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.

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.

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.

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.

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.

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.

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.

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.

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 1996.

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.

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.

380. Crop Physiology
Spring of even-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.

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.

404. Forest and Agricultural Ecology
Fall. 4(3-3) Interdepartmental with Forestry. Administered by Forestry.
P: CSS 210, BOT 105.
Structure and function of ecosystems managed for crop and wood production. Productivity, nutrient cycling, community dynamics as affected by management intensity and natural disturbance. Dynamics of managed versus natural ecosystems.

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.

409. Forest Hydrology
Spring of odd-numbered years. 3(2-3) Interdepartmental with Forestry and Resource Development. Administered by Forestry.
P: CSS 210; MTH 116; CPS 100 or CPS 130 or CPS 131. R: Not open to freshmen and sophomores.
Science and technology of the hydrologic cycle and water resources in forest, wildland, wetland, and rural watersheds.

425. Microbial Ecology
Spring. 3(3-0) Interdepartmental with Microbiology. Administered by Microbiology.
P: MIC 301.
Microbial population and community interactions. Microbial activities in natural systems, including associations with plants or animals.

426. Biogeochemistry
Summer. 3 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Microbiology, Geological Sciences, and Zoology. Administered by Microbiology.
P: BS 110 or BS 111, CEM 143 or CEM 251.
Integration of the principles of ecology, microbiology, geochemistry, and environmental chemistry. Societal applications of research in aquatic and terrestrial habitats.

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.

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.

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.

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.

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.

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

465. Statistical Methods for Biologists II
Spring. 3(3-0) Interdepartmental with Statistics and Probability, and Animal Science. Administered by Statistics and Probability.
P: STT 464.
Concepts of reducing experimental error: covariance, complete and incomplete block designs, latin squares, split plots, repeated-measures designs, regression applications, and response surface designs.

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.

477. Pest Management I: Pesticides in Management Systems
Fall. 3(3-0) Interdepartmental with Entomology, Horticulture, and Fisheries and Wildlife. Administered by Entomology.
P: CEM 143; BOT 405 or CSS 402, ENT 404 or ENT 470 or FW 328.
Chemistry, efficient use, environmental fate, and legal aspects of pesticides.

478. Pest Management II: Biological Components of Management Systems
Spring. 3(2-3) Interdepartmental with Entomology, Horticulture, Fisheries and Wildlife, and Forestry. Administered by Entomology.
P: ENT 404 or ENT 470 or BOT 405 or CSS 402 or FW 328.
Principles of host plant resistance and biological control and their relationship to the design of agroecosystems. Classification of insect biological control agents.

481. Agricultural Research Systems in Developing Countries
Summer. 2(2-0) Interdepartmental with Agriculture and Natural Resources, Agricultural Economics, and Animal Science. Administered by Agriculture and Natural Resources.
R: Open only to seniors and graduate students in the College of Agriculture and Natural Resources.
Planning, organizing and managing agricultural research systems. Problems and alternative reforms to improve research productivity. Adapting new agricultural technology in developing countries.

486. Biotechnology in Agriculture: Applications and Ethical Issues
Spring of even-numbered years. 3(3-0) Interdepartmental with Horticulture, Philosophy, and Forestry. Administered by Horticulture.
P: BS 111 or BOT 105. R: Not open to freshmen and sophomores.
Current and future roles of biotechnology in agriculture: scientific basis, applications. Environmental, social, and ethical concerns.

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.

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.

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.

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.

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

819. Advanced Plant Breeding
Fall. 3(3-0) Interdepartmental with Horticulture and Forestry. Administered by Horticulture.
P: CSS 450, STT 422.
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.

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 even-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.

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.

829. Advanced Microbial Ecology
Fall of even-numbered years. 3(3-0) Interdepartmental with Microbiology. Administered by Microbiology.
Functional roles of microorganisms, their population dynamics and interactions, and their mechanisms of evolutionary change in natural communities, laboratory experiments, and mathematical models.

831. Soil and Plant Resources for Sustained World Food Production
Spring of odd-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.

832. Environmental and Natural Resource Law
Fall. 3(3-0) Interdepartmental with Resource Development, Agricultural Economics, Forestry, and Geography. Administered by Resource Development.
P: RD 430.
Origin and development of environmental law. Theories of power, jurisdication, sovereignty, property interests, pollution, and other bases for legal controls of natural resources. Common law and constitutional limitations on governmental power.

836. Plant Evolution and the Origin of Crop Species
Fall of even-numbered years. 3(3-0) Interdepartmental with Horticulture and Forestry. Administered by Horticulture.
P: CSS 350.
Cultural and biological aspects of the evolution of domestic plants. Origin and diversity of cultivated plants.

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.

841. Soil Microbiology
Spring of even-numbered years. 3(3-0) Interdepartmental with Microbiology. Administered by Microbiology.
P: MIC 425.
Ecology, physiology, and biochemistry of microorganisms indigenous to soil.

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.

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.

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.

860. Ecology and Evolution in Terrestrial Systems
Summer. 4 credits. Given only at W.K. Kellogg Biological Station. Interdepartmental with Botany and Plant Pathology, and Zoology. Administered by Botany and Plant Pathology.
P: STT 422.
Field experimental and quantitative approaches to ecological and evolutionary mechanisms.

863. Mineral-Water Interactions
Spring of odd-numbered years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Geological Sciences.
R: Open only to graduate students in Crop and Soil Sciences or Geological Sciences or 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. Organic Chemistry of Soils
Spring of odd-numbered years. 2(2-0)
Chemistry of natural and anthropogenic organic substances in soils.

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.

891. Current Topics in Ecology and Evolution
Summer. 1 credit. Given only at W.K. Kellogg Biological Station. A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Zoology, and Botany and Plant Pathology. Administered by Zoology.
Presentation and critical evaluation of theoretical and empirical developments 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 Horticulture and Forestry. Administered by Horticulture.
R: Open only to graduate students in Plant Breeding and Genetics or Genetics. 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 Horticulture and Forestry. 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 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.

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.

930. Advanced Forest Genetics
Fall of odd-numbered years. 2(1-2) Interdepartmental with Forestry and Horticulture. Administered by Forestry.
P: HRT 819 or HRT 836.
Applications of genetics, plant breeding, and biotechnology to the improvement, and preservation of diversity, of tree species.

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.

941. Quantitative Genetics in Plant Breeding
Spring of even-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.

943. Techniques of Analyzing Unbalanced Research Data
Spring. 4(4-0) Interdepartmental with Animal Science, Forestry, Horticulture, and Fisheries and Wildlife. Administered by Animal Science.
P: STT 464. R: Open only to graduate students in the College of Agriculture and Natural Resources.
Linear model techniques to analyze research data characterized by missing and unequal number of observations in classes. Simultaneous consideration of multiple factors. Estimable comparisons. Hypothesis testing. Computational strategies. Variance and covariance components. Breeding values.

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.

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.

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.

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.

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.

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.

251H. Microeconomics and Public Policy
Fall, Spring. 4(4-0)
R: 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.

252H. Macroeconomics and Public Policy
Fall, Spring. 3(3-0)
P: EC 251H; or EC 201, EC 301. R: 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.

301. Intermediate Microeconomics
Fall, Spring, Summer. 3(3-0)
P: EC 201, EC 202. R: 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.

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.

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.

330. Money, Banking, and Financial Markets
Fall, Spring, Summer. 3(3-0)
P: EC 201 or EC 251H; EC 202 or EC 252H.
Money markets and financial intermediation. Money, the Federal Reserve System, and monetary policy. Regulation of money markets.

335. Survey of Public Economics
Fall, Spring, Summer. 3(3-0) Interdepartmental with Public Resource Management.
P: EC 201 or EC 251H. R: Not open to students with credit in EC 435 or EC 436.
Economics of the public sector. Public goods, externalities, design and incidence of the tax system. Equity and efficiency effects of government programs.

340. Survey of International Economics
Fall, Spring, Summer. 3(3-0)
P: EC 201 or EC 251H; EC 202 or EC 252H. R: Not open to students with credit in EC 440 or EC 441.
Comparative advantage. Costs and benefits of trade. International economic policies. Balance of payments. Foreign exchange markets. The international monetary system. Contemporary trade and international currency issues.

360. Private Enterprise and Public Policy
Fall, Spring, Summer. 3(3-0)
P: EC 201 or EC 251H.
Effects of antitrust, economic regulation, and other public policies on competition, monopoly, and other market problems in the United States economy.