Introduction to the science and art of horticulture including plant breeding, ornamental plant and food production (organic and traditional), postharvest handling, horticultural industries and landscaping. Educate consumers about horticultural plants, products, and their relationship to environment.

Contemporary research and movements involving agricultural and food system sustainability. Socio-cultural factors influencing food and agriculture.

Introduction to Sustainable Agriculture and Food Systems
Fall, Spring. 2(2-0) Interdepartmental with Animal Science and Crop and Soil Sciences and Community Sustainability. Administered by Crop and Soil Sciences, R: Open to undergraduate students or agricultural technology students.

Crop scouting and agricultural clientele interactions for improved crop management. Offered first ten weeks of semester.

Introduction to Horticulture Fall, Spring. 2(2-0) SA; HRT 201 Concepts and practices of horticulture. Crop selection and management, factors affecting plant growth and development, and plant identification. Field trip required.

Plant Propagation and Use Spring, 3(2-2) SA; HRT 204L, HRT 194 Asexual and sexual propagation. Genetic variation and plant selection/breeding. Plant production, use and plant identification. Field trip required.

Plant Mineral Nutrition Spring, 1(3-0) P; CSS 210 RB; HRT 203 Mineral elements required by plants. Essential elements, effect of soil and potting media on nutrient availability, absorption and function in plant physiology, and nutrient deficiency and toxicity symptoms. Methods of monitoring and managing plant nutrient levels. Class meets first five weeks of semester.

Training and Pruning Plants Spring, 1(2-2) Principles and techniques of pruning for landscape and nursery ornamentals, Christmas tree production, tree fruits, and small fruits. Pruning practices, equipment, and basic large tree care techniques. Class meets last five weeks of the semester.

Horticulture Career Development Fall, 1(1-0) Internship preparation and identification of employment opportunities. Career goal establishment, resume construction, correspondence development, personal budgeting, interview skills and strategies.

Landscape Plants I Fall, 3(2-2) R: Open to undergraduate students or agricultural technology students. Identification, adaptation, and evaluation of shade trees, narrow-leaved evergreens, shrubs, woody vines, herbs, ornamental grasses, and herbaceous perennials.

Landscape Plants II Fall, Spring, 3(2-2) R: Open to undergraduate students or agricultural technology students. Identification, adaptation, and evaluation of flowering trees and shrubs, evergreen trees and shrubs, ground covers and bulbs.

Landscape Maintenance Fall, Spring of odd years. 2(2-0) R: Open to undergraduate students or agricultural technology students. Ornamental plant management. Plant growth and development related to pruning, fertilization, irrigation, weed control, transplanting; development of landscape management specifications; integrated plant management and plant health care programs.

Landscape Maintenance Field Laboratory Fall, 1(0-2) P: HRT 213 or concurrently R: Open to undergraduate students or agricultural technology students. Landscape maintenance. Site analysis. Pruning woody plants, transplanting by hand and mechanical tree spade, and planting techniques for ornamentals. Herbaceous perennial care, cutting back, dividing. Scouting as a component of integrated pest management and plant health care programs.

Landscape and Turfgrass Business Operations Spring, 2(3-0) R: Open to undergraduate students or agricultural technology students. SA: AT 082 Organizing, marketing, and directing a business enterprise within the turf and landscape industry. Project estimating, bidding, payroll, equipment, and accounting. Offered first ten weeks of semester.

Irrigation Systems for Horticulture-Spring, 2(2-0) R: Open to undergraduate students or agricultural technology students. Irrigation design, installation, maintenance, hydraulics, equipment and component selection, pumps, troubleshooting, best management practices, water quality and conservation.

Irrigation Systems for Horticulture Laboratory Spring, 1(0-2) P: HRT 218 or concurrently R: Open to undergraduate students or agricultural technology students. Irrigation design, installation, maintenance, controller programming, assembly of equipment and components, electrical and hydraulic troubleshooting.

Landscape Computer Aided Design Spring of even years. 2(3-0) RB; CSE 101 or CSS 110 Computer Aided Design (CAD) for landscape design. Calculations, take offs, perspective drawings using AutoCAD software. Offered first ten weeks of semester.

Annual and Aquatic Landscape Plants Fall, 3(2-2) R: Open to undergraduate students or agricultural technology students. Identification and evaluation of annuals, biennials and aquatic plants used in landscapes and for other horticultural purposes.

Greenhouse Structures and Management Fall, 3(3-0) Planning and operation of a commercial greenhouse. Structures, coverings, heating, cooling, ventilation, irrigation, fertilization, root media, and pest control.

Sustainable Farm and Food Systems Fall Studies Fall, Spring of odd years. 2(2-0) R: Open to undergraduate students or agricultural technology students. Field visits to farm and food system operations that utilize sustainable practices in Michigan. Offered first half of semester.

Clerkship in Grape Harvesting and Processing Fall of even years. 1(0-2) Fall: Northwestern Michigan College. R: Open to undergraduate students or agricultural technology students. Hands-on skills in the management of grape harvest and processing; winery and cellar operations. Course meets on-farm. Field trips required.

Principles of Viticulture Spring of even years. 3(3-0) Spring: Northwestern Michigan College. P: PLB 105 R: Open to undergraduate students or agricultural technology students. SA: HRT 432 Grapevine physiology, grape production, cultural practices and vineyard management. Field trip required.

Field Practices of Viticulture Summer of even years. 3(2-2) P: HRT 232 R: Open to undergraduate students or agricultural technology students. Cool climate grape production and vineyard management. Field trips required.

Current Issues in Viticulture and Enology Spring of even years. 1(1-0) Spring: Northwestern Michigan College. A student may earn a maximum of 3 credits in all enrollments for this course. R: Open to undergraduate students or agricultural technology students. SA: HRT 334 Grape, juice, and wine production. Current and new technologies. Wine sales and marketing. Vineyard and winery establishment and management. Presentations and discussions by MSU faculty and Michigan grape and wine industry professionals.
242 Passive Solar Greenhouses for Protected Cultivation
Spring, 1(1-0): R: Open to undergraduate students or agricultural technology students.
Season extension and year-round vegetable, herb, flower, and fruit production in unheated, low cost passive solar greenhouses. Marketing options, site selection, site preparation, structures, and organic crop management methods. Field trip required.

243 Organic Transplant Production
Spring, 1(1-0)

251 Organic Farming Principles and Practices
Spring, 3(3-0) Interdepartmental with Crop and Soil Sciences. Administered by Horticulture. History and principles of organic farming. Farms as ecological systems. Certification process and agencies. Organic matter management, the soil food web, and nutrient availability. Biodiversity, crop rotations, plant competition, ground cover, and plant health. Integrating crops and animals. Organic animal husbandry. Field trip required.

253 Compost Production and Use
Spring, 1(1-0): R: Open to undergraduate students or agricultural technology students.
Process and methods of composting, maturity and quality analysis, and use of compost products at home and farm scale. Field trip required.

290 Independent Study in Horticulture
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to students in the Institute of Agricultural Technology. SA: HRT 075
A planned learning experience developed by the student in cooperation with a faculty member.

310 Nursery Management
Fall, 3(2-3): P: HRT 203 or HRT 109 SA: HRT 071, HRT 210
Management and cultural practices of field and container grown nursery operations. Site selection and development, financing, legal restrictions, personnel management, production practices, nutrition, irrigation, weed and pest control, modification of plant growth, storage, shipping, and marketing. Field trip required.

311 Landscape Design and Management Specifications
Spring, 4(3-2) Interdepartmental with Landscape Architecture. Administered by Horticulture. P: HRT 211 and (HRT 212 or concurrently). Landscape design techniques, spatial organization, plant selection, plant and site interaction. Relationship between design, construction, and maintenance. Preparation of planting and maintenance specifications.

323 Floriculture Production: Herbaceous Perennials and Annuals
Spring of even years. 3(2-3): P: HRT 203 and (HRT 204 or concurrently) and HRT 221
Commercial greenhouse and outdoor production of herbaceous perennials, annuals, and other plants typically sold in retail nurseries for outdoor gardens. Plant identification, propagation, production, scheduling, and finishing procedures based on specific plant growth requirements. Plant selection, marketing, and retailing issues.

332 Tree Fruit Production and Management
Fall, 3(2-2): P: HRT 203 or PLB 105 or PLB 203
Commercial apple, cherry, peach, and pear production. Cultural practices to manipulate growth and development and optimize fruit yields and quality. Field trips required.

336 Viticulture and Berry Production
Spring, 2(1-2): P: HRT 203 or HRT 251 or HRT 221
Commercial production of grapes, blueberries, strawberries, raspberries, blackberries, cranberries and minor fruit. Physiology, growth and development of these species. Cultural practices used to optimize fruit yields and quality. Field trip required.

341 Vegetable Production and Management
Spring, 3(3-0): P: HRT 203 or (HRT 251 or concurrently) SA: HRT 440, HRT 442
Field production of vegetable crops. Marketing systems, tillage practices, field establishment, cultural management, pest management, harvesting, and postharvest handling and storage.

361 Applied Plant Physiology
Fall, 3(3-0): P: PLB 105 or BS 161 or BS 171 RB: HRT 203 and HRT 204
Whole plant physiological and growth responses of plants to light, temperature, and gases during commercial plant production. Coordination and management of growth for optimum production and quality.

362 Applied Crop Improvement
Spring, 1(3-0): P: HRT 203 and PLB 105
History of plant improvement. Basic genetic principles of crop breeding and biotechnology. Class meets weeks 6 to 10 of the semester.

401 Advanced Horticultural Crop Physiology
Spring, 3(3-0): P: HRT 361 or PLB 301 R: Not open to freshmen or sophomores. SA: HRT 480
Physiological and flowering responses of horticultural crop plants to environmental variables. Adaptive responses of plants to environmental stress. Management of these factors for optimum production.

403 Handling and Storage of Horticultural Crops
Fall, 3(2-3): P: BS 161 or PLB 105 R: Not open to freshmen or sophomores. SA: HRT 492
Biological principles involved in quality maintenance of horticultural products. Control of deterioration during harvesting, handling, transport, and storage.

404 Horticulture Management (W)
Spring, 3(2-2): P: (HRT 203) and completion of Tier I writing requirement RB: EC 201 or EC 202 R: Open to seniors in the College of Agriculture and Natural Resources. SA: HRT 498
Integration of management, economic, marketing, and horticultural production principles to develop personnel, financial, and resource strategies. Horticultural business plan development in a team situation. Effects of business decisions on people and profits.

405 Sustainable Practices for Horticultural Food Crop Production
Spring, 1(1-0): P: HRT 203

407 Horticulture Marketing
Fall, 3(2-2) RB: EC 201 or EC 202 R: Open to juniors or seniors or graduate students in the College of Agriculture and Natural Resources.
Demographic and purchase trends of perishable horticultural commodities including landscape and floral crops, and fruits and vegetables. Market segmentation and product targeting, distribution, branding and packaging, and advertising and promotion. Services as a critical component of strategic business planning.

411 Landscape Contract Management

415 Natural Landscapes, Native Plants and Landscape Restoration
Fall of even years. 3(3-0): P: HRT 211 or HRT 212 or BS 162 or LB 144 R: Not open to freshmen.
Natural landscapes, native plants and landscape restoration options for natural and built environments. Planning and design approaches, site engineering, construction practices, and management guidelines. Case studies, regulatory policies, contracts, services, resources and issues. Field trip required.

417 Sustainable Sites and Environmental Landscape Practices
Fall of odd years. 3(3-0): P: HRT 211 or HRT 212 R: Not open to freshmen.
Sustainable sites and environmental landscape practices integrated into the built environment. Planning and design approaches, site engineering, construction practices, and management guidelines. Case studies, specifications, certification programs.

420 Cover Crops in Agroecosystems
Fall, 3(2-2) Interdepartmental with Crop and Soil Sciences. Administered by Crop and Soil Sciences. P: CSS 101 or HRT 251 or HRT 341 and CSS 210 and Completion of Tier I Writing Requirement
Management, environmental, economic, and social considerations of cover crops across agroecosystems.
843 Forum in Computational and Plant Sciences
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Biochemistry and Molecular Biology and Computational Mathematics, Science, and Engineering and Crop and Soil Sciences and Plant Biology. Administered by Plant Biology. Professional development focused on diverse modes of communication in support of interdisciplinary science with an emphasis on plant and computational sciences.

844 Frontiers in Computational and Plant Sciences
Spring. 3(3-0) Interdepartmental with Biochemistry and Molecular Biology and Computational Mathematics, Science, and Engineering and Crop and Soil Sciences and Plant Biology. Administered by Crop and Soil Sciences. RB: Basic programming, mathematical modeling, and statistics. Interdisciplinary research interfacing computational and plant sciences. Molecular system biology, phenomics, and mechanisms connecting genotype and phenotype.

860 Scientific Writing: Workshop
Spring. 1(1-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open to graduate students.
Development of scientific writing skills.

863 Environmental Plant Physiology
Spring of odd years. 3(3-0) Interdepartmental with Plant Biology. Administered by Plant Biology. RB: PLB 301 or PLB 414 or PLB 415 SA: BOT 863
Interaction of plant and environment. Photobiology, thermophysiology, and plant-water relations.

865 Plant Growth and Development
Fall of even years. 3(3-0) Interdepartmental with Plant Biology. Administered by Plant Biology. RB: PLB 415 SA: BOT 865
Genetics and molecular biology of development in higher plants as influenced by genes and environment. Biosynthesis, action and signal transduction of phytohormones and other signaling molecules. Initiation, formation and patterning of plant organs and cell types. Genetic mechanisms underlying developmental diversity.

883 Environmental Design Seminar
Spring. 3(3-0) Interdepartmental with Interior Design and Landscape Architecture. Administered by Landscape Architecture. RB: Undergraduate design degree. R: Open to graduate students in the Department of Horticulture or in the School of Planning, Design and Construction. SA: Examination of the breadth of environmental design projects. Literature review of focused projects. Development of practicum or thesis proposals.

890 Independent Study
Fall, Spring. Summer. 1 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department.
Individual study of problems of special interest.

891A Selected Topics in Horticulture
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 the Department of Horticulture. Approval of department. Horticultural science topics of current interest and importance.

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 Crop and Soil Sciences and Forestry. Administered by Horticulture. R: Open only to graduate students in the Plant Breeding and Genetics major or Genetics major. 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 Crop and Soil Sciences and Forestry. Administered by Horticulture. Experience in review, organization, oral presentation, and analysis of research.

894 Horticulture Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Experience in review, organization, oral presentation and analysis of research.

898 Master's Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 6 credits in all enrollments for this course. R: Approval of department. Master's degree Plan B project.

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 graduate students in the Department of Horticulture. Master's thesis research.

941 Quantitative Genetics in Plant Breeding
Spring of even years. 3(2-2) Interdepartmental with Crop and Soil Sciences and Forestry. RB: CSS 819 and STT 464
Theoretical and genetic basis of statistical analysis of quantitative traits using genetic markers. Computational tools for the study of quantitative traits.

999 Doctoral Dissertation Research
Fall, Spring. Summer. 1 to 24 credits. A student may earn a maximum of 36 credits in all enrollments for this course. R: Open to doctoral students in the Department of Horticulture. Doctoral dissertation research.