

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 existing 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. Introduction to Crop Science
Fall. 4(3-2)
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.

204. Corn and Soybean Production
Fall. 2(2-0) CSS 101, 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 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. 2(2-0) CSS 101, CSS 210.
Small grain production, use, and marketing in Michigan and the world.

210. Fundamentals of Soil Science
Fall, Winter. 4(3-2) CEM 141.
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.

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) BOT 301; CSS 101 or HRT 101.
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 350. Interdepartmental with the Department of Horticulture.
Application of genetics and other sciences to breeding and improvement of agronomic and horticultural crops.

409. Terrestrial Hydrology
Winter. 3(2-2) CSS 210, MTH 108, CPS 100, Juniors; or approval of department. Interdepartmental with the departments of Forestry and Resource Development. Administered by the Department of Forestry.
Global hydrologic cycle, balances, and precipitation. Water storage and flows in vegetation, soil and groundwater of forest, wildland, rural and wetland landscapes. Management effects on evapotranspiration, groundwater recharge, and streamflow.

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.

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.

451. Plant Molecular Genetics
Spring. 4(2-6) CSS 350 or ZOL 441. Interdepartmental with the departments of Forestry and Horticulture.
Principles, concepts, and techniques of plant biotechnology. Recombinant DNA technology, plant molecular biology, transformation, and tissue culture in relation to plant improvement.

455. Pollutants in the Soil Environment
Fall. 3(3-0) CEM 143, Seniors or approval of department.
Chemical and biological reactions of organic and inorganic pollutants in soils.

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

470. Soil Classification

Spring, 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.

800. Statistical Packages for Analysis of Experiments

Fall, Spring, 3(2-2) STT 423 or approval of instructor.

Use of microcomputers and mainframes for research data analysis and graphical presentations. Software covered includes SAS, BMDP, SPSS, MSTAT, and PLOTIT. File transfer. EDITOR.

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 (MTC)

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.

817. Plant Breeding Methods

(CSS 823.) Fall, 3(3-0) STT 422 or concurrently. 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.

819. Plant Breeding Systems

(CSS 822.) 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.

821. Genetic Concepts in Plant Breeding

Fall, 3(3-0) CSS 350 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.

825. Clay Mineralogy

(GLG 825.) Winter, 4(3-4) CSS 840, CSS 850 or approval of department. Interdepartmental with the Department of Geological Sciences.

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.

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 426 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.

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.

853. Plant Mineral Nutrition

Winter of odd-numbered years. 4(4-0) BOT 301, CSS 430 or approval of department. Interdepartmental with the Department of Horticulture.

Principles of mineral transport in plant cells and tissues. Plant responses to and diagnosis of mineral stresses. Physiological roles of mineral nutrients as related to plant growth and productivity.

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. 4(4-0) MTH 113, STT 423 or approval of department. 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 817 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 of odd-numbered years. 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 geneecology.

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

201. Introduction to Microeconomics
Fall, Winter, Spring, Summer. 4(4-0) Open to Freshmen. Not open to students who have credit in EC 251H or EC 210.
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
(EC 200.) Fall, Winter, Spring, Summer. 4(4-0) Open to Freshmen. Not open to students who have credit in EC 252H or EC 210.
Determinants of Gross National Product, unemployment, inflation and economic growth. National income accounting, fiscal policy; aggregate demand and supply management.

210. Fundamentals of Economics
Fall, Winter. 4(4-0) MTH 215 or concurrently. Students may not earn credit in EC 210 if they have credit in either EC 201 or EC 202.
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. Not open to students who have credit in EC 201, EC 324 and EC 325.
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. Not open to students who have credit in EC 202, EC 326 and EC 327.
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) EC 201 or EC 202.
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 202 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. 4(4-0) EC 201, EC 202 or EC 210. Not open to students who have credit in EC 251H.
Consumer choice and theory of demand. Theory of production and cost. Theory of the firm under varying market structures.

325. Microeconomics II
Fall, Winter, Spring, Summer. 3(3-0) EC 324. Not open to students who have credit in EC 251H.
Theory of distribution and factor rewards. Welfare economics and general equilibrium theory. Externalities and public goods. Decision-making under uncertainty. Other advanced topics.

326. Macroeconomics I
Fall, Winter, Spring, Summer. 3(3-0) EC 201, EC 202 or EC 210. Not open to students who have credit in EC 252H.
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. Not open to students who have credit in EC 252H.
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 202 or EC 210, Juniors.
The stock market; principles of investment; analysis of selected industries and corporations; regulation by the Securities and Exchange Commission.

361. Economic Development of Asia
Fall. 3(3-0) EC 201, EC 202 or EC 210.
Population and resources; comparison of three economic systems: Communism in China, free enterprise in Japan and socialism in India; the role of Japan in regional trade and development.

362. Economic Development of Latin America
Winter. 3(3-0) EC 201, EC 202 or EC 210.
Concentration of political and economic power as related to income distribution, tax structures, agrarian reform; inflation, trade, exchange rates, integration; population and employment policy.

363. Economic Development of Tropical Africa
Spring. 3(3-0) EC 201, EC 202 or EC 210. Interdepartmental with Public Affairs Management.
African economic development in historical perspective. Analysis of contemporary economic development problems faced by tropical African countries. Alternative strategies for African economic development.

400. Independent Study
Fall, Winter, Spring, Summer. 1 to 4 credits. Seniors or approval of department.
Research and reading course for students interested in doing independent work in economics.

401. Interpreting Economic News and Research
Winter. 3(3-0) EC 201, EC 202 or EC 210 or EC 251H; EC 252H.
Reporting and interpreting economic news and research. Sources of data and research information. Critical examination of written and broadcast reports through application of economic principles. Case studies.

406. Public Expenditure: Theory and Policy
Fall, Spring. 4(4-0) EC 201 or EC 210. Interdepartmental with Public Affairs Management.
Expenditure theory; objectives and rationale of government activity in the market system; efficiency criteria in government decision-making; planning-programming-budgeting systems and cost-benefit analysis.

407. Public Revenues
Winter. 4(4-0) EC 201 or EC 210.
Principles and theory of the distribution of tax burdens and the incidence of taxation. Income, sales, property, and other major revenue sources.