<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Semesters Available</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Introduction to Crop Science</td>
<td>3</td>
<td>Fall</td>
<td>Open to undergraduate students or agri-cultural technology students. Principles of crop production including crop and soil management and improvement. International and sustainable agriculture. Water quality issues.</td>
</tr>
<tr>
<td>105</td>
<td>Agricultural Industries Seminar</td>
<td>3</td>
<td>Fall, 2-0</td>
<td>R: Open to agricultural technology students in the College of Agriculture and Natural Resources. Not open to students with credit in CSE 101. Use of computers in agriculture. Basic computer operating systems. Management and use of storage media. Laboratory experience in word processing, spreadsheets, databases, programming languages, networking, and software related to agriculture.</td>
</tr>
<tr>
<td>125</td>
<td>Computer Applications in Agronomy</td>
<td>3</td>
<td>Fall, 1-2</td>
<td>R: Open to undergraduate students or agricultural technology students in the College of Agriculture and Natural Resources. Preparation for academic and professional success. Preparation for opportunities in the agriculture industry.</td>
</tr>
<tr>
<td>129</td>
<td>Introduction to Sustainable Agriculture and Food Systems</td>
<td>3</td>
<td>Fall, Spring, Summer</td>
<td>2-0</td>
</tr>
<tr>
<td>178</td>
<td>Turfgrass Irrigation</td>
<td>3</td>
<td>Fall</td>
<td>P: CSS 232 Turfgrass irrigation systems. Installation and maintenance including water management. Offered first ten weeks of semester.</td>
</tr>
<tr>
<td>181</td>
<td>Pesticide and Fertilizer Application Technology</td>
<td>3</td>
<td>Spring</td>
<td>SA: CSS 061 Effective and efficient application of pesticides and fertilizers to turf and ornamentals. Pesticide handling, legal, and environmental concerns. Calibration of equipment. Offered first ten weeks of semester.</td>
</tr>
<tr>
<td>192</td>
<td>Professional Development Seminar I</td>
<td>3</td>
<td>Spring</td>
<td>R: Open to students in the Department of Plant, Soil and Microbial Sciences. Career development, critical issues analysis, resume writing, scientific presentations and public speaking in crop and soil sciences.</td>
</tr>
<tr>
<td>201</td>
<td>Forage Crops</td>
<td>3</td>
<td>Fall, 3-2</td>
<td>R: Open to undergraduate students or agricultural technology students. Turfgrass identification; soil fertilization; planting and harvesting of grasses and legumes.</td>
</tr>
<tr>
<td>202</td>
<td>World of Turf</td>
<td>3</td>
<td>Fall, Spring, Summer</td>
<td>2-0</td>
</tr>
<tr>
<td>202L</td>
<td>World of Turf Lab</td>
<td>3</td>
<td>Fall</td>
<td>1-0</td>
</tr>
<tr>
<td>203</td>
<td>Applied Turf Management</td>
<td>3</td>
<td>Fall</td>
<td>1-0</td>
</tr>
<tr>
<td>210</td>
<td>Fundamentals of Soil Science</td>
<td>3</td>
<td>Fall</td>
<td>P: CSS 101 or HRT 203 R: Open to undergraduate students or agricultural technology students. Crop production, pest scouting and other production problems, and field diagnoses. Interaction with agriculture clientele. Offered first ten weeks of semester.</td>
</tr>
<tr>
<td>215</td>
<td>Seed and Grain Quality</td>
<td>3</td>
<td>Fall</td>
<td>R: Open to undergraduate students or agricultural technology students. SA: CSS 051 Principles and practices of producing, conditioning, testing and marketing field crop seed. Grain grading and quality evaluation. Offered first ten weeks of semester.</td>
</tr>
<tr>
<td>217</td>
<td>Advanced Crop Production</td>
<td>3</td>
<td>Fall</td>
<td>P: CSS 101 RB: CSS 210 and CSS 110 R: Open to undergraduate students or agricultural technology students. Systems approach to production of field crops including corn, soybeans, small grains, sugar beets, and dry beans.</td>
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<tr>
<td>222</td>
<td>New Horizons in Biotechnology</td>
<td>3</td>
<td>Fall</td>
<td>R: Open to undergraduate students or agricultural technology students. Perspectives on biotechnology for safer food production, environmental quality, and improved human health. Impacts of biotechnology on the national economy. Political and ethical ramifications of applied biotechnology.</td>
</tr>
<tr>
<td>231</td>
<td>Turfgrass Management</td>
<td>3</td>
<td>Fall</td>
<td>4-3 P: CSS 210 or concurrently RB: CSS 110 or CSE 101 Turfgrass utilization, identification, establishment and management principles. Responses to various cultural practices.</td>
</tr>
<tr>
<td>262</td>
<td>Turfgrass Management Seminar</td>
<td>3</td>
<td>Fall</td>
<td>2-0</td>
</tr>
<tr>
<td>265</td>
<td>Golf Course Design and Construction Techniques</td>
<td>3</td>
<td>Fall</td>
<td>Spring</td>
</tr>
<tr>
<td>267</td>
<td>Performance Turf Design and Construction</td>
<td>3</td>
<td>Spring</td>
<td>Fall, Spring, Summer</td>
</tr>
<tr>
<td>269</td>
<td>Turfgrass Strategies: Integration and Synthesis</td>
<td>3</td>
<td>Spring</td>
<td>3-0</td>
</tr>
<tr>
<td>271</td>
<td>Turfgrass Soil Fertility</td>
<td>3</td>
<td>Spring</td>
<td>3-0</td>
</tr>
<tr>
<td>290</td>
<td>Independent Study in Crop and Soil Science</td>
<td>3</td>
<td>Fall, Spring</td>
<td>Summer</td>
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</tbody>
</table>
Crop and Soil Sciences—CSS

292 Management of Turfgrass Weeds
Fall. 3(2-2) P: CSS 232 RB: PLB 105
Chemical, biological, and cultural methods of managing cool- and warm-season turfgrass weeds. Environmental considerations in weed management.

294 Issues in International Agriculture
Spring. 1(1-0) P: Completion of Tier I Writing Requirement R: Open to undergraduate students or agricultural technology students. SA: CSS 494
Global issues related to food production, soil resources and sustainability of agriculture in developing and developed countries.

302 Principles of Weed Management
Fall. 3(2-2) P: CSS 101 or PLB 105 or BS 161 or HRT 203 or CSS 232 or LB 145 R: Open to undergraduate students or agricultural technology students. SA: CSS 402, CSS 156
Cultural, mechanical, biological, and chemical weed management principles and practices. Environmental considerations. Field trips required.

330 Soil Chemistry
Spring. 2(2-2) P: CSS 210 and CEM 143
Organic and inorganic soil processes including mineralization, adsorption, desorption, and precipitation. Chemistry of soil organic matter and inorganic soil components.

340 Applied Soil Physics
Spring. 2(2-2) P: CSS 210
Soil physical properties including solids, water, air, and heat. Transport processes in soil.

350 Introduction to Plant Genetics
Spring. 3(4-0) P: PLB 105 or BS 161 R: Not open to freshmen or sophomores. Fundamentals of plant genetics with applications to agriculture and natural resources.

360 Soil Biology
Fall. 3(2-2) P: CSS 210 RB: CSS 330
Overview of organismal diversity and biological soil processes. Role of macroorganisms and microorganisms in soil processing, including nutrient cycling.

382 Turfgrass Physiology
Spring. 2(3-0) Interdepartmental with Horticulture. Administered by Crop and Soil Sciences. P: (CSS 232) Completion of Tier I writing requirement. RB: PLB 105 SA: CSS 282, CSS 068, CSS 332
Physiological principles of turfgrass growth and development. Water relations, light, temperature, respiration, photosynthesis, mineral nutrition, and hormone action. Impact of mowing, cultivation, and traffic on turfgrass growth. Offered first ten weeks of semester.

424 Sustainable Agriculture and Food Systems: Integration and Synthesis
Fall. 3(3-0) Interdepartmental with Environmental Studies and Agriscience and Horticulture. Administered by Crop and Soil Sciences. P: CSS 124 RB: (CSS 101 or CSS 360 or CSS 431 or ENT 479 or HRT 203 or HRT 251 or HRT 341 or EEP 255 or EEP 260 or ESA 343) or (ESA 444 or GEO 410) R: Open to juniors or seniors or graduate students.

425 Microbial Ecology
Spring. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Microbiology and Molecular Genetics. RB: MNG 301 SA: MPH 425
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.

431 International Agricultural Systems
Spring. 3(3-0) P: ANR 250 or EEP 260 or ISS 310 or ISS 315 or ISS 318 or ISS 320 or ISS 330A or ISS 330B or ISS 330C or ISS 336 R: Not open to freshmen. World production capacity for food, fiber and biofuel as related to soil, biology and climatic resources. Principles and case studies of sustainable systems presented from developing and developed countries. Emerging issues in agricultural globalization and biodiversity.

441 Plant Breeding and Biotechnology
Spring of even years. 3(3-0) Interdepartmental with Forestry and Horticulture. Administered by Crop and Soil Sciences. P: CSS 101
Plant improvement by genetic manipulation. Genetic variation in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars. Importance of plant breeding to our food system, economy, and environment.

442 Agricultural Ecology
Fall. 3(3-0) R: Open to juniors or seniors or graduate students.
Ecological principles in the design and management of agricultural ecosystems. Integration of ecological factors regulating crop and rangeland productivity.

445 Evolution (W)
Fall. 3(3-0) Interdepartmental with Plant Biology and Zoology. Administered by Zoology. P: (ZOL 341 or CSS 350) and completion of Tier I writing requirement R: Not open to freshmen. SA: ZOL 345

451 Biotechnology Applications for Plant Breeding and Genetics
Spring. 3(2-2) Interdepartmental with Forestry and Horticulture. Administered by Crop and Soil Sciences. RB: (CSS 350 or ZOL 341) and CSS 441
Principles, concepts, and techniques of agricultural plant biotechnology. Recombinant DNA technology, plant molecular biology and transformation in relation to plant improvement.

452 Watershed Concepts
Fall, Spring. Summer. 3(3-0) Interdepartmental with Biosystems Engineering and Environmental Studies and Agriscience and Forestry and Fisheries and Wildlife. Administered by Environmental Studies and Agriscience. P: ESA 324 and ZOL 355 RB: Organic chemistry SA: RD 452
Watershed hydrology and management. The hydrologic cycle, water quality, aquatic ecosystems, and social systems. Laws and institutions for managing water resources.

455 Environmental Pollutants in Soil and Water
Spring. 3(3-0) P: CEM 143 or CEM 251 RB: CSS 210 R: Open to juniors or seniors or graduate students.
Environmental sources, physicochemical and biological processes, management of plant nutrients, heavy metals, organic contaminants, pesticides and pharmaceuticals in soil and water.

464 Statistics for Biologists
Fall. 3(3-0) Interdepartmental with Animal Science and Statistics and Probability. Administered by Statistics and Probability. RB: STT 421
Biological random variables. Estimation of population parameters. Testing hypotheses. Linear correlation and regression. Analyses of counted and measured data to compare several biological groups including contingency tables and analysis of variance.

467 BioEnergy Feedstock Production
Fall. 3(3-0) Interdepartmental with Biosystems Engineering and Forestry. Administered by Crop and Soil Sciences. P: MTH 103 or MTH 116 or MTH 124 or MTH 132 or LB 118 or MTH 152 R: CSS 101 and CSS 210
Agronomic, economic, technological, and environmental principles involved in bioenergy feedstock production. Cultivation, harvest, transportation, and storage of agricultural and forest biomass.

470 Soil Resources
Fall. 3(2-3) RB: CSS 210 R: Not open to freshmen or sophomores. Evaluation of the properties, genesis, and classification of soil resources to assist in making land-use decisions.

477 Pesticides in Pest Management
Fall of even years. 3(3-0) Interdepartmental with Entomology and Horticulture. Administered by Entomology. P: PLP 405 or CEM 350 or ENT 404 or ENT 470 RB: CEM 143 or CEM 251 R: Open to juniors or seniors or graduate students.
Chemistry, modes of action, product development and regulation of pesticides. Environmental and social aspects of pesticide use.

478 Integrated Pest Management (W)
Spring of odd years. 3(3-0) Interdepartmental with Entomology and Horticulture. Administered by Entomology. P: (ENT 404 or ENT 470 or PLP 405 or CSS 302) and completion of Tier I writing requirement
Theory, philosophy and application of pest management focusing on agricultural and natural systems.

480 Soil Fertility and Management
Fall. 3(3-0) P: CSS 101 and CSS 330 and CSS 340 and CSS 360 and (CSS 470 or concurrently)
Comprehensive management of agricultural soils. Soil fertility, including liming and fertilizer materials and other nutrient sources. Site specific soil management. Environmental impacts including soil erosion, runoff, and organic matter mineralization.
Biology in Agriculture: Applications and Ethical Issues
Fall of even years. 3(3-0) Interdepartmental with Forestry and Horticulture and Philosophy. Administered by Horticulture. P: BS 181 or PLB 155. RB: CSS 350 or ZOL 341. R: Not open to freshmen or sophomores.
Current and future roles of biotechnology in agriculture: scientific basis, applications, environmental, social, and ethical concerns.

Agricultural Cropping Systems: Integration and Problem Solving
Spring. 3(2-2) P: (CSS 101 and CSS 210) and completion of Tier I writing requirement. RB: (PLP 405 and ENT 404) and Course work in crop production and management. R: Open to seniors in the College of Agriculture and Natural Resources.
Integration and synthesis of agronomic and related concepts in agricultural cropping systems. Problem solving and application of information.

Independent Study
Fall, Spring. Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P: CSS 101 or CSS 210 R: Approval of department; application required.
Individual work on field, laboratory, or library research problem of special interest to the student.

Special Topics
Fall, Spring. Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. P: CSS 101 or CSS 210
Topics from crop production, crop physiology, turfgrass management, organic soils, turfgrass soils, soil fertility, plant and soil relationships, genetics, biotechnology, environmental science, or sustainable agriculture.

Professional Development Seminar II
Fall. 1(0-2) P: (CSS 192 or CSS 262) and (CSS 210 and completion of Tier I Writing requirement) R: Open to seniors in the Department of Plant, Soil and Microbial Sciences.
Synthesis, integration and application of agronomic principles to current issues in agronomy via discussion and oral and written communication.

Professional Internship in Crop and Soil Sciences
Fall, Spring. Summer. 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. A student may earn a maximum of 6 credits in all enrollments for any or all of these courses: ABM 493, ANR 493, ANS 493, CMP 493, CSS 493, CIP 493, ESA 493, FIM 493, FSC 493, FW 493, HRT 493, PKG 493, PLP 493 and PRR 493. P: Completion of Tier I writing requirement. R: Approval of department; application required.
Supervised professional experiences in agencies and businesses related to crop and soil sciences and environmental soil sciences.

Undergraduate Research
Fall, Spring, Summer. 3(0-9) R: Approval of department; application required.
Faculty supervised research in a selected area of crop and soil sciences or environmental soil science.

Weed Biology
Spring of even years. 2(2-0) RB: A previous course in weed science or plant biology or ecology.
Weed biology, including weed seed production and dispersal and seed fate. Weed life history traits and ecophysiology, including invasive species. Data collection in weed ecology research.

Herbicide Action and Metabolism
Spring of odd years. 2(2-0) Properties and characteristics of herbicides. Processes involved in herbicide action, transport, and fate in plants and soils.

Advanced Statistics for Biologists

Advanced Plant Breeding
Fall of even years. 3(3-0) Interdepartmental with Forestry and Horticulture. Administered by Horticulture. RB: STT 422 and ZOL 341
Genetic expectations resulting from breeding strategies with cross- and self-pollinated crop plants. Germplasm collections, mapping populations, and modifications of reproductive biology useful for crop improvement.

Plant Reproductive Biology and Polyplody
Spring of odd years. 1(3-0) Interdepartmental with Forestry and Horticulture and Plant Biology and Plant Pathology. Administered by Horticulture. RB: Introductory Genetics and Plant Biology
Genetic processes underlying variations in plant reproductive biology and polyplody. Utilization of these characteristics in plant breeding.

Crop Evolution
Spring of odd years. 1 credit. Interdepartmental with Forestry and Horticulture and Plant Biology and Plant Pathology. Administered by Horticulture. RB: Introductory Genetics and Plant Biology
Cultural and biological aspects of the evolution of domestic plants.

Historical Geography of Crop Plants
Spring of odd years. 1 credit. Interdepartmental with Forestry and Horticulture and Plant Biology and Plant Pathology. Administered by Horticulture. RB: Introductory Genetics and Plant Biology
Development and spread of the major crop species.

Soil Physics
Fall of odd years. 3(2-3) R: Open to graduate students in the College of Agriculture and Natural Resources or in the College of Engineering or in the College of Natural Science.
Physical properties of soil including texture, structure, consistency, aeration, moisture content, and temperature. Quantitative measurement of plant growth. Agronomic and engineering practices.

Population Genetics, Genealogy and Genomics
Fall. 3(3-0) Interdepartmental with Animal Science and Forestry and Fisheries and Wildlife and Genetics and Horticulture. Administered by Forestry. RB: Pre-calculus, basic genetics

Soil Chemistry
Spring. 3(3-3) R: Open to graduate students in the College of Agriculture and Natural Resources or in the College of Engineering or in the College of Natural Science.
Ion activities, ionic exchange and equilibrium reactions. Soil pH, macro- and micronutrients, saline soils and availability of nutrients to plants.

Plant Mineral Nutrition
Fall of odd years. 3(3-0) Interdepartmental with Horticulture. Administered by Horticulture. RB: PLB 301

Plant Molecular and Omic Biology
Spring. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Plant Biology. Administered by Plant Biology. RB: ZOL 341 SA: BOT 856
Recent advances in genetics and molecular biology of higher plants.

Environmental Fate of Organic Contaminants in Soils
Spring. 3(3-0) RB: Undergraduate level coursework in general and organic chemistry, and introductory microbiology.
Chemistry and biology of toxicants in soils as determinants of environmental fate.

Scientific Communication and Professional Development
Spring. 1(0-2)
Interactive professional experiences including grant proposal preparation and presentation, scientific presentations, mock position interviews, and resume preparation.

Independent Study
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Open to graduate students in the College of Agriculture and Natural Resources or in the College of Engineering or in the College of Natural Science.
Individual study on field, laboratory, or library research.

Current Topics in Ecology and Evolution
Summer. 1 to 2 credits. A student may earn a maximum of 10 credits in all enrollments for this course. Interdepartmental with Plant Biology and Zoology. Administered by Zoology.
Presentation and critical evaluation of theoretical and empirical developments in ecology and evolutionary biology by visiting scientists.
891B  Selected Topics in Plant Breeding and Genetics
Fall, Spring, Summer. 1 to 2 credits. A student may earn a maximum of 6 credits in all enrollments for this course. Interdepartmental with Forestry and Horticulture. Administered by Horticulture. R: Open only to graduate students in the Plant Breeding and Genetics major or Genetics major. Approval of department.
Selected topics in plant breeding.

892  Plant Breeding and Genetics Seminar
Fall, Spring, Summer. 1(1-0) A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Forestry and Horticulture. Administered by Horticulture.
Experience in review, organization, oral presentation, and analysis of research.

892B  Ecological Food and Farming Systems Seminar
Fall, Spring. 1 credit. Interdepartmental with Community, Agriculture, Recreation and Resource Studies. Administered by Crop and Soil Sciences.
Experiential learning, and multidisciplinary and applied research, in ecological food and farming systems.

893  Selected Topics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to graduate students in the College of Agriculture and Natural Resources or in the College of Engineering or in the College of Natural Science.
Selected topics in crop and soil sciences of current interest and importance.

899  Master's Thesis Research
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open to masters students in the Department of Plant, Soil and Microbial Sciences.
Master’s thesis research.

921  Geostatistics
Fall of odd years. 3(3-0) RB: Statistical methods or approval of department. Working knowledge of SAS software. Spatial variability analysis. Variogram models. Kriging and cokriging. Field experiments with spatial trends. Longitudinal data. Modeling in the presence of spatial and temporal correlations.

941  Quantitative Genetics in Plant Breeding
Spring of even years. 3(2-2) Interdepartmental with Forestry and Horticulture. Administered by Crop and Soil Sciences. RB: CSS 819 and STT 464
Theoretical and genetic basis of statistical analysis of quantitative traits using genetic markers. Computational tools for the study of quantitative traits.

999  Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open to doctoral students in the Department of Plant, Soil and Microbial Sciences.
Doctoral dissertation research.