*890. Practicum*

*Fall, Winter, Spring, Summer. 1(0-4) to 6(0-24) Majors or approval of school.*

Planned program of research observation, study and work in selected criminal justice agencies. Designed to supplement classroom study with participation in domestic and foreign criminal justice systems.

*892. Quantitative Methods in Criminal Justice Research.*

*Winter. 4(4-0) C J 492, C J 811.*

Views the relationship and application of statistical techniques to theory building and concept construction. Gives an overview of statistical methods with an emphasis on those most useful for research in criminal justice.

*897. Policy Change Paper*

*Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 4 credits. Majors or approval of school.*

Development of plan for significant policy change and its implementation in a criminal justice agency.

*899. Master's Thesis Research*

*Fall, Winter, Spring, Summer. 1 to 12 credits. May reenroll for a maximum of 12 credits. Majors or approval of school.*

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

*930. Seminar on Criminal Justice Systems*

*Winter. 3(3-0) Graduate students.*

Topical issues on the development, functioning, and interrelationships of components of criminal justice systems and how systemic coherence can be achieved within a democratic society.

*990. Seminar in Criminal Justice and Criminology*

*Fall. 3 to 5 credits. Graduate students.*

Analysis of major research contributions to criminal justice and criminology.

*992. Research Utilization and Application in Criminal Justice*

*Spring. 3(3-0) Majors or approval of school.*

Substantive and administrative problems of conducting research and exisiting attempts to solve these. Utilization of research in bringing about change in the criminal justice system. Methods of maximizing research utility.

## CROP AND SOIL SCIENCES CSS

### College of Agriculture and Natural Resources

*101. Crop Science*

*Fall. 3(3-0)*

Principles of identification, adaptation, management, and utilization of field crops for food and fiber. Fundamentals of crop management, breeding, weed control, crop quality, and tropical crops in world agriculture.

*202. Soil and Our Environment*

*Spring. 3(3-0) Not open to students with credit in CSS 210. Non-majors only.*

Role of soil in growing plants, water use and conservation, nutrient cycling, fertilizers, environmental quality, animal health, food-population dilemma.

*204. Corn and Soybean Production*

*Fall. 2(2-0) CSS 101, CSS 202 or CSS 210.*

Topics related to increased efficiency in corn and soybean production: time of planting; irrigation scheduling; fertility; and weed, insect and disease control.

*205. Navy Bean and Sugarbeet Production*

*Winter. 2(2-0) CSS 101, CSS 202 or CSS 210.*

Navy bean and sugarbeet production and marketing in Michigan. Presentations by specialists from within the University and the navy bean and sugarbeet industries.

*206. Small Grain Production*

*Winter. 1(1-0) CSS 101, CSS 202 or CSS 210.*

Small grain production, use, and marketing in Michigan and the world.

*210. Fundamentals of Soil Science*

*Fall, Winter. 4(3-2) CEM 141B. Not open to students with credit in CSS 202.*

Nature of soils and their relation to plant growth, water regimes, nutrient cycling, erosion, environmental quality, plant composition, animal health and world food production.

*301. Forage Crops*

*Fall. 3(2-2) Sophomores.*

Distribution, morphology, identification, physiology, management and utilization of forage crops for hay silage, and pasture for livestock and for soil improvement and conservation.

*318. Turfgrass Management*

*(CSS 418.) Fall. 3(3-0) CSS 210 or concurrently.*

Turfgrass management of golf courses, home lawns, parks, and athletic fields. Species identification and adaptation, routine and specialized cultural practices, pest identification and control.

*331. Soil Management*

*Winter. 4(4-0) CSS 210.*

Management of soils, drainage, and irrigation, organic matter, tillage, rotation, conservation practices, soil reaction, lime, fertilizers, and micronutrients. Soil management vs. soil conservation. Special study in general crops, horticultural crops, greenhouse crops, turf and organic soils.

*350. Plant and Animal Genetics*

*(CSS 250.) Winter. 5(5-0) Juniors or approval of department.*

Fundamentals of modern genetics with particular focus on problems and application in agriculture and natural resources.

*380. Ecology and Physiology of Agricultural Plants*

*Spring. 3(3-0) FOR 220 or BOT 301.*

Interrelationships of physiological processes and environmental manipulation for higher yield of agricultural plants.

*390. Soil Conservation and Land Use*

*Winter. 3(3-0) CSS 210.*

Concepts of soil erosion by water and wind and methods for soil conservation including control of erosion and sedimentation. Interpretation of soil properties for land use decisions.

*402. Principles of Weed Control in Field Crops*

*Fall. 4(3-2) CEM 143, BOT 301.*

Principles underlying weed control practices for agronomic crops. Factors involved in mechanical, chemical and biological control and basic physiological aspects of herbicide applications.

*406. Crop Improvement and Seed Production*

*Winter. 4(3-2)*

Practical methods of crop improvement, seed production, storing, cleaning, packing, and distribution, seed certification of small grains, legumes, corn, beans, potatoes, visits to seed agencies and seed farms.

*408. Principles of Plant Breeding*

*Winter. 4(3-2) CSS 250. Interdepartmental with the Department of Horticulture.*

Application of genetics and other sciences to breeding and improvement of agronomic and horticultural crops.

*411. Independent Study*

*Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 8 credits if different problem is taken. Approval of department.*

Individual work on a field, laboratory or library research problem of special interest to the student and supervised by faculty.

*412. Topics in Agronomy*

*Fall, Winter, Spring, Summer. 2(2-0) or 3(3-0) May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.*

Topics will be selected from crop production, crop physiology, turfgrass management, organic soils, turfgrass soils, soil fertility and genetic analysis.

*414. Turfgrass Soil Management*

*Fall. 3(2-2) CSS 318.*

Fertility and pH control of turf soils; drainage; irrigation programming; cultivation; topdressing; soil amendments; construction of specialized soils.

*416. Principles of Turfgrass Culture*

*Winter. 3(3-0) CSS 318.*

Growth and development of the turfgrass plant as related to turfgrass management practices.

*417. Turfgrass Seminar*

*Fall. 1(2-0) CSS 318.*

Seminars by leaders of the turfgrass industry; golf course design and maintenance, specialized equipment, and research developments.

*419. Management of Turfgrass Pests*

*Fall. 4(3-2) CSS 318 or concurrently.*

Chemical, biological and cultural methods of managing weed, disease, and insect pests of turfgrass.

*420. Seminar*

*Winter. 1(1-0) May reenroll for a maximum of 4 credits.*

*424. Forest Soils*

*Spring. 3(2-3) CSS 210; Juniors or approval of department. Forestry majors: FOR 305, FOR 402, FOR 425, FOR 429 concurrently. Interdepartmental with and administered by the Department of Forestry.*

Interrelationships of forest site and the growth of trees. Properties, classification, inventory, productivity and management of forest soils. Effects of silvicultural and forest management practices on the soil.

### 425. Forest Soils Laboratory

*Spring. 1(0-3) CSS 210; FOR 305, FOR 402, FOR 424, FOR 429 concurrently. Interdepartmental with and administered by the Department of Forestry.*

Exercises and field trips relating to properties, classification, inventory, productivity and management of forest soils. Extended field trips required.

### 426. Microbial Ecology

*Spring. 3(3-0) MPH 301 or MPH 303, MPH majors must enroll concurrently in MPH 426A. Interdepartmental with and administered by the Department of Microbiology and Public Health.*

Microbial activities in natural ecosystems; their association with plants and animals, and their transformations of carbon, nitrogen and sulfur in soil and aquatic habitats.

### 426A. Microbial Ecology Recitation

*Spring. 1(1-0) MPH 426 concurrently. Interdepartmental with and administered by the Department of Microbiology and Public Health.*

Quantitative aspects of microbial ecology.

### 430. Soil Fertility and Fertilizers

*Spring. 4(3-2) CSS 210.*

Diagnosing fertility status of soils by soil analysis and plant deficiency symptoms. Liming and fertilization with macro- and micronutrients and transformation of nutrients in soils. Fertilizer manufacture technology and use.

### 440. Soil Biophysics

*Winter. 3(3-0) CSS 210 and BOT 301; CSS 380 recommended.*

Salient features of soil physical and biological properties related to plant growth, principles and applications. Emphasis on root responses to the environment. Bioenergetics of the root-soil interface.

### 470. Soil Classification

*Fall, Spring, Summer of odd-numbered years. 4(0-8) CSS 210 or approval of department.*

Determination of soil properties by field examination of soils. Classification of soils. Preparation of land use report based upon soil maps of assigned areas. Field trips required.

### 480. World Soils and Land Use

*Spring. 3(2-2) CSS 210 or approval of department.*

Nature, geography and use of the world's major soils. Uses emphasized will include agriculture, range, and forestry.

### 485. Seed Science

*Spring. 3(3-2) Approval of department.*

Morphological and physiological changes during seed formation, development, maturation and germination. Practical and biological aspects of seed drying. Storage, deterioration, dormancy and quality. Current problems and research in seed science.

### 801. Crop Ecology

*Winter of even-numbered years. 2(2-0) Approval of department.*

World climates affecting crops and cropping systems. Limiting environmental factors for crop distribution and productivity. Physiological basis of stress injury and resistance for chilling, freezing, flooding, drought and salinity.

### 805. Herbicidal Action and Metabolism

*Spring of odd-numbered years. 3(3-0) CSS 402; BOT 415 or concurrently.*

A study of the properties and characteristics of herbicides, the fundamental processes involved in the physiological action, behavior, and metabolism of herbicides.

### 811. Independent Study

*Fall, Winter, Spring, Summer. 1 to 6 credits. May reenroll for a maximum of 12 credits. Approval of department.*

Individual study on field, laboratory or library research.

### 812. Selected Topics

*Fall, Winter, Spring, Summer. 2(2-0) or 3(3-0) May reenroll for a maximum of 9 credits if different topics are taken. Approval of department.*

Topics will be selected from physiology of herbicides, micronutrients, advanced soil physics, advanced soil chemistry.

### 814. Plant Breeding and Genetics Seminar

*Winter. 1(1-0) May reenroll for a maximum of 2 credits. Approval of department. Interdepartmental with the departments of Forestry and Horticulture.*

### 815. Selected Topics in Plant Breeding and Genetics

*Fall, Winter, Spring, Summer. 2 to 5 credits. May reenroll for a maximum of 12 credits if different topics are taken. Approval of department. Interdepartmental with the departments of Forestry and Horticulture.*

Selected topics in plant breeding including: host-plant resistance, nutrition and quality, computerized records and data analysis, classical literature and strategies for improving field, horticulture and forestry crops.

### 816. Special Problems in Plant Breeding and Genetics

*Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 8 credits. Approval of department. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Horticulture.*

Students may conduct research in a laboratory, greenhouse or field-plot on a selected subject or study selected published literature under the supervision of a faculty member.

### 820. Seminar

*Winter, Spring. 1(1-0) May reenroll for a maximum of 3 credits.*

Studies and presentation of research in crop and soil sciences.

### 821. Genetic Concepts in Plant Breeding

*Fall. 3(3-0) CSS 250 or ZOL 441. Interdepartmental with the departments of Forestry and Horticulture.*

Genetic structure of plant populations, gene action, inbreeding, outbreeding, heterosis, linkage and recombination, genetic architecture of traits, genetic distance.

### 822. Plant Breeding Systems

*Winter. 3(3-0) CSS 821, STT 422. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Horticulture.*

Breeding systems for improvement of self and cross pollinated and of vegetatively propagated crops. The genetic basis for parent selection.

### 823. Plant Breeding Methods

*Spring. 3(3-0) HRT 822, STT 423. Interdepartmental with the departments of Forestry and Horticulture.*

Methods, strategies and practices in organization and operation of plant breeding programs. Emphasis on practical application of classical, modern and futuristic approaches to plant breeding.

### 825. Clay Mineralogy

*Winter. 4(3-4) CSS 840, CSS 850 or approval of department. Interdepartmental with and administered by Geology.*

Structures and properties of clays; their origins, occurrence, and utilization. Methods of studying clays including x-ray diffraction, differential thermal analysis, infrared absorption and other chemical and physical techniques.

### 831. World Food Crops

*Spring of odd-numbered years. 3(3-0)*

World food crop production and related systems of agriculture which provide this resource. The impact of modern discoveries and opportunities for change.

### 833. Soil Fertility and Plant Nutrition

*Winter. 3(3-0) CSS 430 or approval of department.*

Fundamental concepts in soil fertility and mineral nutriton of plants; fate of nutrients applied to soils, nutrient uptake, translocation and utilization by plants; principles of laboratory, greenhouse and field research methods.

### 836. Evolution of Crop Plants

*Fall of even-numbered years. 3(3-0) CSS 821 or approval of department. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Horticulture.*

Cultural and biological aspects of evolution under domestication; origin and diversity of cultivated plants.

### 838. Tissue Culture for Plant Breeding

*(HRT 840.) Winter of even-numbered years. 3(2-2) BOT 414, CSS 821. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Horticulture.*

The application of plant cell, protoplast and tissue culture methodologies and principles to crop improvement.

### 840. Soil Physics

*Fall. 5(3-6) CSS 430, CEM 162 or approval of department.*

Physical properties of soil (texture, structure, consistency, aeration, water, temperature, etc.), their quantitative measurement, and relation to plant growth, and agronomic and engineering practices.

### 842. Advanced Soil Microbiology

*Fall of odd-numbered years. 3(3-0) MPH 425 or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.*

Biochemistry, biology, and community ecology of microorganisms indigenous to soil. Emphasis on current research problems.

### 843. Soil Microbiology Laboratory

*Fall of odd-numbered years. 2(0-6) MPH 842 concurrently or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.*

Fundamental techniques of dealing with microorganisms indigenous to soil. Metabolic activity of microorganisms. Interaction between microorganisms and plants.

*844. Plant Organelle Genetics*

*Winter of odd-numbered years. 3(3-0) Approval of department. Interdepartmental with Genetics and the departments of Botany and Plant Pathology, Forestry, and Horticulture. Administered by the Department of Horticulture.*

Organization, structure, function, heredity, molecular biology and manipulation of chloroplasts and mitochondria. Biological interactions between the nucleus and organelles.

*850. Soil Chemistry*

*Winter. 5(3-6) CSS 430; CEM 162, CEM 383; or approval of department.*

Chemistry of mineral weathering and soil formation, ion activities, ionic exchange and equilibrium reactions, soil pH, specific elements and their chemical analysis, and availability of nutrients to plants.

*865. Organic Chemistry of Soils*

*Spring of odd-numbered years. 3(3-0) CEM 242.*

Relationship of natural and synthetic organic chemicals to chemical and biochemical processes in the soil environment.

*870. Origin and Classification of Soils*

*Winter. 4(3-2) CSS 470, CSS 840, or approval of department.*

Genesis, morphology and classification of major soils of the world. Relationships among soils in natural and cultural landscapes. How soil properties affect their use, management and conservation. Land classifications for various purposes.

*899. Master's Thesis Research*

*Fall, Winter, Spring, Summer. Variable credit. Approval of department.*

*920. Applied Regression Analysis*

*Spring. 3(3-0) STT 423 or approval of department.*

Multiple regression, model selection, the general linear model and confounding in factorial sets of treatments.

*940. Theoretical Population Genetics*

*Winter of even-numbered years. 4(4-0) MTH 113, STT 422, CSS 821. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Forestry.*

Discussion of mathematical theories in population genetics and experimental works on natural and laboratory populations.

*941. Quantitative Genetics in Plant Breeding*

*Spring of even-numbered years. 4(4-0) STT 423, CSS 823 or approval of department. Interdepartmental with the departments of Forestry and Horticulture.*

Calculation and implication of genetic parameters. Linkage. Coancestry and inbreeding. Covariance between relatives. Heritability and selection. Genotype by environment interaction. Emphasis on relationship of quantitative genetics to plant breeding.

*944. Physiological Genetics*

*Winter. 3(3-0) BOT 413; CSS 821. Interdepartmental with the departments of Forestry and Horticulture. Administered by the Department of Forestry.*

Control of variation in higher plants including adaptive physiology, quantitative genetics, growth correlation, biochemical genetics, hybrid physiology, and genecology.

*999. Doctoral Dissertation Research*

*Fall, Winter, Spring, Summer. Variable credit.*

## EARTH SCIENCE

See Geological Sciences.

## ECONOMICS EC

### College of Business and Graduate School of Business Administration

Courses are classified as follows:
Applied Welfare Economics—410.
Labor Economics and Industrial Relations—305, 306, 455, 457.
Money and Banking—318, 330, 470.
International Economics—428.
Public Finance—406, 407, 408.
Price and Value Theory—324, 325, 426.
Income and Employment Theory—326, 451, 470.
History of Economic Thought—421, 422.
Industrial Organization and Control—444, 445.
Economic Development, Regional Studies, and Comparative Economics Systems—430, 431, 434.

*200. Introduction to Macroeconomics*

*Fall, Winter, Spring, Summer. 4(4-0) Open to Freshmen. Students may begin sequence with either EC 200 or EC 201.*

Determinants of Gross National Product, unemployment, inflation and economic growth. National income accounting, fiscal policy; aggregate demand and supply management.

*201. Introduction to Microeconomics*

*Fall, Winter, Spring, Summer. 4(4-0) Open to Freshmen. Students may begin sequence with either EC 200 or EC 201.*

Economic institutions, reasoning and analysis. Consumption, production, determination of price and quantity in different markets, income distribution, market structure and normative analysis.

*210. Fundamentals of Economics*

*Fall, Winter. 4(4-0) MTH 215 or MTH 228; or concurrently. Students may not earn credit in EC 210 if they have credit in either EC 200 or EC 201.*

Economic principles, institutions and reasoning using mathematics, when useful, as a tool of analysis. Consumption, production, the market system, income distribution and elements of employment and inflation theory.

*251H. Households, Firms and Markets*

*Fall. 5(5-0) Honors College students.*

Microeconomic theory and its applications to analysis and policy. Substitutes for EC 201, EC 324, and EC 325.

*252H. Macroeconomics and Public Policy*

*Winter. 5(5-0) Honors College students.*

Theory of national income, unemployment, inflation and economic growth and its application to economic analysis and policy. Substitutes for EC 200, EC 326 and EC 327 combined.

*305. Industrial Relations and Trade Unionism*

*Fall, Winter, Spring, Summer. 4(4-0)*

Development, aims, structure, and functions of labor and employer organizations. Their relation to economic, political, and legal institutions and their impact on society. Primary issues in collective bargaining.

*306. Government Programs for Workers*

*Winter, Spring. 4(4-0) EC 201. Interdepartmental with Public Affairs Management.*

Economics of selected government institutions and programs for workers. Social security, worker's compensation, Unemployment Insurance, OSHA, employment and training programs, wages and hours legislation, anti-discrimination programs.

*318. Money, Credit and Banking*

*Fall, Winter, Spring, Summer. 4(4-0) EC 200 or EC 210.*

Commercial banking and the money supply. The Federal Reserve System, the Treasury, and other financial institutions. Sources and uses of funds in the financial market.

*324. Microeconomics I*

*Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210.*

Theory of production and cost. Theory of the firm under varying market structures.

*325. Microeconomics II*

*Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210, and EC 324.*

Consumer choice and theory of demand. Theory of distribution and factor rewards. Welfare economics and general equilibrium theory.

*326. Macroeconomics I*

*Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201 or EC 210.*

Review of national income accounting. Determination of aggregate output, employment, the price level, and the inflation rate. Policy applications.

*327. Macroeconomics II*

*Fall, Winter, Spring, Summer. 3(3-0) EC 326.*

Consumption theories, investment theories, role of expectations, theories of economic growth and cycles, stabilization policies, and other advanced topics.

*330. Investments and Security Markets*

*Fall, Spring. 3(3-0) EC 200 or EC 210, Juniors.*

The stock market; principles of investment; analysis of selected industries and corporaions; regulation by the Securities and Exchange Commission.

*337. American Social and Economic History: Foundations*

*Winter. 4(4-0) Interdepartmental with and administered by the Department of History.*

Multiple sources of economic growth in economic, social and political change, education, science and technology, political action, and other factors, mid-19th century.

*338. American Social and Economic History: Modern Trends*

*Spring. 4(4-0) Interdepartmental with and administered by the Department of History.*

Urbanization, origins and implications of largescale organizations in business and other sectors of society, and sources of economic growth since mid-19th century.