDS 303	Humans and the Environment	3	PO 425	Feed Manufacturing Technology	3
NR 300	Natural Resource Measurements	4	PO 433	Poultry Processing and Products	3
NR 303	Humans and the Environment	3	PO 525	Feed Manufacturing Technology	3
NR 400	Natural Resource Management	4	PO 533	Poultry Processing and Products	3
NR 420	Watershed and Wetlands Hydrology	4	PP 315	Principles of Plant Pathology	4
NR 421	Wetland Science and Management	3	PP 318	Forest Pathology	3
NR 460	Renewable Natural Resource Management and Policy	3	PP 470	Advanced Turfgrass Pest Management	2
NR 484	Environmental Impact Assessment	4	SSC 185	Land and Life	3
NR 500	Natural Resource Management	4			
NR 520	Watershed and Wetlands Hydrology	4			

SSC 341	Soil Fertility and Nutrient Management	3
SSC 342	Soil and Plant Nutrient Analysis	1
SSC 421	Role of Soils in Environmental Management	3
SSC 440	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
SSC 442	Soil and Environmental Biogeochemistry	3
SSC 452	Soil Classification	4
SSC 461	Soil Physical Properties and Plant Growth	3
SSC 462	Soil-Crop Management Systems	3
SSC 470	Wetland Soils	3
SSC 540	Geographic Information Systems (GIS) in Soil Science and Agriculture	3
SSC 570	Wetland Soils	3
TOX 201	Poisons, People and the Environment	3
TOX 401	Principles of Toxicology	4
TOX 415	Environmental Toxicology and Chemistry	4
TOX 501	Principles of Toxicology	4

Semester Sequence

This is a sample.

First Year

Fall Semester		Hours
Select one of the following: ¹		2
LSC 101	Critical and Creative Thinking in the Life Sciences	
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)		
PB 103 or LSC 103	Perspectives on Botany or Exploring Opportunities in the Life Sciences	1
BIO 181	Introductory Biology: Ecology, Evolution, and Biodiversity ¹	4

CH 101	Chemistry - A Molecular Science	3
CH 102	General Chemistry Laboratory	1
Select one of the following: ²		3
MA 121	Elements of Calculus	
MA 131	Calculus for Life and Management Sciences A	
MA 141	Calculus I	
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1

Hours 15

Spring Semester

BIO 183	Introductory Biology: Cellular and Molecular Biology ¹	4
Select one of the following:		4
CH 220 & CH 222	Introductory Organic Chemistry and Organic Chemistry I Lab	
CH 221 & CH 222	Organic Chemistry I and Organic Chemistry I Lab	
ENG 101	Academic Writing and Research	4
Restricted Elective (p.)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1

Hours 16

Second Year

Fall Semester

PB 250	Plant Biology ¹	4
ST 101	Statistics by Example ³	3
or ST 311 or Introduction to Statistics		
Restricted Elective (p.)		4
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3

Hours 14

Spring Semester

GN 311	Principles of Genetics	4
PB Elective (p. 3) ^{4,5}		3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		3
Restricted Elective (p.)		3
Free Elective		3

Hours 16

Third Year

Fall Semester

PB Elective (p. 3) ^{4,5}		3
PY 131	Conceptual Physics ⁶	4
or PY 211 or College Physics I		
Restricted Electives (p.)		5
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3

Hours 15

Spring Semester

Advanced Communication Elective (p. 1)		3
PB Elective 300-level or higher (p. 2) ^{4,5}		3

Applied Plant Science Elective (p.)	3
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)	3
Free Elective	3
Hours	15
Fourth Year	
Fall Semester	
Select one of the following:	3
PB 492 External Learning Experience	
PB 493 Plant Biology Supervised Undergraduate Research Experience	
PB 495 Special Topics in Plant Biology	
ALS 498 Honors Research or Teaching I	
PB Elective 300-level or higher (p. 2) ^{4,5}	3
Restricted Elective (p.)	3
Free Elective	3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	3
Hours	15
Spring Semester	
Restricted Electives (p.)	6
GEP US Diversity, Equity, and Inclusion (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-usdei/)	3
Free Electives	5
Hours	14
Total Hours	120

¹ Students Entering NC State through the Life Sciences First Year (LSFY) Program must take LSC 101 Critical and Creative Thinking in the Life Sciences

² Credit is not allowed for more than one of MA 121 Elements of Calculus, MA 131 Calculus for Life and Management Sciences A, and MA 141 Calculus I

³ Credit is not allowed for both ST 101 Statistics by Example and ST 311 Introduction to Statistics. Students interested in research are strongly encouraged to take both ST 311 Introduction to Statistics and ST 312 Introduction to Statistics II

⁴ A minimum of four Plant Biology elective courses are required and must total 12 credit hours. At least two of these courses must be at the 300-level or higher and must total 6 credit hours. A minimum GPA of 2.00 is required across all PB coursework.

⁵ At least one course PB Elective course must have a laboratory or be a laboratory or field-based course.

⁶ Students interested in pursuing graduate and professional training should take PY 211 College Physics I to meet the PY requirement followed by PY 212 College Physics II as a Restricted Elective.

universities, for research positions in major federal and state government laboratories, and in private industry. Research technician positions in many life science areas in governmental and industrial laboratories are also career possibilities. The field of plant biotechnology provides additional opportunities with several graduates seeking employment in the biotechnology industry including companies in nearby Research Triangle Park. Graduates are also well qualified for professional training in the health professions.

Career Opportunities

The undergraduate degree is an excellent pre-professional degree in the plant sciences. Graduates are employed as researchers in academic, government, or industrial labs, as field botanists and conservationists in state and natural parks, and as employees of environmental education, or public service organizations. Many majors continue with graduate studies in a plant science discipline, after which they are qualified for teaching positions in community colleges, prominent colleges and