<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSS 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>CSS 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, spread sheets, data bases, programming languages, networking, and software related to agriculture.</td>
</tr>
<tr>
<td>CSS 120</td>
<td>Agricultural Industry Issues</td>
<td>Issues facing the agricultural industry. Role of government in addressing these issues.</td>
</tr>
<tr>
<td>CSS 135</td>
<td>Crop Scouting and Investigation</td>
<td>Crop production, pest scouting and other production problems, and field diagnoses. Interaction with agriculture clientele.</td>
</tr>
<tr>
<td>CSS 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.</td>
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<tr>
<td>CSS 171</td>
<td>Operations Budgeting for Golf Course Managers</td>
<td>Crop production, pest scouting and other production problems, and field diagnoses. Interaction with agriculture clientele.</td>
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<tr>
<td>CSS 178</td>
<td>Golf Turf Irrigation</td>
<td>Golf course irrigation systems: installation and maintenance including water management.</td>
</tr>
<tr>
<td>CSS 181</td>
<td>Pesticide and Fertilizer Application Technology</td>
<td>Effective and efficient application of pesticides and fertilizers to turf and ornamentals. Pesticide handling, legal, and environmental concerns. Calibration of equipment.</td>
</tr>
<tr>
<td>CSS 192</td>
<td>Professional Development Seminar I</td>
<td>Career development, critical issues analysis, resume writing, scientific presentations and public speaking in crop and soil sciences.</td>
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<tr>
<td>CSS 221</td>
<td>Turfgrass and the Environment</td>
<td>Pesticide and nutrient fate, site assessment, fuel use, equipment washing systems and criteria for recognizing sensitive sites. Conservation and best management practices to maximize protection of natural resources.</td>
</tr>
<tr>
<td>CSS 222</td>
<td>Advanced Crop Production</td>
<td>Systems approach to production of field crops including corn, soybeans, small grains, sugar beets, and dry beans.</td>
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<tr>
<td>CSS 240</td>
<td>BioEnergy Crop Production</td>
<td>Agronomic, economic, and environmental impacts of bioenergy crop production. Integration of bioenergy crops into existing production systems.</td>
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<tr>
<td>CSS 232</td>
<td>Introduction to Turfgrass Management</td>
<td>Turfgrass utilization, identification, establishment and management principles. Responses to various cultural practices.</td>
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<tr>
<td>CSS 242</td>
<td>Athletic Field Maintenance and Construction</td>
<td>Maintenance, renovation, and construction of athletic fields with emphasis on baseball and football. Soil testing, cultivar selection, and surveying. Safety and liability concerns.</td>
</tr>
<tr>
<td>CSS 251</td>
<td>Organic Farming Principles and Practices</td>
<td>Organic matter management, the soil food web, and nutrient availability. Biodiversity, crop rotations, plant competition, ground cover, and plant health. Integrating crops and animals. Organic animal husbandry.</td>
</tr>
<tr>
<td>CSS 264</td>
<td>Golf Course Design and Construction Techniques</td>
<td>Concepts and theory of golf course design and construction including location, space, topography, clientele, and environmental concerns.</td>
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<tr>
<td>CSS 269</td>
<td>Turfgrass Strategies</td>
<td>Issues in turfgrass management including employee relations, construction, and environmental problems.</td>
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<tr>
<td>CSS 272</td>
<td>Turfgrass Soil Management</td>
<td>Impact of fertilizer programs on turfgrasses and the environment. Irrigation, drainage, cultivation, top dressing, amendments and pH control of turfgrass soils.</td>
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<tr>
<td>CSS 290</td>
<td>Independent Study in Crop and Soil Science</td>
<td>Field, laboratory, or library research projects.</td>
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<tr>
<td>CSS 302</td>
<td>Principles of Weed Management</td>
<td>Cultural, mechanical, biological, and chemical weed management principles and practices. Environmental considerations.</td>
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<tr>
<td>CSS 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.</td>
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<tr>
<td>CSS 340</td>
<td>Applied Soil Physics</td>
<td>Soil physical properties including solids, water, air, and heat. Transport processes in soil.</td>
</tr>
<tr>
<td>CSS 350</td>
<td>Introduction to Plant Genetics</td>
<td>Fundamentals of plant genetics with applications to agriculture and natural resources.</td>
</tr>
<tr>
<td>CSS 360</td>
<td>Soil Biology</td>
<td>Overview of organismal diversity and biological soil processes. Role of macroorganisms and microorganisms in soil processing, including nutrient cycling.</td>
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Crop and Soil Sciences—CSS

362 Management of Turfgrass Pests
Fall. 4(3-2) Interdepartmental with Entomology and Plant Pathology. Administered by Crop and Soil Sciences. P: CSS 232
Chemical, biological, and cultural methods of managing weeds, diseases, and insect pests of turfgrass. Environmental considerations in pest management.

380 Crop Physiology
Spring of even years. 3(2-3) P: CSS 101 and (BOT 105 or BOT 301)
Physiological and metabolic function of plants from a whole plant viewpoint. Environmental effects on crop growth, development, and yield.

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.

404 Forest and Agricultural Ecology Laboratory
Fall. 3(0-3) Interdepartmental with Forestry. Administered by Forestry. P: CSS 210 and (BOT 105 or BS 110) RB: ZOL 355
Ecological interactions crucial to the sustainable management of crop and forest ecosystems. Plant resources, competition, community development and dynamics, biodiversity, primary productivity, nutrient cycling, ecosystem structure and function, and impacts of global environmental change.

404L Forest and Agricultural Ecology Laboratory
Fall. 1(0-3) Interdepartmental with Forestry. Administered by Forestry. P: CSS 210 and (BOT 105 or BS 110) and (FOR 404 or concurrently) RB: ZOL 355
Field studies and data analysis of ecological processes central to the sustainable management of forest and agricultural resources. Field exercises cover primary production, community structure, soil resources, biodiversity, succession, nutrient cycling, critiques of primary literature. Two weekend field trips required.

406 Seed Production and Technology
Fall of even years. 3(2-2) P: CSS 101 and CSS 350 R: Not open to freshmen or sophomores.
Principles and practices of field seed production. Crop improvement, variety release, seed production, seed technology and evaluation involved in producing high quality field crop seed.

425 Microbial Ecology
Spring. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Microbiology and Molecular Genetics. RB: MMG 301 SA: MPP 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 LAB 144 or CBS 194B or BS 111 or CBS 145 or CBS 149H) and (CEM 143 or CEM 251) SA: MPH 426
Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Societal applications of research in aquatic and terrestrial habitats.

431 Soil and Plant Resources for Sustained World Food and Fiber Production
Spring of odd years. 3(3-0) P: CSS 101 and CSS 210
World food and fiber production capacities related to soil and climatic resources. Management and utilization of genetic resources for sustained production of human foods and animal feeds.

440 Soil Biophysics
Fall of even years. 3(2-2) P: CSS 210 R: Not open to freshmen or sophomores.
Plant growth properties and soil physical conditions which influence productivity. Principles and applications of soil texture, structure, mechanical impedance, aeration and water. Root responses to the environment.

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.

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 Applications and Forestry and Fisheries and Wildlife. Administered by Environmental Studies and Applications. 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 seniors 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.

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
Spring of odd 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 graduates.

478 Pest Management II: Biological Components of Management Systems (W)
Spring of even years. 3(2-3) Interdepartmental with Entomology and Horticulture and Fisheries and Wildlife and Horticulture. Administered by Entomology. RB: (CEM 143 or CEM 251) and (PLP 405 and 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 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.

486 Biotechnology in Agriculture: Applications and Ethical Issues
Fall of even years. 3(3-0) Interdepartmental with Forestry and Horticulture and Philosophy. 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.
802 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.

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 Crop and Soil Sciences. R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science.
Mineral structures. X-ray diffraction, pedogenic processes, and mineral transformations and stability.

825 Clay Mineralogy and Soils Genesis
Spring of even years. 3(3-0) Interdepartmental with Geological Sciences. Administered by Crop and Soil Sciences. R: Open only to graduate students in the College of Agriculture and Natural Resources or College of Engineering or College of Natural Science.
Preparation of chromosomes from commercially important plants for cytogenetic analysis.

837 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.

841 Soil Microbiology
Spring of even years. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Microbiology and Molecular Genetics. RB: MMG 425 SA: MPH 841
Ecology, physiology, and biochemistry of microorganisms indigenous to soil.

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(3-3) 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, macronutrients, micronutrients, gaseous solubility 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: BOT 301

856 Plant Molecular 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) RB: Undergraduate level coursework in general and organic chemistry, and introductory microbiology.
Chemistry and biology of toxicants in soils as determinants of environmental fate.
870 Techniques of Analyzing Unbalanced Research Data
Spring. 4(4-0) Interdepartmental with Animal Science and Forestry and Fisheries and Wildlife and Horticulture. Administered by Animal Science. RB: STT 464 R: Open only to graduate students in the College of Agriculture and Natural Resources. SA: ANS 943
Linear model techniques to analyze biological research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Prediction of breeding values and estimation of population parameters from variance and covariance components.

880 Scientific Communication and Professional Development
Spring. 1(0-2)
Interactive professional experiences including grant preproposal preparation and presentation, 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 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. 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. 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.

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 Contemporary Statistical Models in Biology
Fall of odd years. 3(3-0) RB: (STT 465) or approval of department. Working knowledge of SAS software. Estimating functions. Growth models, generalized linear models, linear and non-linear mixed models. 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 only to doctoral students in the Department of Crop and Soil Sciences. Doctoral dissertation research.