

Horticulture Science (HS)

HS 101 Introduction to Ornamentals and Landscape Technology (1 credit hours)

Introduction to the collegiate experience, academic skills of successful students, and scope, purpose, and objectives of the Agricultural Institute with an emphasis on areas related to the ornamental and landscape plants industry. Students will explore college and departmental resources, academic policies and procedure, the green industry, career opportunities, and current trends and issues in horticulture.

Requisite: Agricultural Institute Only
Typically offered in Fall only

HS 111 Plant ID (3 credit hours)

Identification, adaptation, culture, and use of ornamental trees, shrubs, vines, ground covers and herbaceous plants.

Requisite: Agricultural Institute Only
Typically offered in Fall only

HS 115 Plant Growth and Development (3 credit hours)

Examination of how plants grow and respond to environmental and cultural stimuli. Topics include: cell growth; flower, fruit, seed, shoot, and root development and functions; anatomy of stems, roots and leaves; hormonal regulation of growth; adaptations for survival; plant responses to temperature, light and gravity; photosynthesis, transpiration, and absorption of water and nutrients.

Requisite: Agricultural Institute Only
Typically offered in Fall only

HS 121 Plant Propagation (3 credit hours)

Principles and practices involved in sexual (seed) and asexual (vegetative) propagation of a variety of plants. Methods of asexual propagation include cuttings, layering, budding and grafting, division, separation, and micropropagation (tissue culture). Emphasis on factors affecting the regeneration of species by particular techniques.

Requisite: Agricultural Institute Only
Typically offered in Spring only

HS 131 Fruit & Vegetable Production (3 credit hours)

The objective of this course is to give students a fundamental and practical understanding of small-scale fruit & vegetable production in North Carolina. Agricultural Institute students only.

Requisite: Agricultural Institute Only
Typically offered in Spring only
This course is offered alternate odd years

HS 141 Greenhouse Crop Production (3 credit hours)

Production of greenhouse crops. Emphasis on greenhouse construction and environmental manipulation of crop growth. Site selection, construction materials, greenhouse design. Specific flowering crops as models to demonstrate potted flowering plant, cut flower, and bedding plant production systems. Hands-on crop production experience plus trips to commercial floriculture production and marketing facilities.

Typically offered in Spring only
This course is offered alternate odd years

HS 144/PP 144 Weeds & Diseases of Ornamentals (3 credit hours)

The objective of this course is to give students a fundamental and practical understanding of weed, disease, and pesticide management in the ornamental industries in North Carolina. Agricultural Institute students only.

Requisite: Agricultural Institute Only
Typically offered in Fall only

HS 151 Nursery Production (3 credit hours)

Total aspects of field and container nursery stock production including site selection and development, propagation, growing procedures, harvesting, marketing, shipping and labor management practices.

P: SSC 112 or instructor permission
Typically offered in Spring only
This course is offered alternate even years

HS 162 Landscape Maintenance (3 credit hours)

A study of the maintenance of landscaped areas including plant material selection, installation, pruning, fertilization, and pest control of trees, shrubs, lawns, flower beds, and interior plants.

Requisite: Agricultural Institute Only
Typically offered in Fall only

HS 171 Landscape Construction (3 credit hours)

This course will provide students a fundamental and practical understanding of landscape construction techniques and equipment. AGI students only.

Requisite: Agricultural Institute Only
Typically offered in Spring only
This course is offered alternate even years

HS 200 Home Horticulture (3 credit hours)

Introduction and review of home horticulture as it relates to the horticultural enthusiast. A general understanding of plant growth, structure, and development; house plant selection and care, selecting trees, shrubs, and flowers for the home landscape, and other related topics. Note: this course was previously offered as HS 100.

GEP Natural Sciences
Typically offered in Fall, Spring, and Summer

HS 201 The World of Horticulture: Principles and Practices (3 credit hours)

Principles of plant growth and development relating to production and utilization of fruit, vegetable, floricultural, and ornamental crops. Historical, economic, and global importance of horticultural crops and services.

GEP Natural Sciences
Typically offered in Fall, Spring, and Summer

HS 201A The World of Horticulture: Principles and Practices (3 credit hours)

Principles of plant growth and development relating to production and utilization of fruit, vegetable, floricultural, and ornamental crops. Historical, economic, and global importance of horticultural crops and services.

GEP Natural Sciences
Typically offered in Fall, Spring, and Summer

HS 202 Home Plant Identification (3 credit hours)

An introductory course developed in conjunction with Longwood Gardens on plant taxonomy, identification, characteristics, and use in the home landscape. A palette of 150 plants will be covered including identification by scientific and common names and aspects of their cultivation. Not for Horticultural Science Majors [SH, THG, THL].

Typically offered in Spring only

HS 203 Home Plant Propagation (3 credit hours)

Not for Horticultural Science Majors (SH, THG, THL). Substitution of HS 203 for HS 301 are not allowed. An introduction to the basic principles of sexual and asexual plant propagation, including seeds, cuttings, layering, Grafting, and Division.

GEP Natural Sciences

Typically offered in Spring only

HS 204 Home Landscape Maintenance (3 credit hours)

An understanding of the basic principles of landscape maintenance including, but not limited to, soil fertility and management, tree biology, pruning, turfgrass maintenance, plant selection, irrigation management and waterwise gardening, integrated pest management, and hardscape construction. Not for Horticultural Science majors (SH, THG, THL).

Prerequisite: HS 200 or HS 201

GEP Natural Sciences

Typically offered in Fall and Spring

HS 205 Home Food Production (3 credit hours)

Home food production will play an important role in increasing the sustainability of the world's food systems for the foreseeable future. The goal of this course is to familiarize students with the scientific knowledge and tried-and-true practices needed to successfully produce food at home, even in small-scale environments such as decks and patios. On-campus students will be required to participate in two Saturday field trips to visit local home gardens. Distance education students will be required to visit two home gardens in their area. Not for Horticultural Science Majors (SH, THG, THL).

Typically offered in Fall and Spring

HS 215/ANS 215 Agricultural Genetics (3 credit hours)

To provide an introduction to the science of genetics as applied to agriculture. Emphasis is given to qualitative and quantitative genetics. By the end of this course, students should be able to apply genetic concepts to efficiently solve problems and make predictions necessary for "real-life" agricultural situations.

Prerequisite: BIO 183 or equivalent or instructor's consent

GEP Natural Sciences

Typically offered in Fall only

HS 242 Landscape Design Introduction (3 credit hours)

Landscape Horticulture is concerned with the small-scale design and use of plants and other materials to help humans relate better to the land. In this course, we will pursue an understanding of this relationship and explore the social, environmental, and economic implications of landscape design and the processes by which this understanding can be employed to design residential landscapes. There are an infinite number of design possibilities for each project, so it's a designer's responsibility and challenge to develop a creative and functional design that accommodates the needs of the users and is appropriate for a specific site.

GEP Visual and Performing Arts

Typically offered in Spring only

HS 250 Home Landscape Design: Creating Garden Spaces (3 credit hours)

Home landscape design is a 3-credit hour course for non-landscape design majors. Students will be introduced to the various issues associated with landscape design at the residential level. Through a series of Power Point lectures, on-line discussions, and small projects/exercises, students will gain an understanding of landscape graphics. Skills in design, and develop landscape plans and other forms of landscape graphics. Students will use all of their learned skills to develop a design for a given site using provided design software.

Typically offered in Summer only

HS 252 Landscape Design Graphic Communication (3 credit hours)

This class is an introduction to the basic graphic skills necessary to develop and communicate creative ideas in landscape design. In the design process, we use graphic skills to communicate our ideas, starting with analysis, moving on to concept, then to design development, and finally to illustrative renderings. The design process will be introduced and serve as a backdrop for incrementally introducing graphic skills. The class will become confident in the use of manual drawing skills, and will be introduced to the use of computer drafting skills. Graphics supplies, with an estimated expense of \$120.00, are required for the course.

Prerequisite: Horticultural Science Majors

Typically offered in Spring only

HS 272 Landscape Design/Build (4 credit hours)

This course will consist of the development of design and construction projects, which will incorporate the entire design process culminating with a complete set of construction documents, cost predictions and built projects. Critical and creative thinking strategies are incorporated in teaching and learning activities. Course materials and experiences will prepare the student for further design/build experiences as well as the NC Landscape Contractor's Licensing Exam.

Prerequisite: HS 201 and HS 242

Typically offered in Fall only

HS 275 Floral Design (3 credit hours)

This course explores the history of floral design, care, handling, and identification of fresh cut flowers, the use of tools, equipment, and supplies and the application of basic design styles, and displays. Students will gain hand-on experience in creating a wide variety of floral displays and will be able to keep their arrangements. An additional fee (not greater than \$200) will be assessed to your tuition bill for fresh flower supplies for the semester for this class.

GEP Visual and Performing Arts

Typically offered in Fall only

HS 280 Hands-On-Horticulture (3 credit hours)

This course will provide students a fundamental and practical understanding of applied techniques in horticulture. Students will learn basic hardscape construction, basic wooden landscape structure construction, vegetable harvest, propagation of perennial plants, principles of irrigation installation, safe and efficient use of landscape equipment including arboriculture, and professional certification and licensing. Pesticide Licensing Fee of \$75 required.

Typically offered in Summer only

HS 290 Horticulture: Careers and Opportunities (1 credit hours)

Introduction and orientation to programs in horticultural science. Discussion of the current status of horticulture, extension and research. Emphasis on undergraduate program management, internships, graduate education, and career planning. Guest lectures, career opportunities and qualifications for employment in horticulture and related fields.

Typically offered in Fall only

HS 301 Plant Propagation (4 credit hours)

Theoretical basis and techniques for successful asexual and sexual propagation of seed plants and ferns. Influence of heredity, phytopathological infection, and environmental conditions on success and quality of propagules. Recent developments and innovations in propagation techniques and methodologies.

P: BIO 181 or PB 200; R: Restricted to students majoring or minoring in HS only. HS 203, Home Plant Propagation is recommended for students in other programs.

Typically offered in Fall and Spring

HS 302 Gardening with Herbaceous Perennials (3 credit hours)

Examination of the use of herbaceous perennials in the home garden and commercial landscapes. Topics include: general plant characteristics, culture and management, garden attributes, design usage, horticultural history, propagation, use of exotic [nonnative]species in the garden, heirloom roses and ornamental grasses.

Typically offered in Spring only

HS 303 Ornamental Plant Identification I (3 credit hours)

Identification, distribution, growth, characteristics, adaptation, and usage of ornamental plants. Emphasis on bedding plants, trees and gymnosperms.

Prerequisite: BIO 181

GEP Natural Sciences

Typically offered in Fall only

HS 304 Ornamental Plant Identification II (3 credit hours)

Identification, distribution, growth, characteristics, adaptation, and usage of ornamental plants. Emphasizes shrubs, ground covers, and vines.

Prerequisite: BIO 181

GEP Natural Sciences

Typically offered in Spring only

HS 357 Landscape Design Grading and Drainage (4 credit hours)

This course is an introduction to landforms, site grading and drainage, and the manipulations of such landforms necessary to create built landscapes. Site design, site development, and site engineering all refer to the process of grading and drainage. Grading and drainage are processes used to reshape the earth's surface and to convey surface water runoff.

Prerequisite: Landscape Horticulture (11HORTTHL) students, HS 242 and 252

Typically offered in Spring only

HS 400 Residential Landscaping (4 credit hours)

Equips students with the necessary skills to create functional, aesthetic, and humanistic designs for residential and other small scale projects. Aspects of problem identification, project organization, design, execution, and evaluation. Required field trip with fee.

Prerequisite: HS 242, HS 252, HS 303, HS 304, and HS 357

Typically offered in Spring only

HS 403/HS 503 Plant Micropropagation and Tissue Culture (3 credit hours)

The course will introduce advanced plant propagation methods that cover micropropagation, tissue culture, sterile seed sowing, embryo rescue, fern spore culture, anther/pollen culture, and plant acclimation. Biotechnology based on tissue culture, including polyploid manipulation and gene transformation, will be also introduced. Emphasis will be placed on the technical aspects of plant propagation, as well as the biological basis for the responses demonstrated by plant species to different micropropagation protocols.

Prerequisites: C- or better in HS 301, or C- or better in CS 211, or C- or better in HS 215, or C- or better in GN 311, or C- or better in PB 250.

Typically offered in Fall only

HS 410/CS 410 Community Food Systems (3 credit hours)

This course explores the economic, socio-cultural, policy and health perspectives of community food systems using a multidisciplinary and systems-level framework. Students will use a systems framework to critically examine local and global food challenges related to food insecurity, food justice and food sovereignty, food waste and sustainable approaches to addressing food challenges. Novel aspects of this course include student experiential learning opportunities that include service learning with community partners addressing local food challenges, team building through group work and in-class discussion and development of personal food ethic provocative proposition.

Prerequisite: Junior or senior standing

Typically offered in Fall only

HS 411 Nursery Management (3 credit hours)

Principles and practices of production, management, and marketing of field-grown and container-grown nursery plants. One of three scheduled weekend field trips required at students' expense.

Prerequisite: BIO 181, SSC 200, Junior standing

Typically offered in Fall only

HS 416/HS 516 Planting Design (4 credit hours)

Developing and cultivating a design process for creating meaningful and compelling ornamental planting designs through the study and practice of spatial articulation (form, enclosure, permeability), physical properties of plants (line, form, texture, color), client/site analysis and program development, visual journaling, garden narrative, presentation skills, utilizing principles of visual composition, design communication, and understanding and resolving technical and horticultural issues in contemporary planting design.

Prerequisite: Landscape Horticulture (11HORTTHL) concentration, HS 400

Typically offered in Fall only

HS 418 Landscape Design Digital Media Graphics (3 credit hours)

Digital media is used in the landscape design profession as a tool with analytic, expressive, and representational abilities. The course focuses on introducing landscape design students to digital representational tools used to communicate design ideas for small scale landscape design projects. Students will be introduced to techniques used in AutoCAD, Photoshop, Illustrator, InDesign, and Sketch Up modeling programs. Digital representation will be used to develop the variety of images necessary to explore and communicate design intentions. Materials for this course will cost approximately \$50.

Prerequisite: HS 242 and HS 400

Typically offered in Fall only

HS 420/HS 520 Green Infrastructure (3 credit hours)

Green infrastructure is defined as the interconnected networks of natural and constructed ecological systems within and in-between urban areas. When implemented in a holistic way, green infrastructure can provide benefits at the residential, neighborhood, community levels providing for greater health and well-being, an improved functional environment, and a thriving dynamic economy. Well-designed urban landscapes offer significant economic and social benefits that directly improve the urban environment for people, plants and animals- from increasing real estate value and reducing energy costs, to enhancing health and food security, and providing habitat for a diverse population of animals and plants. Since addressing environmental issues requires a multidisciplinary approach, this course is designed for any student with interests in horticulture, biological engineering, landscape architecture, environmental sciences, urban forestry, and any others who care about the sustainability of their communities.

Typically offered in Fall only

This course is offered alternate even years

HS 421/HS 521 Temperate-Zone Tree Fruits: Physiology and Culture (3 credit hours)

Physiology and culture of the major temperate-zone tree fruit and nut crops of the United States. Fundamental principles underlying woody plant growth as applied to the culture of specific tree-fruit crops with emphasis on crops of commercial importance to North Carolina.

Prerequisite: BIO 181 or BO 200

Typically offered in Spring only

This course is offered alternate odd years

HS 422 Small Fruit Production (3 credit hours)

Importance and economic value of blackberries, blueberries, cranberries, grapes, raspberries, strawberries and minor small fruit crops in the agricultural economy of the USA and the world. Cultural requirements of these crops and manipulation of their known morphological and physiological traits for successful production. Six all afternoon field trips are required.

Prerequisite: BIO 181, SSC 200, HS 201

Typically offered in Spring only

This course is offered alternate even years

HS 428/SSC 428 Soil Management Principles for Sustainable Agriculture (1 credit hours)

The course is designed to be taken as a companion course to SSC 427 and provides hands-on field and lab experiences that investigate the fundamentals of soil carbon, soil health, greenhouse gas emissions as influenced by sustainable management practices. This is accomplished through a series of exercises at the Fyke Crops Garden, Agroecology Farm and in the lab, and site visits to the Center for Environmental Farming, composting facilities, and operational farms.

Prerequisite: SSC 200 or equivalent and BIO 181 or 183; Corequisite: SSC 427

Typically offered in Fall only

HS 431 Vegetable Production (4 credit hours)

Principles and practices of production and marketing of seventeen vegetable crops grown in the U.S. Additional topics include pest management, seed technology, food safety, sustainable agriculture, use of genetically engineered crops, and consumer issues.

Prerequisite: BIO 181, SSC 200

Typically offered in Fall only

HS 432/HS 532 Introduction to Permaculture (3 credit hours)

Permaculture means "permanent culture," and "...is the conscious design and maintenance of cultivated ecosystems that have the diversity, stability, and resilience of a natural ecosystem." [Bill Mollison] This course will explore a design/thinking methodology that seeks to provide our essential physical needs, food, water, shelter, energy, etc., while doing so in an environmentally friendly, sustainable manner. This course is restricted to upper level undergraduate, graduate, or matriculated continuing education students. STUDENTS MAY NOT RECEIVE CREDIT FOR BOTH HS 432 AND HS 532.

Typically offered in Fall and Summer

HS 433/HS 533 Public Garden Administration (3 credit hours)

This course addresses the practices, programs, and professional skills that are critical to the successful management of public gardens. The aim of the course is to better prepare graduate students and upper-level undergraduates for potential careers in public garden administration. Topics will include a brief history, impact, and current trends of public gardens in the United States; plant collections; managing staff, volunteers, and boards, and the visiting public; finances and fund raising; educational programming; visitor services; and careers in public gardens. Two Saturday off-campus field trips are required.

Typically offered in Fall only

This course is offered alternate even years

HS 440 Greenhouse Management (3 credit hours)

Perspective of greenhouse systems management. Selection of greenhouse site, construction, heating, cooling and production systems. Emphasis on greenhouse operations, cost accounting and analysis. Other topics; root substrates, sanitation, water, fertilization, chemical growth regulation, temperature, light and marketing. Hands-on experience in greenhouse operations plus trips to commercial greenhouses and markets.

Prerequisite: SSC 200 and HS 201

Typically offered in Fall only

HS 442 Floriculture Crop Production (3 credit hours)

Production of floricultural crops. Emphasis on environmental manipulation and scheduling of crop growth and development for targeted market periods. Specific flowering crops as models to demonstrate potted flowering plant, cut flower, and bedding plant production systems. Hands-on crop production experience plus field trips to commercial floriculture production and marketing facilities.

Prerequisite: SSC 200, HS 201

Typically offered in Spring only

This course is offered alternate even years

HS 451/HS 551 Plant Nutrition (3 credit hours)

An understanding of the basic mineral nutrient requirements, nutritional monitoring procedures, and fertilizer application methods in horticultural production systems including those for fruits, field vegetables, fruits and vegetables under plasticulture, nursery crops, landscapes, greenhouse flowers and vegetables, interior plantscapes, hydroponics, and organic farming.

Prerequisite: SSC 200

Typically offered in Spring only

HS 462/HS 562/FS 562/FS 462 Postharvest Physiology (3 credit hours)

Preharvest and postharvest factors that affect market quality of horticultural commodities with an emphasis on technologies to preserve postharvest quality and extend storage life of fruits, vegetables and ornamentals.

Typically offered in Spring only

HS 471 Landscape Ecosystem Management (4 credit hours)

Well-designed, installed, and maintained urban/suburban ecosystems offer significant economic and social benefits that directly improve the environment for people, plants and animals. Learn how to select, install and maintain plants as part of a sustainable landscape. This course provides students with the tools to understand and implement landscape ecosystem management techniques that include, but are not limited to plant selection and maintenance, soil maintenance and renovation, thoughtful application of common landscape chemistry and IPM, urban/suburban wildlife conservation (including plant pollinators), and installation and promotion of green infrastructure practices.

Prerequisite: SSC 200

Typically offered in Fall only

HS 476/HS 576 Crop Physiology and Production in Controlled Environments (3 credit hours)

This course focuses on plant eco-physiological responses to different environmental factors such as: light intensity, quality, duration and penetration; CO₂ diffusion; thermodynamic properties of moist air; root environment; air dynamics; water relations; and canopy energy balance. In addition, the course emphasizes the application of controlled environment technologies to manipulate crop responses. The laboratory is designed to optimize the production of edible crops in greenhouses and vertical farms by applying the foundational knowledge of plant eco-physiology in combination with advance controlled environment technologies.

Prerequisite: PB 321 or PB 421 and either MA 114 or MA 121 or MA 131 or MA 141

Typically offered in Spring only

HS 480/CS 480 Sustainable Food Production (capstone) (1 credit hours)

This course introduces students to the process of developing a project for presentation in the area of sustainable food production and food systems. Students are to synthesize and integrate knowledge acquired in previous course work and other learning experiences and to apply theory and principles in a situation that approximates some aspect of professional practice. Students are expected to present their projects at the end of the semester in a PowerPoint style format to faculty and student peers.

Prerequisites: Senior standing and CS 430

Typically offered in Fall and Spring

HS 491 Sustainable Agriculture Entrepreneurship Study Abroad (3 credit hours)

This course provides an international perspective on entrepreneurship and sustainability in agricultural and life sciences while examining one of three unique, Spanish-speaking locations (Oaxaca, Mexico; Valencia, Spain; and Queretaro, Mexico). The course is led by three instructors that speak Spanish, have very close ties to the communities visited, and are experts in the fields of sustainability and entrepreneurship. The different components of sustainability: increase in production, efficient use of non-renewable resources, ecological stewardship, economic improvement, and increase in quality of life will be experienced. The practice of entrepreneurship will be identified through examples of the implementation of these sustainable motivators as then analyze different businesses' strengths and constraints. This course intends to give an intimate look into an international location with the intent of getting students out of their comfort zone, challenging their mindsets, and providing the opportunity to experience cultural and agricultural diversity.

Typically offered in Summer only

HS 492 Horticulture Internship (1-3 credit hours)

A learning experience in Horticultural Science where a student can gain real-world experience relevant to their academic and career goals. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience (135 hours = 3 credits). The experience must be arranged by the student and approved by the Department of Horticultural Science prior to the start of the experience. To gain approval, a student must submit the completed HS 492 contract and have it approved by their experience supervisor and the undergraduate coordinator. In addition to the work described in the contract, a student will complete two reflective assignments.

Typically offered in Fall, Spring, and Summer

HS 493 Research Experience in Horticultural Science (1-3 credit hours)

A learning experience in Horticultural Science where a student can gain research experience relevant to their academic and career goals. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience (135 hours = 3 credits). The experience must be arranged by the student and approved by the undergraduate coordinator prior to the start of the experience. To gain approval, a student must submit the completed HS 493 contract and have it approved by their research experience supervisor and the undergraduate coordinator. In addition to the work described in the contract, a student will complete a two reflective assignments.

Typically offered in Fall, Spring, and Summer

HS 494 Teaching Experience in Horticultural Science (1-3 credit hours)

A learning experience in Horticultural Science where a student can gain teaching experience relevant to their academic and career goals. A minimum of 45 hours must be completed for each credit hour earned, with 3 credit hours maximum for each experience (135 hours = 3 credits). The experience must be arranged by the student and approved by the undergraduate coordinator prior to the start of the experience. To gain approval, a student must submit the completed HS 494 contract and have it approved by their experience supervisor and the undergraduate coordinator. In addition to the work described in the contract, a student will complete two reflective assignments.

Typically offered in Fall, Spring, and Summer

HS 495 Experimental Courses in Horticultural Science (1-6 credit hours)

Offering of new courses on a trial basis. Topic varies based on offering. Repetition with different course content acceptable up to 2 times and total of 6 units.

Typically offered in Fall, Spring, and Summer

HS 502/PP 502/CS 502 Plant Disease: Methods & Diagnosis (2 credit hours)

Introduction to the basic principles of disease etiology in plants and the methods used to research and diagnose plant diseases caused by bacteria (and other prokaryotes), fungi (and oomycetes), nematodes and viruses. Lab-based course intended to give graduate students a practical, hands-on research experience for diagnosing and characterizing each plant pathogen group. Introduction to pathogen-specific as well as more general experimental techniques utilized in plant pathology. No course prerequisites, but prior experience in microbiology and/or completion of PP 315, PP 501 or equivalent will benefit the PP 502 learning experience.

Prerequisite: Graduate standing or department consent

Typically offered in Fall only

HS 503/HS 403 Plant Micropropagation and Tissue Culture (3 credit hours)

The course will introduce advanced plant propagation methods that cover micropropagation, tissue culture, sterile seed sowing, embryo rescue, fern spore culture, anther/pollen culture, and plant acclimation. Biotechnology based on tissue culture, including polyploid manipulation and gene transformation, will be also introduced. Emphasis will be placed on the technical aspects of plant propagation, as well as the biological basis for the responses demonstrated by plant species to different micropropagation protocols.

Prerequisites: C- or better in HS 301, or C- or better in CS 211, or C- or better in HS 215, or C- or better in GN 311, or C- or better in PB 250.

Typically offered in Fall only

HS 510 Applied Statistics in Horticultural Research (1 credit hours)

This course will introduce statistical methods frequently used in Horticulture research and will provide Horticulture graduate students with statistical guidance for their graduate research. The class will address (1) basic statistical methods for horticulture research, (2) options when working with skewed data, (3) horticulture relevant research design, and (4) evaluating inappropriate statistical analysis, interpretation, and experimental design.

R: Graduate students in Horticultural Science only

Typically offered in Fall only

HS 516/HS 416 Planting Design (4 credit hours)

Developing and cultivating a design process for creating meaningful and compelling ornamental planting designs through the study and practice of spatial articulation (form, enclosure, permeability), physical properties of plants (line, form, texture, color), client/site analysis and program development, visual journaling, garden narrative, presentation skills, utilizing principles of visual composition, design communication, and understanding and resolving technical and horticultural issues in contemporary planting design.

Prerequisite: Landscape Horticulture (11HORTTHL) concentration, HS 400

Typically offered in Fall only

HS 520/HS 420 Green Infrastructure (3 credit hours)

Green infrastructure is defined as the interconnected networks of natural and constructed ecological systems within and in-between urban areas. When implemented in a holistic way, green infrastructure can provide benefits at the residential, neighborhood, community levels providing for greater health and well-being, an improved functional environment, and a thriving dynamic economy. Well-designed urban landscapes offer significant economic and social benefits that directly improve the urban environment for people, plants and animals- from increasing real estate value and reducing energy costs, to enhancing health and food security, and providing habitat for a diverse population of animals and plants. Since addressing environmental issues requires a multidisciplinary approach, this course is designed for any student with interests in horticulture, biological engineering, landscape architecture, environmental sciences, urban forestry, and any others who care about the sustainability of their communities.

Typically offered in Fall only

This course is offered alternate even years

HS 521/HS 421 Temperate-Zone Tree Fruits: Physiology and Culture (3 credit hours)

Physiology and culture of the major temperate-zone tree fruit and nut crops of the United States. Fundamental principles underlying woody plant growth as applied to the culture of specific tree-fruit crops with emphasis on crops of commercial importance to North Carolina.

Prerequisite: BIO 181 or BO 200

Typically offered in Spring only

This course is offered alternate odd years

HS 532/HS 432 Introduction to Permaculture (3 credit hours)

Permaculture means "permanent culture," and ... "is the conscious design and maintenance of cultivated ecosystems that have the diversity, stability, and resilience of a natural ecosystem." [Bill Mollison] This course will explore a design/thinking methodology that seeks to provide our essential physical needs, food, water, shelter, energy, etc., while doing so in an environmentally friendly, sustainable manner. This course is restricted to upper level undergraduate, graduate, or matriculated continuing education students. STUDENTS MAY NOT RECEIVE CREDIT FOR BOTH HS 432 AND HS 532.

Typically offered in Fall and Summer

HS 533/HS 433 Public Garden Administration (3 credit hours)

This course addresses the practices, programs, and professional skills that are critical to the successful management of public gardens. The aim of the course is to better prepare graduate students and upper-level undergraduates for potential careers in public garden administration. Topics will include a brief history, impact, and current trends of public gardens in the United States; plant collections; managing staff, volunteers, and boards, and the visiting public; finances and fund raising; educational programming; visitor services; and careers in public gardens. Two Saturday off-campus field trips are required.

Typically offered in Fall only

This course is offered alternate even years

HS 541/CS 541 Plant Breeding Methods (3 credit hours)

Overview of plant breeding methods for advanced undergraduate and beginning graduate students. Covers principles and concepts of inheritance, germplasm resources, pollen control, measurement of genetic variances, and heterosis. Special topics include heritability, genotype-environment interaction, disease resistance, and polyploidy. In-depth coverage on methods for breeding cross-pollinated and self-pollinated crops. Prepares students for advanced plant breeding courses.

Prerequisite: ST 511, Corequisite: ST 512

Typically offered in Fall only

HS 550 Environmental Nursery Production (3 credit hours)

The course focuses on the impacts of the nursery industry on the environment and environmentally sound nursery practices. Exploration of the major challenges facing the nursery industry that drive decision making during production. Evaluation of past and current research addressing these challenges and sampling procedures and interpretation will be learned. Graduate status and an undergraduate nursery production or management course or working knowledge of nursery production required.

Prerequisite: HS 411, Nursery Management, or an equivalent course.

Typically offered in Fall only

This course is offered alternate odd years

HS 551/HS 451 Plant Nutrition (3 credit hours)

An understanding of the basic mineral nutrient requirements, nutritional monitoring procedures, and fertilizer application methods in horticultural production systems including those for fruits, field vegetables, fruits and vegetables under plasticulture, nursery crops, landscapes, greenhouse flowers and vegetables, interior plantscapes, hydroponics, and organic farming.

Prerequisite: SSC 200

Typically offered in Spring only

HS 562/FS 562/FS 462/HS 462 Postharvest Physiology (3 credit hours)

Preharvest and postharvest factors that affect market quality of horticultural commodities with an emphasis on technologies to preserve postharvest quality and extend storage life of fruits, vegetables and ornamentals.

Typically offered in Spring only

HS 576/HS 476 Crop Physiology and Production in Controlled Environments (3 credit hours)

This course focuses on plant eco-physiological responses to different environmental factors such as: light intensity, quality, duration and penetration; CO₂ diffusion; thermodynamic properties of moist air; root environment; air dynamics; water relations; and canopy energy balance. In addition, the course emphasizes the application of controlled environment technologies to manipulate crop responses. The laboratory is designed to optimize the production of edible crops in greenhouses and vertical farms by applying the foundational knowledge of plant eco-physiology in combination with advance controlled environment technologies.

Prerequisite: PB 321 or PB 421 and either MA 114 or MA 121 or MA 131 or MA 141

Typically offered in Spring only

HS 590 Special Problems in Horticultural Science (1-6 credit hours)

Selection of a subject by each student on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in horticultural science.

Typically offered in Fall, Spring, and Summer

HS 601 Professional Presentation Skills in Horticultural Science (2 credit hours)

The purpose of this course is to familiarize the students with the professional presentation skills they need to be successful. These skills include speaking, writing, poster and website development, based on the student's proposed research/project and literature review.

Typically offered in Fall only

HS 610 Special Topics in Horticultural Science (1-6 credit hours)

Investigation of special theoretical problems at 600 level in horticultural science not related to a thesis problem; new 600-level courses during developmental phase.

Typically offered in Fall, Spring, and Summer

HS 615 Advanced Special Topics (1-6 credit hours)

Investigation of theoretical problems at the 600 level in horticultural science not related to a thesis problem; new 600-level courses during the development phase.

Typically offered in Fall, Spring, and Summer

HS 685 Master's Supervised Teaching (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall, Spring, and Summer

HS 688 Non-Thesis Masters Continuous Registration - Half Time Registration (1 credit hours)

For students in non-thesis master's programs who have completed all credit hour requirements for their degree but need to maintain half-time continuous registration to complete incomplete grades, projects, final master's exam, etc.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall and Spring

HS 689 Non-Thesis Master Continuous Registration - Full Time Registration (3 credit hours)

For students in non-thesis master's programs who have completed all credit hour requirements for their degree but need to maintain full-time continuous registration to complete incomplete grades, projects, final master's exam, etc. Students may register for this course a maximum of one semester.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall and Spring

HS 690 Master's Examination (1-9 credit hours)

For students in non thesis master's programs who have completed all other requirements of the degree except preparing for and taking the final master's exam.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall, Spring, and Summer

HS 693 Master's Supervised Research (1-9 credit hours)

Instruction in research and research under the mentorship of a member of the Graduate Faculty.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall, Spring, and Summer

HS 695 Master's Thesis Research (1-9 credit hours)

Thesis research.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall, Spring, and Summer

HS 696 Summer Thesis Research (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Master's in Horticultural Science

Typically offered in Summer only

HS 699 Master's Thesis Preparation (1-9 credit hours)

Original research on specific problems in fruit, vegetable and ornamental crops.

Prerequisite: Master's in Horticultural Science

Typically offered in Fall, Spring, and Summer

HS 703 Breeding Asexually Propagated Crops (1 credit hours)

Principles and problems associated with breeding clonally propagated crops and techniques used in overcoming these problems. Taught third five weeks of semester. Drop date is by last day of 3rd week of minicourse.

Prerequisite: CS 413

Typically offered in Fall only

HS 704 Plant Nomenclature (1 credit hours)

A practical foundation in plant nomenclature and nomenclatural references. Emphasis on the evolution of international rules for naming plant taxa and their application in both wild and cultivated plants. Nomenclature applications used in patents, cultivar releases and journal articles. Taught mid-semester. Taught five weeks of semester.

Prerequisite: PB 421

Typically offered in Spring only

HS 705 Physiology Of Flowering (1 credit hours)

Examination of physiological basis of flowering in plants such as: floral initiation, transition to reproductive growth; floral development; plant response to light, temperature, nutrition, water supply; plant age; chemical growth regulation and in vitro flowering. Taught first five weeks of fall semester. Drop date is by last day of 3rd week of minicourse.

Prerequisite: PB 421

Typically offered in Fall only

HS 707 Environmental Stress Physiology (1 credit hours)

Physiology of plant responses to environmental stresses, with emphasis on current research in selected physiological, molecular, and biochemical mechanisms for tolerance to environmental stresses such as temperature extremes, drought, salt, pathogens and other plants.

Prerequisite: PB 421

Typically offered in Fall only

This course is offered alternate odd years

HS 708 Application of Genomics to Plant Breeding (1 credit hours)

The latest advancements in plant breeding with genomics and sequencing technologies will be evaluated, and Linux, cloud computing, and Perl programming will be used to analyze genomics and transcriptomics data. Students will work with software packages commonly used for plant breeding and will give students practice with analyzing large data sets and manipulating text files beyond the capabilities of Microsoft Excel or similar spreadsheet programs.

R: Graduate Standing

Typically offered in Fall only

HS 709 Applied Plant-Light Interactions: Light Effects on Crop Yield, Morphology, and Development (1 credit hours)

This course focuses on the impact of light spectra on plant growth, morphology, and development. Plant responses to light intensity, ultraviolet, blue, green, red, and far-red light are presented and reinforced with examples from current research. Applications of these impacts are valuable throughout the agricultural sector.

Typically offered in Spring only

This course is offered alternate even years

HS 716/CS 716 Weed Biology (3 credit hours)

This course analyzes the interactions between human disturbance and dynamics of weed populations and communities. Emphasis is given to factors that drive weed control actions and the ecological and evolutionary processes by which weeds survive and adapt to these actions. Similarities and differences between weeds and invasive plant species are discussed as well as benefits and limitations of using traditional ecological theory from natural systems to explain weed behavior in highly disturbed environments.

Prerequisite: CS 414

Typically offered in Spring only

HS 717/CS 717 Weed Management Systems (1 credit hours)

Weed management systems including integration of cultural, biological, mechanical and chemical methods for vegetables, fruits, ornamentals, turf, small grains, corn, tobacco, cotton, peanuts, aquatic and non-cropland settings. Taught second 5 weeks of semester. Drop date is by last day of 3rd week of minicourse.

Prerequisite: CS 414

Typically offered in Fall only

HS 720/CS 720/GN 720 Molecular Biology In Plant Breeding (3 credit hours)

Theory and principles of molecular biology applied to plant breeding. Understanding of the relationship between genes and crop traits. Principles and molecular mechanisms of crop traits, and their applications to solve breeding problems and improve crop traits, which include heterosis, male/female sterility, self-incompatibility, polyploidy, double haploid, protoplast fusion, random mutagenesis, plant regeneration, transgenic breeding, advanced genome editing for breeding, gene silencing, gene activation, gene drive, plant synthetic biology, metabolic engineering, epigenetics for trait improvement, gene stacking, decoy and R genes, and bioconfinement.

P: CS 211 or GN 311 or equivalent, and PB 421 or equivalent.

Typically offered in Spring only

HS 725/SSC 725/TOX 725/CS 725 Pesticide Chemistry (1 credit hours)

Chemical properties of pesticides including hydration and solvation, ionization, volatilization, lipophilicity, molecular structure and size, and reactivity and classification according to chemical description, mode of action or ionizability. Taught during the first 5 weeks of semester. Drop date is last day of 3rd week of the minicourse.

Prerequisite: (CH 201 or CH 203) and (CH 221 or CH 225)

Typically offered in Fall only

HS 727/SSC 727/TOX 727/CS 727 Pesticide Behavior and Fate In the Environment (2 credit hours)

Sorption/desorption, soil reactivity, movement, volatilization, bioavailability, degradation and stability of pesticides in the environment. Taught during the last 10 weeks of semester. Drop date is last day of 3rd week of the minicourse.

Prerequisite: CS(HS,SSC,TOX) 725,SSC 200

Typically offered in Fall only

HS 729/CS 729 Herbicide Behavior In Plants (2 credit hours)

Chemical, physiological and biochemical actions of herbicides in plants including uptake, translocation, metabolism and mechanism of action.

Typically offered in Fall only

HS 745/CS 745/GN 745 Quantitative Genetics In Plant Breeding (1 credit hours)

Theory and principles of plant quantitative genetics. Experimental approaches of relationships between type and source of genetic variability, concepts of inbreeding, estimations of genetic variance and selection theory.

Prerequisite: CS(GN, HS) 541, ST 712, course in quantitative genetics recommended

Typically offered in Spring only

This course is offered alternate years

HS 746/CS 746/GN 746 Cytogenetics in Plant Breeding (2 credit hours)

Theory and principles of plant breeding methodology including population improvement, selection procedures, genotypic evaluation, cultivar development and breeding strategies.

Typically offered in Spring only

This course is offered alternate years

HS 757/GN 757/ST 757 Quantitative Genetics Theory and Methods (3 credit hours)

The essence of quantitative genetics is to study multiple genes and their relationship to phenotypes. How to study and interpret the relationship between phenotypes and whole genome genotypes in a cohesive framework is the focus of this course. We discuss how to use genomic tools to map quantitative trait loci, how to study epistasis, how to study genetic correlations and genotype-by-environment interactions. We put special emphasis in using genomic data to study and interpret general biological problems, such as adaptation and heterosis. The course is targeted for advanced graduate students interested in using genomic information to study a variety of problems in quantitative genetics.

Prerequisite: ST 511

Typically offered in Fall only

This course is offered alternate even years

HS 790 Special Problems in Horticultural Science (1-6 credit hours)

Selection of a subject by each student on which to do research and write a technical report on the results. The individual may choose a subject pertaining to his or her particular interest in any area of study in horticultural science.

Typically offered in Fall, Spring, and Summer

HS 815 Advanced Special Topics (1-6 credit hours)

Investigation of theoretical problems at 600 level in horticultural science not related to a thesis problem; new 600-level courses during development phase.

Typically offered in Fall, Spring, and Summer

HS 860/CS 860/GN 860 Plant Breeding Laboratory (1 credit hours)

Visitation of plant breeding projects in the Depts. of CS and HS at NC State, along with commercial seed companies. Discussion and viewing of breeding objectives, methods and equipment and teaching and practice of hybridization methods.

Prerequisite: HS 541 or CS 541

Typically offered in Spring only

This course is offered alternate even years

HS 861/CS 861/GN 861 Plant Breeding Laboratory (1 credit hours)

Visitation of plant breeding projects in the Depts. of CS and HS at NC State, along with commercial seed companies. Discussion and viewing of breeding objectives, methods and equipment and teaching and practice of hybridization methods.

P: CS 741 or GN 741 or HS 741

Typically offered in Fall only

This course is offered alternate even years

HS 885 Doctoral Supervised Teaching (1-3 credit hours)

Teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

Typically offered in Fall, Spring, and Summer

HS 890 Doctoral Preliminary Examination (1-9 credit hours)

For students who are preparing for and taking written and/or oral preliminary exams.

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer

HS 895 Doctoral Dissertation Research (1-9 credit hours)

Dissertation Research

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer

HS 896 Summer Dissertation Research (1 credit hours)

For graduate students whose programs of work specify no formal course work during a summer session and who will be devoting full time to thesis research.

Prerequisite: Doctoral student

Typically offered in Summer only

HS 899 Doctoral Dissertation Preparation (1-9 credit hours)

For students who have completed all credit hour requirements, full-time enrollment, preliminary examination, and residency requirements for the doctoral degree, and are writing and defending their dissertations.

Prerequisite: Doctoral student

Typically offered in Fall, Spring, and Summer