<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
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<tbody>
<tr>
<td>105</td>
<td>Agricultural Industries Seminar</td>
<td>Preparing students to succeed academically and professionally and introducing them to opportunities in the agriculture industry.</td>
</tr>
<tr>
<td>110</td>
<td>Computer Applications in Agronomy</td>
<td>Use of computers in agriculture. Basic computer operating systems. Management and use of storage media. Laboratory experience in word processing, spreadsheets, data bases, programming languages, networking, and software related to agriculture.</td>
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<tr>
<td>112</td>
<td>Agricultural Industry Issues</td>
<td>Issues facing the agricultural industry. Role of government in addressing these issues.</td>
</tr>
<tr>
<td>124</td>
<td>Introduction to Sustainable Agriculture and Food Systems</td>
<td>Impact of agricultural and social sciences on our food system. Contemporary research and movements involving agricultural and food system sustainability.</td>
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<tr>
<td>135</td>
<td>Crop Scouting and Investigation</td>
<td>Crop scouting, pest scouting and other production problems, and field diagnoses. Interaction with agriculture clientele. Offered first ten weeks of semester.</td>
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<tr>
<td>151</td>
<td>Seed and Grain Quality</td>
<td>Principles and practices of producing, conditioning, testing and marketing field crop seed. Grain grading and quality evaluation. Offered first ten weeks of semester.</td>
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<tr>
<td>171</td>
<td>Operations Budgeting for Golf Course Managers</td>
<td>Golf course irrigation operations. Offered first ten weeks of semester.</td>
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<tr>
<td>178</td>
<td>Turfgrass Irrigation</td>
<td>Turfgrass irrigation systems. Installation and maintenance including water management. Offered first ten weeks of semester.</td>
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<tr>
<td>192</td>
<td>Professional Development Seminar I</td>
<td>Principles and practices of producing, conditioning, soil fertilization. Planting and harvesting of grasses and legumes. Offered first ten weeks of semester.</td>
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<tr>
<td>202</td>
<td>The World of Turf</td>
<td>Role of turf in society and the environment. Principles underlying establishment and maintenance of turf on athletic fields, parks, home lawns, and golf courses. Aesthetic, safety, and economic aspects of turfgrass management practices. Offered first ten weeks of semester.</td>
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<tr>
<td>203</td>
<td>Applied Turf Management</td>
<td>Principles and practices for establishing and maintaining turf in residential and commercial lawns. Field trips required. Offered first ten weeks of semester.</td>
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<tr>
<td>212</td>
<td>Advanced Crop Production</td>
<td>Systems approach to production of field crops including corn, soybeans, small grains, sugar beets, and dry beans. Offered first ten weeks of semester.</td>
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<tr>
<td>222</td>
<td>Turfgrass Management</td>
<td>Turfgrass utilization, identification, establishment and management principles. Responses to various cultural practices. Offered first ten weeks of semester.</td>
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<tr>
<td>267</td>
<td>Performance Turf Design and Construction</td>
<td>Performance turf design, construction, renovation and establishment principles. Offered first ten weeks of semester.</td>
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<tr>
<td>272</td>
<td>Turfgrass Fertility</td>
<td>Issues in turfgrass management including employee relations, cultural, and environmental problems. Offered first ten weeks of semester.</td>
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<tr>
<td>290</td>
<td>Independent Study in Crop and Soil Science</td>
<td>A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to students in the Institute of Agricultural Technology. SA: CSS 057 Not open to students with credit in CSS 232. Offered first ten weeks of semester.</td>
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<tr>
<td>302</td>
<td>Management of Turfgrass Weeds</td>
<td>Turfgrass management principles and practices. Responses to various cultural practices. Offered first ten weeks of semester.</td>
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<tr>
<td>302</td>
<td>Principles of Weed Management</td>
<td>Cultural, mechanical, biological, and chemical weed management principles and practices. Offered first ten weeks of semester.</td>
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<tr>
<td>330</td>
<td>Soil Chemistry</td>
<td>Organic and inorganic soil processes including mineralogy, adsorption, desorption, and precipitation. Chemistry of soil organic matter and inorganic soil components. Offered first ten weeks of semester.</td>
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<tr>
<td>340</td>
<td>Applied Soil Physics</td>
<td>Soil physical properties including solids, water, air, and heat. Transport processes in soil. Offered first ten weeks of semester.</td>
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Crop and Soil Sciences—CSS

350 Introduction to Plant Genetics
Spring. 3(4-0) Interdepartmental with . Administered by Crop and Soil Sciences. P: BOT 105 or BS 111 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 Not open to students with credit in 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. Biogeochemical and socio-economic aspects of food, fiber, and fuel production. Environmental impacts and social context. Experiential learning projects.

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

426 Biogeochemistry
Summer. 3 credits. Interdepartmental with Geological Sciences and Microbiology and Molecular Genetics and Zoology. Administered by Microbiology and Molecular Genetics. RB: (BS 110 or LBS 144 or LBS 148H or BS 111 or LBS 145 or LBS 149H) and (CEM 143 or CEM 251) SA: MPM 426 Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Societal applications of research in aquatic and terrestrial habitats.

431 International Agricultural Systems
Spring. 3(3-0) P: ANR 250 or EEP 260 or ISS 310 or ISS 315 or ISS 316 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 variability 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)
Spring. 3(3-0) Interdepartmental with Plant Biology and Zoology. Administered by Zoology. P: (ZOL 341 or CSS 340) and completion of Tier I writing requirement R: Not open to freshmen. SA: ZOL 345 Processes of evolutionary change in animals, plants. Microbes. Population genetics, microevolution, speciation, adaptive radiation, macroevolution. Origin of Homo sapiens.

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. 3(3-0) Interdepartmental with Biosystems Engineering and Environmental Studies and Agriscience and Fisheries and Wildlife and Horticulture. 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 Pollutants in the Soil Environment
Fall. 3(3-0) P: (CEM 143) and completion of Tier I writing requirement. R: Open only to sophomores or graduate students. Chemical and biological reactions of organic and inorganic pollutants in soils.

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 RB: CSS 101 and CSS 210 Agroecological, 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 Pest Management I: Pesticides in Management Systems
Fall of even years. 3(3-0) Interdepartmental with Entomology and Fisheries and Wildlife and Horticulture. Administered by Entomology. RB: (CEM 143 or CEM 251) and (PLP 405 and CSS 402) and (ENT 404 or ENT 470) R: Open to juniors or seniors or graduate students. Chemistry, modes of action, and environmental fate of pesticides. Product development and regulation. Social aspects of pesticide use.

478 Pest Management II: Biological Components of Management Systems (W)
Spring of even years. 3(2-3) Interdepartmental with Entomology and Forestry and Fisheries and Wildlife and Horticulture. Administered by Entomology. P: (ENT 404 or ENT 470 or PLP 405 or CSS 402) and completion of Tier I writing requirement. Principles of host plant resistance and biological control and their relationship to the design of agroecosystems. Classification of insect biological control agents.

480 Soil Fertility and Management
Fall. 3(3-0) P: 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.

486 Biotechnology in Agriculture: Applications and Ethical Issues
Fall of even years. 3(3-0) Interdepartmental with Forestry and Horticulture and Philosphy. Administered by Horticulture. P: BOT 105 or BS 111 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.

488 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: (CSS 310 and CSS 430 and PLP 405 and ENT 404) and Course work in crop production and management. R: Open only 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.
490 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.

491 Special Topics
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

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.

492 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 only to seniors in the Department of Crop and Soil Sciences. Synthesis, integration, and application of agronomic principles to current issues in agronomy via discussion and oral and written communication.

493 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, AEE 493, ANR 493, ANS 493, CMP 493, CSS 493, EEP 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.

499 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.

802 Weed Biology
Spring of even years. 2(2-0) R: 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 ecophyiology, including invasive species. Data collection in weed ecology research.

805 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.

814 Advanced Statistics for Biologists


819 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.

820 Plant Reproductive Biology and Polyploidy
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 polyploidy. Utilization of these characteristics in plant breeding.

821 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.

822 Historical Geography of Crop Plants
Spring of even years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. R: Open only to graduate students in the Department of Crop and Soil Sciences or Department of Geological Sciences or Department of Geography.

Mineral structures. X-ray diffraction, pedogenic processes, and mineral transformations and stability.

823 Confocal Microscopy
Fall, Spring. 2(2-2) Interdepartmental with Natural Science. Administered by Natural Science


840 Soil Physics
Fall of odd years. 3(2-3) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or 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.

842 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


850 Soil Chemistry
Spring. 3(3-0) R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science.

Ion activities, ionic exchange and equilibrium reactions. Soil pH, macro- and micronutrients, saline soils and availability of nutrients to plants.

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


856 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.

863 Mineral-Water Interactions
Fall of even years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences. R: Open only to graduate students in the Department of Crop and Soil Sciences or Department of Geological Sciences or Department of Geography.

Mineralogy, petrology and geochemistry of fluid-rock reactions in geologic, sedimentary and geochemical cycles. Rock and mineral weathering, soil formation, genesis and burial diagenesis of sediments and sedimentary rocks, and metamorphism.

865 Environmental Fate of Organic Contaminants in Soils
Spring of even years. 3(3-0) R: Undergraduate level coursework in general and organic chemistry, and introductory microbiology.

Chemistry and biology of toxicaants in soils as determinants of environmental fate.

880 Scientific Communication and Professional Development
Spring. 1(0-2)

Interactive professional experiences including grant proposal preparation, scientific presentations, mock position interviews, and resume preparation.

890 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 only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science. Individual study on field, laboratory, or library research.

891 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 only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or 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 only to master's students in the Department of Crop and Soil 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.

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 484
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 only to doctoral students in the Department of Crop and Soil Sciences.
Doctoral dissertation research.