

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 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, spread sheets, data bases, programming languages, networking, and software related to agriculture.

181 Pesticide and Fertilizer Application Technology
Fall. 3(2-2) SA: CSS 081

Effective and efficient application of pesticides and fertilizers to turf; pesticide handling, legal, and environment concerns. Calibration of equipment.

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, Spring. 3(2-3) Interdepartmental with Forestry. P:NM: (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.

222 New Horizons in Biotechnology
Fall. 2(2-0) Interdepartmental with Entomology.

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.

232 Introduction to Turfgrass Management
Fall. 3(2-2) P:M: (CSS 210 or concurrently) P:NM: (CSS 110 or CSE 101)

Turfgrass utilization, identification, establishment and management principles. Responses to various cultural practices.

242 Athletic Field Maintenance
Fall. 2(2-0) P:M: (CSS 232)

Art and science of athletic field maintenance including root-zone modification, traffic wear management, field preparation techniques, wet weather strategies, safety concerns, legal issues, and crisis management. Field trips required.

873 Legal Issues in Criminal Justice
Fall of even years. 3(3-0) R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Law as an instrument of social control. Legal basis of criminal law and criminal justice policies. Legal limitations on criminal justice institutions and policies.

885 Security Management
Fall. 3(3-0) P:NM: (CJ 811 or concurrently) R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Organization and management of security operations in business, industry and government.

886 Security Administration
Spring. 3(3-0) R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Administrative and quantitative techniques for security operations. Statistical analyses. Analysis of financial statements. Operations research and computer techniques.

887 Quantitative Methods in Criminal Justice Research

Spring. 3(3-0) P:NM: (CJ 811) R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Descriptive and inferential statistics and computer use in criminal justice research.

890 Independent Study
Fall, Spring. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major. Approval of school.

Individual research and writing under faculty supervision.

894 Practicum
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 master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major. Approval of school.

Observation, study, and work in selected criminal justice agencies. Participation in domestic and foreign criminal justice systems.

896 Policy Analysis under Conditions of Change
Spring. 3(3-0) P:NM: (CJ 811) R: Open only to master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Methods of policy analysis in criminal justice settings. Policy analysis for the formulation, adoption and implementation of changes.

899 Master's Thesis Research
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 master's students in the School of Criminal Justice or to doctoral students in the Social Science-Criminal Justice major.

Planned research and writing directed by student's thesis committee.

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

902 Seminar in Criminal Justice Systems
Spring of even 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.

903 Research Utilization in Criminal Justice
Spring of odd 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.

904 Criminal Justice Organizations and Processes
Fall. 3(3-0) R: Open only to graduate students in Criminal Justice.

Theoretical perspectives on organizations and processes in criminal justice. Evaluation of organizational performance in justice agencies.

905 Law and Society
Spring. 3(3-0) R: Open only to graduate students in Criminal Justice.

Theoretical perspectives on law. Impact of law on society and the criminal justice system.

906 Advanced Quantitative Methods in Criminal Justice Research
Fall. 3(3-0) P:NM: (CJ 887 and STT 421) or introductory statistics course. R: Open only to graduate students in Criminal Justice.

Applications of quantitative techniques to criminal justice data. Use of multiple regression and SPSS.

907 Advanced Topics in Criminal Justice Data Analysis

Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. P:M: (CJ 906) R: Open only to graduate students in Criminal Justice.

Advanced quantitative analysis techniques for criminal justice data.

908 Advanced Topics in Criminal Justice
Spring. 3(3-0) A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to graduate students in Criminal Justice.

Intensive study of one subfield of criminal justice. Critical evaluation of the literature.

999 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 12 credits. A student may earn a maximum of 50 credits in all enrollments for this course. R: Open only to doctoral students in Criminal Justice.

Doctoral dissertation research.

Crop and Soil Sciences—CSS

- 262 Turfgrass Management Seminar**
Fall. 1(2-0) A student may earn a maximum of 2 credits in all enrollments for this course. P:M: (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.
- 267 Turfgrass Practices**
Spring. 2(2-2) P:M: (CSS 232) SA: CSS 067
Turfgrass establishment, renovation, and construction principles. Maintenance of golf course turf. Agronomic and management principles applied to golf course maintenance.
- 269 Turfgrass Strategies**
Spring. 2(3-0) P:M: (CSS 232)
Issues in turfgrass management including employee relations, construction, and environmental problems. Offered first ten weeks of semester.
- 272 Turfgrass Soil Management**
Fall. 3(2-2) RB: (CSS 043 or CSS 210) Not open to students with credit in CSS 044 or CSS 342.
Impact of fertilization programs on turfgrasses and the environment. Irrigation, drainage, cultivation, topdressing, amendments and pH control of turfgrass soils.
- 282 Turfgrass Physiology**
Spring. 2(3-0) P:M: (CSS 232) RB: (BOT 105) Not open to students with credit in CSS 332.
Physiological principles of turfgrass growth and development with emphasis on water relations, light, temperature, respiration, photosynthesis, mineral nutrition, and hormone action. Impact of practices such as mowing, cultivation, and traffic on turfgrass growth.
- 289 Civilizations, Food Crops and the Environment**
Fall, Spring. 3(3-0) Interdepartmental with Agriculture and Natural Resources. Administered by Agriculture and Natural Resources. SA: TCC 289
Role of the major food crops in the survival of civilizations and cultures from the past to the present, and the resulting environmental impacts.
- 292 Management of Turfgrass Weeds**
Spring. 2(2-2) P:M: (CSS 232) RB: (BOT 105)
Chemical, biological, and cultural methods of managing turfgrass weeds. Environmental considerations in weed management.
- 310 Soil Management and Environmental Impact**
Spring. 3(3-0) P:M: (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:M: (CSS 232) and completion of Tier I writing requirement.
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:M: (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:M: (BOT 105 or BS 111) R: Not open to freshmen or sophomores.
Fundamentals of plant genetics with applications to agriculture and natural resources.
- 355 Environmental Soil Chemistry**
Fall. 3(2-2) P:M: (CEM 143 and CSS 210)
Soil chemistry concepts as they apply to major chemical groups of environmental importance including metals, nitrogen, phosphorus, organic contaminants, and pesticides.
- 362 Management of Turfgrass Pests**
Fall. 4(3-2) Interdepartmental with Botany and Plant Pathology; Entomology. P:M: (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:M: (CSS 101 or CSS 210) and (MTH 103 and MTH 104) or (MTH 110 or MTH 116 or LBS 117) and completion of Tier I writing requirement. R: Not open to freshmen or 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 years. 3(2-3) P:M: (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.
- 402 Principles of Weed Science**
Fall. 3(2-2) P:NM: (BOT 105 and CEM 143) R: Not open to freshmen or 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. 3(3-0) Interdepartmental with Forestry. Administered by Department of Forestry. P:M: (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 Department of Forestry. P:M: (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:M: (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.
- 409 Forest Hydrology**
Spring. 3(2-2) Interdepartmental with Forestry; Resource Development. Administered by Department of Forestry. P:NM: (CSS 210 and MTH 116) or (MTH 104 or LBS 117) R: Not open to freshmen or sophomores.
Science and technology of the hydrologic cycle and water resources in forest, midland, wetland, and rural watersheds.
- 425 Microbial Ecology**
Spring. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Department of Microbiology and Molecular Genetics. P:M: (MIC 301) P:NM: (MIC 301) SA: MPH 425
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 and Molecular Genetics; Geological Sciences; Zoology. Administered by Department of Microbiology and Molecular Genetics. P:NM: (BS 110 or LBS 144 or LBS 148H or BS 111 or LBS 145 or LBS 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.
- 430 Soil Fertility and Chemistry**
Spring. 3(2-2) P:M: (CSS 210) R: Not open to freshmen or 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 years. 3(2-2) P:M: (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. 4(3-2) Interdepartmental with Forestry; Horticulture. P:M: (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; Horticulture. P:NM: (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.
- 452 Watershed Concepts**
Fall, Spring, Summer. 3(3-0) Interdepartmental with Resource Development; Biosystems Engineering; Forestry; Fisheries and Wildlife. Administered by Department of Resource Development. P:M: (RD 324 and ZOL 355) RB: organic chemistry
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:M: (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 Statistical Methods for Biologists I**
Fall. 3(3-0) Interdepartmental with Statistics and Probability; Animal Science. Administered by Department of Statistics and Probability. P:NM: (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; Animal Science. Administered by Department of Statistics and Probability. P:NM: (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:NM: (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. Field trips required.
- 477 Pest Management I: Pesticides in Management Systems**
Fall. 3(3-0) Interdepartmental with Entomology; Fisheries and Wildlife; Horticulture. Administered by Department of Entomology. P:NM: (CEM 143 or CEM 251) and (BOT 405 and CSS 402) and (ENT 404 or ENT 470 or FW 328)
Chemistry, efficient use, and environmental fate of pesticides. Legal and 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; Forestry; Fisheries and Wildlife; Horticulture. Administered by Department of Entomology. P:M: (ENT 404 or ENT 470 or BOT 405 or CSS 402 or FW 328) 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.
- 486 Biotechnology in Agriculture: Applications and Ethical Issues**
Fall of even years. 3(3-0) Interdepartmental with Horticulture; Forestry; Philosophy. Administered by Department of Horticulture. P:M: (BOT 105 or BS 111) P:NM: (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.
- 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:M: (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:M: (CSS 101 or CSS 210) P:NM:
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:M: (CSS 210) and (CSS 342 or CSS 370) 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. R: Approval of department; application required. A student may earn a maximum of 6 credits for any or all of these courses: ABM 493, AEE 493, ANR 493, ANS 493, CSS 493, FIM 493, FW 493, HRT 493, PKG 493, PRM 493, PRR 493, and RD 493
Supervised professional experiences in agencies and businesses related to Crop & Soil Sciences and Environmental Soil Sciences
- 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.
- 819 Advanced Plant Breeding**
Fall. 3(3-0) Interdepartmental with Horticulture; Forestry. Administered by Department of Horticulture. P:NM: (CSS 450 and 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.
- 825 Clay Mineralogy and Soils Genesis**
Spring of even 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 years. 1(0-3) Interdepartmental with Forestry; Horticulture.
Preparation of chromosomes from commercially important plants for cytogenetic analysis.
- 829 Advanced Microbial Ecology**
Fall of even years. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Department of Microbiology and Molecular Genetics.
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 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; Geography. Administered by Department of Resource Development. P:NM: (RD 430)
Origin and development of environmental law. Theories of power, jurisdiction, 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 years. 3(3-0) Interdepartmental with Horticulture; Forestry. Administered by Department of Horticulture. P:NM: (CSS 350)
Cultural and biological aspects of the evolution of domestic plants. Origin and diversity of cultivated plants.
- 837 Confocal Microscopy**
Fall, Spring. 2(2-2) Interdepartmental with Natural Science. Administered by Natural Science. R: Approval of department; application required.
Confocal imaging, theory and practice. Basic optics. Lasers. Light paths for transmission, fluorescence and reflection. Image quality, analysis and processing.

Crop and Soil Sciences—CSS

- 840 Soil Physics**
Fall of odd 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 years. 3(3-0) Interdepartmental with Microbiology and Molecular Genetics. Administered by Department of Microbiology and Molecular Genetics. P:NM: (MIC 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 Forestry; Animal Science; Genetics; Fisheries and Wildlife; Horticulture. Administered by Department of Forestry. RB: Pre-calculus, basic genetics

Population genetic processes underlying patterns of molecular genetic variation. Genealogical approaches to the study of genomic diversity, phylogenetic reconstruction, and molecular ecology.

- 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 years. 3(3-0) Interdepartmental with Horticulture. P:NM: (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 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.

- 863 Mineral-Water Interactions**
Spring of odd years. 4(3-2) Interdepartmental with Geological Sciences. Administered by Department of 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 years. 2(2-0)

Chemistry of natural and anthropogenic organic substances in soils.

- 870 Techniques of Analyzing Unbalanced Research Data**
Spring. 4(4-0) Interdepartmental with Animal Science; Forestry; Fisheries and Wildlife; Horticulture. Administered by Department of Animal Science. P:NM: (STT 464) R: Open only to graduate students in the College of Agriculture and Natural Resources. SA: ANS 943 Not open to students with credit in 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.

- 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; Botany and Plant Pathology. Administered by Department of 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; Forestry. Administered by Department of 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; Forestry. Administered by Department of 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.

Master's thesis research.

- 921 Contemporary Statistical Models in Biology**
Fall of odd years. 3(3-0) P:NM: (STT 465) or approval of department. Working knowledge of SAS.

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(3-0) Interdepartmental with Forestry; Horticulture. P:NM: (CSS 450 and 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.

- 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.

Doctoral dissertation research.

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 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. R: Approval of department.

Laboratory techniques and investigations in geological sciences 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) 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.