

**901. Seminar in Contemporary Criminal Justice Theory**  
Fall. 3(3-0)

R: Open only to graduate students in Criminal Justice or in Social Science-Criminal Justice. Theoretical perspectives and issues in criminal justice and criminology  
QA: C J 990

**902. Seminar in Criminal Justice Systems**  
Spring of odd-numbered years. 3(3-0)

R: Open only to graduate students in Criminal Justice or in Social Science-Criminal Justice. Contemporary issues in the criminal justice system.  
QA: C J 990

**903. Research Utilization in Criminal Justice**  
Spring of even-numbered years. 3(3-0)

R: Open only to graduate students in Criminal Justice or in Social Science-Criminal Justice. Research application in criminal justice theory and practice.  
QA: C J 992

**310. Soil Management and Environmental Impact**  
Spring. 3(2-3)

P: CSS 210.  
Management of soil physical and chemical properties for the production of food and fiber. Soil management systems that reduce the environmental impact on soil, water and air resources and maximize crop production potential.  
QP: CSS 210 QA: CSS 390

**332. Advanced Turf Management**  
Spring. 3(3-0)

P: CSS 232.  
Effect of light, heat, cold, drought, and traffic on turfgrass growth and development. Impact of practices such as mowing, cultivation, and compaction on the growth of grasses.  
QP: CSS 318 QA: CSS 416

**342. Turfgrass Soil Management**  
Fall. 3(3-0)

P: CSS 210.  
Fertility and pH control of turf soils. Drainage, irrigation programming, cultivation, topdressing, and soil amendments. Environmental impacts. Specialized soils.  
QP: CSS 318 QA: CSS 414

**350. Introduction to Plant Genetics**  
Spring. 3(4-0)

P: BOT 105 or BS 111. R: Not open to freshmen and sophomores.  
Fundamentals of plant genetics with applications to agriculture and natural resources.  
Temporary approval effective from Spring Semester 1993 through Spring Semester 1995.  
QP: BOT 205, BS 211 QA: CSS 350

**362. Management of Turfgrass Pests**  
Fall. 4(3-2) Interdepartmental with Botany and Plant Pathology, and Entomology.

P: CSS 232.  
Chemical, biological, and cultural methods of managing weeds, diseases, and insect pests of turfgrass. Environmental considerations in pest management.  
QP: CSS 318 QA: CSS 419

**370. Agricultural Cropping Systems Management**  
Fall. 3(2-3)

P: CSS 101 or CSS 210; MTH 110 or MTH 116. R: Not open to freshmen and sophomores.  
Interdisciplinary decision making to select crop and production systems based upon soil productivity, climatic adaptation, environmental impacts, and economic constraints.  
QP: CSS 101 or CSS 210, MTH 108

**380. Crop Physiology**  
Spring of odd-numbered years. 3(2-3)

P: CSS 101; BOT 105 or BOT 301. R: Not open to freshmen and sophomores.  
Physiological and metabolic function of plants from a whole plant viewpoint. Environmental effects on crop growth, development, and yield.  
QP: CSS 101, BOT 301 QA: CSS 380

**402. Principles of Weed Science**  
Fall. 3(2-2)

P: BOT 105, CEM 143. R: Not open to freshmen and sophomores.  
Weed biology and ecology. Cultural, mechanical, biological, and chemical control practices. Herbicide action, selectivity in plants, and effects on environment.  
QP: CEM 143, BOT 301 QA: CSS 402

**406. Seed Production and Technology**  
Fall of even-numbered years. 3(2-2)

P: CSS 101, CSS 350. R: Not open to freshmen and 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.  
QP: CSS 101, CSS 350 QA: CSS 406, CSS 485

**430. Soil Fertility and Chemistry**  
Spring. 3(2-2)

P: CSS 210. R: Not open to freshmen and sophomores.  
Application of chemistry to diagnosing and improving soil fertility. Soil amendments including macro- and micro-nutrients. Reducing environmental degradation.  
QP: CSS 210 QA: CSS 430

**440. Soil Biophysics**  
Fall of even-numbered years. 3(2-2)

P: CSS 210. R: Not open to freshmen and 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.  
QP: CSS 210 QA: CSS 440

**441. Plant Breeding and Biotechnology**  
Spring. 4(3-2) Interdepartmental with Horticulture and Forestry.

P: CSS 350.  
Plant improvement by genetic manipulation. Genetic variability in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars.  
QP: CSS 350 QA: CSS 408

**451. Cellular and Molecular Principles and Techniques for Plant Sciences**  
Spring. 4(2-6) Interdepartmental with Forestry and Horticulture.

P: CSS 350 or ZOL 341.  
Principles, concepts, and techniques of agricultural plant biotechnology. Recombinant DNA technology, plant molecular biology, transformation, cell tissue, and organ culture in relation to plant improvement.  
QP: CSS 350 or ZOL 441 QA: CSS 451, HRT 838

**455. Pollutants in the Soil Environment**  
Fall. 3(3-0)

P: CEM 143. R: Open only to seniors and graduate students.  
Chemical and biological reactions of organic and inorganic pollutants in soils.  
QP: CEM 143 QA: CSS 455

**470. Soil Resources**  
Fall. 3(2-3)

P: CSS 210. R: Not open to freshmen and sophomores.  
Evaluation of the properties, genesis, and classification of soil resources to assist in making land-use decisions. Field trips required.  
QP: CSS 210 QA: CSS 470

**490. Independent Study**

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. R: Approval of department; application required.  
Individual work on field, laboratory, or library research problem of special interest to the student.  
QP: CSS 101 or CSS 210 QA: CSS 411

**491. 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.  
QP: CSS 101 or CSS 210 QA: CSS 412

**492. Seminar**

Fall. 1(1-0)  
P: CSS 210; CSS 342 or CSS 370.  
Synthesis, integration and application of agronomic principles to current issues in agronomy via discussion and oral and written communication.  
QP: CSS 210, CSS 370 or CSS 342 QA: CSS 420

**801. Physiological Crop Ecology**

Fall of even-numbered years. 2(2-0)  
Environmental factors that limit crop distribution and productivity. Physiological basis for stress injury, resistance to temperature extremes, flooding, drought, and salinity.  
QA: CSS 801

**CROP AND SOIL SCIENCES**

**CSS**

**Department of Crop and Soil Sciences**  
**College of Agriculture and Natural Resources**

**101. Introduction to Crop Science**  
Fall. 3(2-2)

Principles of crop management, improvement, and fertilization. International and sustainable agriculture. Water quality issues.  
QA: CSS 101

**110. Computer Applications in Agronomy**  
Fall. 2(1-2)

R: Open only to College of Agriculture and Natural Resources students. Not open to students with credit in CPS 100.  
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.

**201. Forage Crops**  
Fall. 3(2-2)

Forage crop production, management, and utilization. Crop identification. Soil fertilization. Planting and harvesting of grasses and legumes.  
QA: CSS 301

**210. Fundamentals of Soil and Landscape Science**

Fall. 3(2-3) Interdepartmental with Forestry.  
P: CEM 141.  
Agricultural and natural resource ecosystems: soil, vegetation and ground water components. Energy, water and nutrient cycles. Soil classification and mapping. Land management and use issues.  
QA: CSS 210

**232. Introduction to Turfgrass Management**  
Fall. 3(2-2)

P: CSS 110; CSS 210 or concurrently.  
Turfgrass utilization, identification, establishment and management principles. Responses to various cultural practices.  
QP: CSS 210 QA: CSS 318

**262. Turfgrass Management Seminar**  
Fall. 1(2-0)

P: CSS 232 or concurrently.  
Presentations by individuals involved in turfgrass and golf course management. Topics include golf course construction and operations, preparation for tournaments, and public relations.  
QP: CSS 318 QA: CSS 417

**Descriptions—Crop and Soil Sciences  
of  
Courses**

**805. Herbicide Action and Metabolism**  
*Spring of even-numbered years. 2(2-0)*  
Properties and characteristics of herbicides. Processes involved in herbicide action, transport, and fate in plants and soils.  
QA: CSS 805

**823. Methods in Genetic Engineering of Plants**  
*Fall of even-numbered years. 4(0-8) Interdepartmental with Horticulture and Forestry.*  
Bacterial transformation. Plant transformation via Ti-plasmid, protoplast/PEG, and electroporation methods. Detection of foreign gene integration and expression.

**825. Clay Mineralogy and Soils Genesis**  
*Spring of odd-numbered years. 4(3-2) Interdepartmental with Geological Sciences.*  
R: Open only to graduate students in College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.  
Mineral structures. X-ray diffraction, pedogenic processes, and mineral transformations and stability.  
QP: CSS 850, CSS 840, CSS 470 QA: CSS 825, CSS 870

**827. Techniques in Cytogenetics**  
*Fall of odd-numbered years. 1(0-3) Interdepartmental with Horticulture and Forestry.*  
Preparation of chromosomes from commercially important plants for cytogenetic analysis.

**831. Soil and Plant Resources for Sustained World Food Production**  
*Spring of even-numbered years. 3(3-0)*  
World food production capacities related to soil and climatic resources. Management and utilization of genetic resources for sustained production of human foods and animal feeds.  
QA: CSS 831, CSS 480

**840. Soil Physics**  
*Fall of even-numbered years. 3(2-3)*  
R: Open only to graduate students in College of Agriculture and Natural Resources, 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.  
QA: CSS 840

**850. Soil Chemistry**  
*Spring. 3(3-3)*  
R: Open only to graduate students in College of Agriculture and Natural Resources, 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.  
QP: CEM 383 QA: CSS 850

**853. Plant Mineral Nutrition**  
*Fall of odd-numbered years. 3(3-0) Interdepartmental with Horticulture.*  
P: BOT 301.  
Inorganic ion transport in plant cells and tissues. Physiological responses and adaptation to problem soils. Genetic diversity in nutrient uptake and use by plants. Physiological roles of elemental nutrients in crop growth.  
QP: BOT 301 QA: CSS 853

**855. Interfacial Environmental Chemistry**  
*Fall of even-numbered years. 4(4-0)*  
R: Open only to graduate students in College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.  
Principles and mechanisms of reactions at solid-liquid interfaces emphasizing environmental chemistry. Sorption of ionic and organic compounds. Properties of colloids. Kinetics of surface reactions.  
QA: CSS 812

**865. Organic Chemistry of Soils**  
*Spring of even-numbered years. 2(2-0)*  
Chemistry of natural and anthropogenic organic substances in soils.  
QA: CSS 865

**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 College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.  
Individual study on field, laboratory, or library research.  
QA: CSS 811

**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 College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.  
Selected topics in crop and soil sciences of current interest and importance.  
QA: CSS 812

**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 Crop and Soil Sciences.  
QA: CSS 899

**940. Advanced Soil Physics**  
*Fall of odd-numbered years. 2(2-0)*  
P: CSS 840. R: Open only to graduate students in College of Agriculture and Natural Resources, College of Engineering, or College of Natural Science.  
Modelling major physical transport mechanisms in the soil profile. Aeration, temperature and solute movement. Water movement and evaporation.  
QP: CSS 840 QA: CSS 812

**941. Quantitative Genetics in Plant Breeding**  
*Spring of odd-numbered years. 3(3-0) Interdepartmental with Forestry and Horticulture.*  
P: CSS 450, STT 422.  
Theoretical genetic basis of plant breeding with emphasis on traits exhibiting continuous variation. Classical and contemporary approaches to the study and manipulation of quantitative trait loci.  
QA: CSS 941

**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 Crop and Soil Sciences.  
QA: CSS 999

**EARTH SCIENCE ES**

**Department of Geological Sciences  
College of Natural Science**

**445. Field Studies in Earth Science**  
*Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.*  
R: Approval of department.  
Field experience and techniques in geological sciences, meteorology, soil science, or oceanology.  
QA: ES 445

**446. Laboratory Investigations in Earth Science**  
*Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.*  
P: ES 445 or concurrently. R: Approval of department.  
Laboratory techniques and investigations in geological sciences, meteorology, soil science, or oceanology.  
QP: ES 445 QA: ES 446

**800. Special Problems in Earth Science**  
*Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 12 credits in all enrollments for this course.*  
R: Approval of department.  
Individual faculty directed study on topics in earth science.  
QA: ES 800

**ECONOMICS EC**

**Department of Economics  
The Eli Broad College of Business  
and The Eli Broad Graduate  
School of Management**

**201. Introduction to Microeconomics**  
*Fall, Spring, Summer. 3(3-0)*  
R: Not open to students with credit in EC 251H.  
Economic institutions, reasoning and analysis. Consumption, production, determination of price and quantity in different markets. Income distribution, market structure and normative analysis.  
QA: EC 201

**202. Introduction to Macroeconomics**  
*Fall, Spring, Summer. 3(3-0)*  
R: Not open to students with credit in EC 252H.  
Determinants of Gross National Product, unemployment, inflation and economic growth. National income accounting and fiscal policy. Aggregate demand, supply management and monetary policy.  
QA: EC 202

**251H. Microeconomics and Public Policy**  
*Fall, Spring. 4(4-0)*  
R: Open only to Honors College students. Not open to students with credit in EC 301.  
Theories of consumer behavior, production and cost. Output and price determination in competition and monopolies. Welfare economics, general equilibrium, externalities, and public goods.  
QA: EC 251H, EC 324

**252H. Macroeconomics and Public Policy**  
*Fall, Spring. 3(3-0)*  
P: EC 251H; or EC 201, EC 301. R: Open only to Honors College students. Not open to students with credit in EC 302.  
Theory of national income, unemployment, inflation and economic growth and its application to economic analysis and policy.  
QA: EC 252H or EC 326

**301. Intermediate Microeconomics**  
*Fall, Spring, Summer. 3(3-0)*  
P: EC 201, EC 202. Not open to students with credit in EC 251H.  
Theories of consumer choice, production, cost, perfect competition, and monopoly. Welfare economics, general equilibrium, externalities and public goods.  
QP: EC 201, EC 202 QA: EC 324

**302. Intermediate Macroeconomics**  
*Fall, Spring, Summer. 3(3-0)*  
P: EC 201, EC 202. R: Not open to students with credit in EC 252H.  
National income accounting. Determination of aggregate output, employment, price level, and inflation rate. Policy implications.  
QP: EC 201, EC 202 QA: EC 326

**306. Comparative Economic Systems**  
*Fall. 3(3-0)*  
P: EC 201 or EC 251H; EC 202 or EC 252H.  
Characteristics and functions of economic systems. Alternative patterns of economic control, planning, and market structure. Theories, philosophies, and experiences associated with capitalism, socialism, and mixed economies.  
QP: EC 201 or EC 251H, EC 202 or EC 252H QA: EC 434