492. Senior Seminar in Food Science
Spring. 1(1-0)
R: Open only to seniors in Food Science.
Critical study and discussion of contemporary issues related to the food industry.

801. Chemistry of Food Lipids
Fall of odd-numbered years. 3(3-0)
P: FSC 401, BCH 461.
Composition and structure of lipids: physical and chemical properties in relation to their function in foods.

802. Food Proteins
Spring of odd-numbered years. 3(3-0)
P: BCH 461, FSC 401.
Use of proteins and enzymes in the food industry. Functional properties of proteins and enzymes in food systems.

807. Advanced Food Toxicology
Fall of even-numbered years. 3(3-0) Interdepartmental with Animal Science.
R: Approval of department.
Toxicology related to food safety. Metabolism of toxicants as influenced by food constituents, mutagenesis, and chemical carcinogenesis. Risk assessment.

833. Muscle and Meat Biochemistry
Spring of odd-numbered years. 3(3-0)
P: BCH 452 or concurrently.
Anatomical, physiological, and biochemical properties of muscle. Structure and function of muscle proteins. Regulation of muscle contraction. Post mortem biochemical changes and meat protein functionality.

837. Rheological Methods in Food Processing Engineering
Fall. 3(3-0) Interdepartmental with Agricultural Engineering. Administered by Agricultural Engineering.
Definition, analysis, and measurement of rheological properties to describe the steady shear, dynamic, viscoelastic, extensional, and solid behavior of biological materials. Industrial applications of rheological methods with emphasis on fluid and semi-solid foods.

840. Advanced Food Microbiology
Spring of odd-numbered years. 3(3-0)
P: FSC 440.
Detection, characterization, identification, and enumeration of food-associated pathogens. Applications and regulation of food biotechnology.

850. Analytical Techniques in Food Science
Summer of odd-numbered years. 2(1-2)
R: Open only to graduate students in Food Science or Human Nutrition.
Theory and application of dynamic rheological testing, nucleic acid and protein analysis, and immunological techniques. Other new technologies related to food science.

860. Research in Food Processing Technology
Summer of even-numbered years. 2(1-2)
R: Open only to graduate students in Food Science, Human Nutrition, Animal Science, and Horticulture.
Theory, application, and evaluation of food processing technology: ultrafiltration, food irradiation, and critical point extraction.

890. Special Problems in Food Science
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 8 credits in all enrollments for this course.
R: Open only to graduate students in Food Science. Approval of department; application required.
Individual investigation of an area of food science.

891. Selected Topics in Food Science
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course.
R: Open only to graduate students in Foods or Food Science or Human Nutrition.
Topics of current interest and importance in basic and applied areas of food science.

892. Food Science Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course.
R: Open only to graduate students in Food Science.
Critical review of literature. Organization and communication of scientific data in food science.

898. Master's Research
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course.
R: Open only to graduate students in Food Science. Approval of department.
Directed research in support of Plan B master's degree requirements.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 10 credits. A student may earn a maximum of 99 credits in all enrollments for this course.
R: Open only to M.S. students in Food Science.

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 Ph.D. students in Food Science.

FOOD SYSTEMS ECONOMICS AND MANAGEMENT — FSM

Department of Agricultural Economics
College of Agriculture and Natural Resources

200. Introduction to Food Systems Management
Fall. 3(3-0)
Organization and operation of the industrialized food system: agricultural production, food processing, manufacturing, wholesaling, retailing and consumption. Application of economic and management principles to firms and the overall food system.

310. Livestock and Product Marketing
Fall. 3(2-2) Interdepartmental with Animal Science. Administered by Animal Science.
P: ANS 112. R: Not open to freshmen.
Movement of livestock and products into and through market channels. Market structures, futures, options. Current issues. Field trip required.

320. Agribusiness and Food Sales
Spring. 3(3-0)
P: FSM 200 or ML 300. R: Not open to freshmen and sophomores.
Selling processes and activities within agribusiness and food firms. Principles and techniques of sales. Operation of sales organizations.

325. Agribusiness Labor and Personnel Management
Fall. 3(3-0)
P: FSM 200 or MGT 302 or concurrently. R: Not open to freshmen and sophomores.
Labor for farms and agribusinesses: planning, recruiting, training, scheduling, motivating, supervising, and evaluating. Labor regulations, compensation, and records.

330. Farm Business Management
Spring. 3(4-0)
P: FSM 200 or MGT 302. R: Not open to freshmen.
Management, planning, and control of farm production, marketing and financial activities. Problems and evaluation of alternative solutions. Economic principles, budgeting, financial statements.

335. Food Marketing Management
Spring. 3(3-0) Interdepartmental with Marketing and Logistics. Administered by Marketing and Logistics.
P: FSM 200 or ML 300. R: Open only to juniors and seniors in College of Business and in programs for which ML 335 is a catalog-listed requirement.
Management decision-making in food industry organizations (processors, wholesalers, retailers). Marketing and sales in response to customer and consumer needs. Distribution and merchandising systems in domestic and international contexts.

412. Financial Management in the Food System
Spring. 3(3-0)
P: FSM 330, FI 311. R: Not open to freshmen and sophomores.
Analysis of agricultural business performance using financial statements. Capital budgeting of durable investments. Risk. Alternative methods to control capital asset services. Financial markets and credit institutions affecting agriculture.

421. Public Policy Issues in Food and Agribusiness
Spring. 3(3-0)
P: EC 201, FSM 200. R: Not open to freshmen and sophomores.
Objectives, rationale, and consequences of public policy for food and agriculture. Analysis of economic implications for food and agribusinesses, farmers, consumers, and society.

429. Agribusiness Management
Spring. 3(4-0)
P: FSM 330. R: Open only to seniors and graduate students.
Analysis of agribusiness management functions including planning, organizing, and controlling. Integration of production, marketing, and financial aspects of agribusiness. Solutions to agribusiness managerial problems.

439. Food Business Analysis and Strategic Planning
Fall. 3(3-0) Interdepartmental with Marketing and Logistics. Administered by Marketing and Logistics.
P: ML 335 or FSM 335; STT 201 or STT 200 or STT 315. R: Open only to juniors and seniors in College of Business and in programs for which MTA 439 is catalog-listed requirement.
Principles and techniques of business analysis and strategic planning applied to food firms. Food trend forecasts, market potential, competition and cost analyses, business and strategic planning.

441. Commodity and Futures Marketing
Spring. 3(3-0)
P: FSM 200, EC 201; STT 200 or STT 201 or STT 315. R: Not open to freshmen and sophomores.
Supply, demand and prices in commodity markets. Futures and options and their role in forward pricing. Agricultural and food markets.

443. Food Industry and Cooperative Marketing
Spring. 3(3-0)
P: FSM 200. R: Not open to freshmen and sophomores.
Multiple firm and cooperative marketing methods. Organization and operation of cooperatives, marketing orders, trade associations and other forms of group action in the food system.

462. Agricultural Development in Less Developed Countries
Fall. 3(3-0)
P: EC 201; PRM 260 recommended. R: Not open to freshmen and sophomores.
Factors responsible for agricultural growth, as well as technical and institutional change. Sustainable strategies for increasing food production and rural incomes.

490. Independent and Supervised Study
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 7 credits in all enrollments for this course.
P: FSM 200; ML 335 or FSM 330. R: Open only to FSM majors. Approval of department; application required.
In-depth independent study of topics and issues affecting the food system. Complementary to previous coursework, adapted to career aspirations.

FORESTRY FOR

Department of Forestry
College of Agriculture and Natural Resources

101. Michigan's Forests
Spring. 3(3-0)
Ecological, social and economic roles of Michigan's forests in historic and contemporary context. Geographic similarities and differences in forest resources.

201. Tenets of Forestry
Fall. 1(1-0)
R: Open only to Forestry students. Completion of Tier I writing requirement.
History, founding principles, and core concepts of forestry. Stewardship, conservation, professional ethics, and current forestry issues.

202. Introduction to Forestry
Fall, Spring. 3(3-0)
Historical development of forestry. Forest growth, protection, management, and products. Relationship of national and world economy and policy to forestry. Emphasis on multiple uses of forests.

204. Forest Vegetation
Fall. 4(3-3)
Nomenclature, classification, and identification of woody plants. Tree structure as it relates to growth and ecosystem dynamics.

207. Natural Resource Data Analysis
Spring. 3(2- 2)
P: CPS 100 or CPS 130 or CPS 131 or approval of department.
Quantitative analysis of natural resource data. Modeling and display of biophysical and socio-economic data related to natural resource systems.

210. Fundamentals of Soil and Landscape Science
Fall. 3(2-3) Interdepartmental with Crop and Soil Sciences. Administered by Crop and Soil Sciences.
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.

220. Forests and the Global Environment
Fall. 3(3-0)
Relationships between forests, climatic and edaphic factors, and human influences upon forest resources. Deforestation, biodiversity, sustainable forest management and timber trade.

304. Wood Technology
Fall. 4(3-2)
P: CEM 141, PHY 231. R: Not open to freshmen and sophomores.
Structure and identification of wood. Physical and mechanical characteristics. Major industrial timber utilization processes including manufacture of lumber, furniture, composites, and paper.

306. Forest Biometry
Spring. 4(3-2)
P: MTH 116, FOR 201, FOR 204. R: Not open to freshmen and sophomores.
Describing location and area of forest resources. Quantification of site, stand, and tree characteristics. Sampling and inventory. Predicting growth and yield.

404. Forest and Agricultural Ecology
Fall. 4(3-3) Interdepartmental with Crop and Soil Sciences.
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. Silviculture
Spring. 4(3-3)
P: CSS 210, FOR 204. R: Not open to freshmen and sophomores.
Ecophysiology of tree growth and reproduction. Stand structure, composition and growth. Intermediate stand treatments. Natural and artificial reproduction. Silvicultural techniques.

408. Forest Management
Spring. 4(3-2)
P: FOR 420.
Management of forests for timber production in a multiple-use context. Yield projections, harvest scheduling, management prescriptions, project analysis and administration.

409. Forest Hydrology
Spring of odd-numbered years. 3(2-3) Interdepartmental with Crop and Soil Sciences, and Resource Development.
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.

420. Forestry Field Studies
Summer. 3 credits. Offered only at W.K. Kellogg Biological Station and Manistee National Forest.
P: FOR 304, FOR 306, FOR 404, FOR 406. R: Open only to juniors and seniors in College of Agriculture and Natural Resources.
Major forest management concepts. Ecology, silviculture, soils, biometry. Timber harvesting and use. Forest protection. Field trips required.

422. Woody Plant Genetics
Fall. 3(2-2)
P: BOT 105, BOT 301, CSS 350.
Applications of plant breeding and genetic principles to improve tree species and to preserve biological diversity in forest ecosystems for human benefit.

430. Law and Resources
Fall. 3(3-0) Interdepartmental with Resource Development and Public Resource Management. Administered by Resource Development.
P: RD 201; EC 201 or GBL 395. R: Not open to freshmen and sophomores.
Legal principles applied to natural resource use. Sovereignty, property rights, land and water use, jurisdiction, public trust doctrine, fish and game law, mineral rights, and eminent domain. Case and statutory law analysis.

441. Plant Breeding and Biotechnology
Spring. 4(3-2) Interdepartmental with Crop and Soil Sciences, and Horticulture. Administered by Crop and Soil Sciences.
P: CSS 350.
Plant improvement by genetic manipulation. Genetic variability in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars.

450. Forestry in International Development
Fall. 3(3-0) Interdepartmental with Sociology.
P: FOR 404 or FOR 464. R: Open only to seniors and graduate students.
Biophysical, social and economic factors influencing design and implementation of farm, village and community level forestry and agroforestry projects.

451. Cellular and Molecular Principles and Techniques for Plant Sciences
Spring. 4(2-6) Interdepartmental with Crop and Soil Sciences, and Horticulture. Administered by Crop and Soil Sciences.
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.

460. Arboriculture
Fall. 3(2-2)
P: BOT 105; FOR 204, or HRT 211. R: Not open to freshmen and sophomores.
Tree selection and planting to fit climatic, space and edaphic conditions. Diagnosing tree abnormalities. Cultural practices used in the care and maintenance of shade and ornamental trees. Field trip required.

461. Urban Forestry
Spring. 3(3-0)
P: FOR 204 or HRT 211. R: Not open to freshmen and sophomores.
Trees in improving the urban environment. Principles of urban forest management: legal, economic, organizational, and cultural. Street tree planning and inventory systems. Utility forestry and commercial arboriculture. Field trips required.

464. Natural Resource Economics and Social Science
Fall. 3(2-2) Interdepartmental with Park and Recreation Resources, Fisheries and Wildlife, and Resource Development.
P: EC 201 or EC 202. R: Not open to freshmen and sophomores.
Application of economic and social science principles and techniques to production and consumption of natural resources. Benefit-cost analysis. Regional impact analysis. Social impact assessment.