322 Floriculture Production I: Potted Plants and Cut Flowers
Fall. 3(1-4) P:M: HRT 203 and HRT 203L and HRT 204 and HRT 204L and (HRT 221 or concurrently)
Commercial greenhouse and outdoor production of flowering and foliage potted plants and cut flowers. Plant identification, propagation, production, scheduling, and finishing procedures based on specific plant growth requirements.

323 Floriculture Production II: Herbaceous Perennials and Annuals
Spring. 3(2-3) P:M: HRT 203 and HRT 203L and HRT 204 or concurrently and (HRT 204L 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.

331 Tree and Small Fruit Production and Management
Fall. 3(3-0) R: Open only to students in the Viticulture and Enology major. Approval of department; application required.

334 Current Issues in Viticulture and Enology
Spring of even years. 1(1-0) A student may earn a maximum of 3 credits in all enrollments for this course. R: Open only to students in the Viticulture and Enology major. 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.

341 Vegetable Production and Management
Spring. 3(2-3) P:M: HRT 203 and HRT 203L and (HRT 204 or concurrently) and (HRT 204L 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.

382 Turfgrass Physiology
Spring. 2(3-0) Interdepartmental with Crop and Soil Sciences. Administered by Crop and Soil Sciences. P:M: (CSS 232) Completion of Tier I writing requirement. RB: PLB 105 SA: CSS 282, CSS 068 Not open to students with credit in CSS 332.
Physiological principles of turfgrass growth and development. Water relations, light, temperature, respiration, photosynthesis, mineral nutrition, and hormone action. Impact of mowing, cultivation, and traffic on turfgrass growth.

391 Special Topics
Fall. 1 to 2 credits. A student may earn a maximum of 9 credits in all enrollments for this course. Specific topics in horticulture of current interest and importance. Possible field trips.

394 Retail Florist Practicum
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 3 credits in all enrollments for this course. A student may earn a maximum of 6 credits in HRT 394 and HRT 493. R: Approval of department; application required. SA: HRT 394A
Customer relations. Floral design, flower buying, holiday planning, advertising, display. Financial recordkeeping. Flower care and handling.

401 Physiology and Management of Herbaceous Plants
Fall. 3(3-0) P:M: HRT 221 and BOT 301 R: Not open to freshmen or sophomores. Physiological and flowering responses of herbaceous plants to light, temperature, nutrients, and gases. Management of these factors for optimum production.

403 Handling and Storage of Horticultural Crops
Fall. 3(2-3) P:M: BOT 105 or BS 110 R: Not open to freshmen or sophomores. SA: HRT 482
Biological principles involved in quality maintenance of horticultural products. Control of deterioration during harvesting, handling, transport, and storage.

404 Horticulture Management (W)
Spring. 3(2-3) P:M: Completion of Tier I writing requirement. RB: (EC 201 or EC 202) and (HRT 203 and HRT 204) or (CSS 370 or FOR 404) R: Open only to seniors in the College of Agriculture and Natural Resources. SA: HRT 488
Integration and management of 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.

407 Horticulture Marketing
Fall. 3(2-2) RB: (HRT 203 and HRT 204) and (EC 201 and EC 202) and (HRT 210 or concurrently) or (HRT 322 or concurrently) or (HRT 323 or concurrently) or (HRT 331 or concurrently) or (HRT 341 or concurrently)
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
Fall. 3(2-2) RB: HRT 311

419 Landscape Design Practicum
Fall, Spring. 2 to 4 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P:M: HRT 111 or HRT 311 R: Approval of department; application required. Application of landscape design theory and practice to landscape development projects. Client interaction, site visits and design, plan development, and construction and management specifications. Residential, commercial and public landscape projects.

432 Principles and Practices of Grape Production I
Spring. 3(3-0) P:M: CEM 141 and CEM 161 and CSE 101 R: Open only to students in the Viticulture and Enology major. Grapevine physiology, structure, and function. Techniques for vineyard establishment. Cultivar and rootstock selection, influence of environmental factors on vine growth, plant site selection and preparation, training and trellising systems, cultural practices for canopy management, and methods of crop control.

432L Principles and Practices of Grape Production I Laboratory
Spring. 2(0-4) P:M: CEM 141 and CEM 161 and CSE 101 R: Open only to students in the Viticulture and Enology major. C: HRT 432 concurrently.

433 Principles and Practices of Grape Production II
Summer. 3(3-0) P:M: HRT 432 and HRT 432L R: Open only to students in the Viticulture and Enology major. Canopy management, disease and pest control, and the influence of crop adjustment on vine physiology. Environmental effects on fruit maturation. Vineyard sampling techniques and harvesting practices for improved fruit quality.

433L Principles and Practices of Grape Production II Laboratory
Summer. 2(0-4) P:M: HRT 432 and HRT 432L R: Open only to students in the Viticulture and Enology major. C: HRT 433 concurrently.
Vineyard management. Climate, crop load and vine physiology. Effects of pre- and post-veraison practices on vine and fruit development. Disease and pest control strategies. Vineyard berry sampling techniques and laboratory methods to assess fruit quality for harvest.

434 Principles and Practices of Wine Production I
Fall. 3(3-0) P:M: CEM 142 and CEM 162 and CSE 101 R: Open only to students in the Viticulture and Enology major. Origin and history of wine and wine production. Determination and timing of harvest, methods of postharvest handling, storage, and processing of grapes into juice and wine. Physical and chemical changes in wine and processes. Must analysis and adjustment, fermentation, fining, and aging. Physiology of yeasts and bacteria involved in winemaking and spoilage. Cellar practices, problems, and operations.
434L Principles and Practices of Wine Production I Laboratory
Fall. 2(0-4) P:M: CEM 142 and CEM 162 and CSE 101 R: Open only to students in the Viticulture and Enology major. C: HRT 434 concurrently.
Continuation of wine production and winery practices. Instrumental analyses of wine, filtration testing, and bottling. Principles, microbiology, and chemistry involved in the production of good wines. Methods of fermentation, fining treatments, and cellar and small winery operations.

435 Principles and Practices of Wine Production II Spring. 3(3-0) P:M: HRT 434 and HRT 434L R: Open only to students in the Viticulture and Enology major. C: HRT 435 concurrently.
Plant improvement by genetic manipulation. Genotypic variability in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars. Importance of plant breeding to our food system, economy, and environment.

435L Principles and Practices of Wine Production II Laboratory
Spring. 2(0-4) P:M: HRT 434 and HRT 434L R: Open only to students in the Viticulture and Enology major. C: HRT 435 concurrently.
Procedures and analysis involved in wine production during the aging process. Management practices of a small winery, including quality analysis of wines and cellar and equipment concerns.

441 Plant Breeding and Biotechnology
Spring of even years. 3(3-0) Interdepartmental with Crop and Soil Sciences and Forestry. Administered by Crop and Soil Sciences. P:M: CSS 101
Plant improvement by genetic manipulation. Genetic variability in plants. Traditional and biotechnological means of creating and disseminating recombinant genotypes and cultivars. Importance of plant breeding to our food system, economy, and environment.

451 Biotechnology Applications for Plant Breeding and Genetics
Spring. 3(2-2) Interdepartmental with Crop and Soil Sciences and Forestry. Administered by Crop and Soil Sciences. RB: (CSS 350 or ZOL 341) and CSS 441
Principles, concepts, and techniques of agricultural plant biotechnology. Recombinant DNA technology, plant molecular biology and transformation in relation to plant improvement.

475 International Studies in Horticulture
Spring of odd years, Summer. 1 to 6 credits.
A student may earn a maximum of 6 credits in all enrollments for this course. RB: HRT 203 and HRT 204 R: Approval of department; application required.
Study and travel experience emphasizing contemporary problems, issues, and trends in horticulture.

477 Pest Management I: Pesticides in Management Systems
Fall. 3(3-0) Interdepartmental with Crop and Soil Sciences and Entomology and Fisheries and Wildlife. Administered by Entomology. RB: (CEM 243 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 Crop and Soil Sciences and Entomology and Forestry and Fisheries and Wildlife. Administered by Entomology. P:M: (ENT 404 or ENT 470 or PLP 405 or CSS 402) 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.

480 Woody Plant Physiology
Spring. 3(3-0) Interdepartmental with Forestry. Administered by Horticulture. P:M: PLB 105 or BS 110 R: Not open to freshmen or sophomores.
Physiology of carbon utilization. Effects of water, temperature, nutrition, and light on apical, vegetative, and reproductive growth of woody plants.

486 Biotechnology in Agriculture: Applications and Ethical Issues
Fall of even years. 3(3-0) Interdepartmental with Crop and Soil Sciences and Forestry and Philosophy. Administered by Horticulture. P:M: BOT 105 or BS 111 RB: 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 2 credits.
A student may earn a maximum of 6 credits in all enrollments for this course. P:M: HRT 203 and HRT 203L and HRT 204 and HRT 204L R: Approval of department; application required.
Independent study of horticulture on a field, laboratory or library research project of special interest to the student.

491 Selected Topics in Horticulture
Fall, Spring. 1 to 3 credits.
A student may earn a maximum of 6 credits in all enrollments for this course. P:M: HRT 203 and HRT 203L and HRT 204 and HRT 204L RB: HRT 202 R: Not open to freshmen or sophomores.
Selected topics in horticulture of current interest and importance.

493 Professional Internship in Horticulture
Fall, Spring, Summer. 3 credits.
A student may earn a maximum of 6 credits in all enrollments for this course. A student may earn a maximum of 6 credits in all enrollments for any or all of these courses: ABM 493, AEE 493, ANR 493, ANS 493, CSS 493, EEIP 493, FIM 493, FW 493, HRT 493, PKG 493, PLP 493, FRR 493, and RD 493. P:M: (HRT 203 and HRT 203L and HRT 204 and HRT 204L) R: Open only to juniors and seniors in the College of Agriculture and Natural Resources. Approval of department; application required.
Professional career related work experience supervised by a professional horticulturist. Requires 40 hrs per week for 12 to 14 weeks. Must enroll semester prior to completing work experience.

494 Industry-Master’s Apprenticeship
Fall, Spring, Summer. 3 credits.
A student may earn a maximum of 6 credits in all enrollments for this course. P:M: (HRT 433 and HRT 433L) or (HRT 435 and HRT 435L) R: Open only to students in the Viticulture and Enology major. Approval of department; application required.
A focused and supervised work experience with a grape or wine industry master. Intensive training in vineyard or winery techniques, operations and management.

803 Postharvest Physiology
Spring of odd years. 3(3-0)
Physiology, biochemistry and molecular biology of maturation, ripening and senescence of harvested horticultural crops.

811 Plant Developmental Genetics
Fall. 3(2-2) Interdepartmental with Plant Biology. Administered by Horticulture. RB: (ZOL 341 and CSS 350) and (PLB 415 and ZOL 320)
Genetic mechanisms controlling plant development. Model systems and internal, nonenvironmental factors. Methods for the study of plant development. The plant genome. Genetics underlying developmental diversity in higher plants.

816 Environmental Design Theory
Fall. 3(3-0) Interdepartmental with Human Environment and Design and Landscape Architecture and Park, Recreation and Tourism Resources. Administered by Landscape Architecture. RB: Undergraduate degree degree recommended.
Differences between normative theories, scientific theories, models, and constructs. Exploration of normative theories related to thesis or practicum.

817 Environmental Design Studio
Spring. 3(0-6) Interdepartmental with Human Environment and Design and Landscape Architecture and Park, Recreation and Tourism Resources. Administered by Landscape Architecture. RB: (LA 816 and LA 883) R: Undergraduate degree designation.
Development of a student-selected environmental design project in a collaborative setting.

819 Advanced Plant Breeding
Fall. 3(3-0) Interdepartmental with Crop and Soil Sciences and Forestry. Administered by Horticulture. RB: 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.

820 Plant Reproductive Biology and Polyploidy
Spring of odd years. 1(3-0) Interdepartmental with Crop and Soil Sciences and Forestry and Plant Biology and Plant Pathology. Administered by Horticulture. RB: Introductory Genetics and Plant Biology
Genetic processes underlying variations in plant reproductive biology and polyploidy. Utilization of these characteristics in plant breeding.

821 Crop Evolution
Spring of odd years. 1 credit.
Interdepartmental with Crop and Soil Sciences and Forestry and Plant Biology and Plant Pathology. Administered by Horticulture. RB: Introductory Genetics and Plant Biology
Cultural and biological aspects of the evolution of domestic plants.
Historical Geography of Crop Plants
Spring of odd years. 1 credit. Interdepartmental with Crop and Soil Sciences and Forestry and Plant Biology and Plant Pathology. Taught by Horticulture. RB: Introductory Genetics and Plant Biology Development and spread of the major crop species.

Techniques in Cytogenetics
Fall of odd years. 1(0-3) Interdepartmental with Crop and Soil Sciences and Forestry. Taught by Crop and Soil Sciences. Preparation of chromosomes from commercially important plants for cytogenetic analysis.

Population Genetics, Genealogy and Genomics
Fall. 3(3-0) Interdepartmental with Animal Science and Crop and Soil Sciences and Forestry and Fisheries and Wildlife and Genetics. Taught by Forestry. RB: Precalculus, basic genetics Population genetic processes underlying patterns of molecular genetic variation. Genealogical approaches to the study of genomic diversity, phylogenetic reconstruction, and molecular ecology.

Plant Mineral Nutrition
Fall of odd years. 3(3-0) Interdepartmental with Crop and Soil Sciences. Taught by Crop and Soil Sciences. RB: 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.

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

Techniques of Analyzing Unbalanced Research Data
Spring. 4(4-0) Interdepartmental with Animal Science and Crop and Soil Sciences and Forestry and Fisheries and Wildlife. Taught by Animal Science. RB: STT 464 R: Open only to graduate students in the College of Agriculture and Natural Resources. SA: 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.

Environmental Design Seminar
Fall. 3(3-0) Interdepartmental with Human Environment and Design and Landscape Architecture and Park, Recreation and Tourism Resources. Taught by Landscape Architecture. RB: Undergraduate design degree. Examination of the breadth of environmental design projects. Literature review of focused projects. Development of practicum or thesis proposals.

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.

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.

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. Taught 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.

Plant Breeding and Genetics Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. Interdepartmental with Crop and Soil Sciences and Forestry. Taught by Horticulture. Experience in review, organization, oral presentation, and analysis of research.

Horticulture Seminar
Fall, Spring. 1(1-0) A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department. Master's degree Plan B project.

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.

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.

Quantitative Genetics in Plant Breeding
Spring of even years. 3(2-2) Interdepartmental with Crop and Soil Sciences and Forestry. Taught by Crop and Soil Sciences. 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.

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 the Department of Horticulture. Doctoral dissertation research.