fences. Students will progress from cavaletti exercises and jumping grids to jumping small courses. Elements of successful show ring riding will be introduced step-by step such as riding lines, related distances, bending lines, and jumping off of turns. This course is geared towards Hunter Seat Equitation. Prerequisites: Basic Schooling.

***ES 2038**
***Intermediate Dressage***
A more intensive study of riding as art and as correct development of the horse. Students will be exposed to the principles of the dressage training pyramid, with emphasis upon developing engagement, straightness, and suppleness. Lateral movements will be introduced toward the end of the semester. Prerequisite: Basic Schooling.

***ES 2039**
***Flatwork and Gridwork II***
This is a course for the high intermediate rider in which they can further practice the jumping skills acquired in Principles of Jumping while polishing the flat work introduced in Intermediate Dressage. Prerequisites: Principles of Jumping and Intermediate Dressage.

***ES 2040**
***Comparative Techniques in Jumping***
A course for the more advanced rider, comparing the riding styles and training methods necessary to prepare the horse for hunter shows, horse trials, and cross-country competitions. Introduction to cross-country jumping, riding over undulating terrain, and natural obstacles will be introduced. Students will explore conditioning techniques and pacing, and will practice more complicated jumping combinations and schooling techniques. Prerequisites: Flatwork and Gridwork II.

***ES 2041**
***Advanced Methods of Training***
A course for the experienced rider focusing upon advanced techniques and gymnastic exercises designed to promote the horse's athletic development. Complex schooling patterns and lateral work will be practiced. Prerequisite: Intermediate Dressage.

***ES 2042**
***Balanced Equitation II***
An intensive riding skills development course, focusing on improving the rider's posture and effectiveness. The course emphasizes kinesthetic awareness, postural realignment, and elimination of muscular tension to produce a more effective seat. Students are taught to redirect unnecessary tension into useful energy.

***ES 2043**
***Special Training Project***
For the advanced student, in their junior or senior year, who wishes to pursue a training or rehabilitative project with a selected horse, or who would like to train intensively for open competition. Past projects have included the Art and Etiquette of Side Saddle, Starting a Young Horse, Training and Preparing a Young Hunter, Reconditioning/Rehabilitation Project, Advanced Driving, Preparing for Novice Horse Trials. By Director of Equine Studies permission only.

***ES 2044**
***Hartpury Riding Students***
Open only to Hartpury Exchange students studying in the Equine Studies Program at Delaware Valley College

** These Courses are for Equine Studies Majors only*

# Food Science and Management (FS)

**FS 1123**
***Introduction to Foodservice Systems***
An introduction to the field of restaurant and foodservice management. Included is a discussion of the history of foodservice, the different types of foodservice operations, career opportunities available, future trends, and management. 3 hours Lecture — 3 credits

**FS 1130**
***Food, Culture and Cuisine***
A study of foods from cultures of a diverse range of countries by examining the foods they produce and their culinary traditions and practices. Lecture includes the respective geography, crop production, religion, history and sociology of each region. Preparation of ethnic meals in the laboratory is part of the ethnographic study of each region. The student will develop a sophisticated understanding of how the values and ways of life of peoples around the globe relate to the development of various foods. There is a fee for ingredients used in the course. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 1203**
***Science and Technology of Foods***
This course explores the application of science and technology to foods. The goal of this course is for

students to gain a basic understanding of molecular components of foods, relationships between food composition and food structures and functions, and the relationships of molecular properties to food characteristic and quality. The interaction, reaction, and evaluation of foods due to formulation, processing and preparation are considered. The economic, culinary performance, nutritional and food safety issues that relate to the processing and marketing of foods are also considered. Lectures elucidate the role of engineering, biotechnology, chemistry, biochemistry, nutrition, toxicology, and microbiology in supplying the world with safe and nutritious food. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 1205**
***Principles of Professional Cooking***
This course will provide a foundation of fundamental knowledge of standards, principles, and techniques required for food production. The physical characteristics of food components are introduced as students learn their selection, care, and preparation. Emphasis is placed on foodservice terminology and quantity production. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 2116**
***Physical Sciences and Food***
The objective of this course is to illustrate to the student how the physical sciences are applied to the evaluation and processing of foods. Students will also work with computational methods which are applied in technical work and develop skills in writing technical reports. Prerequisite: Elementary Functions. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 2212**
***Sanitation Management***
Topics covered in this course include the microbiology of sanitation; communicable diseases associated with foods; insect and rodent control; chemistry of detergents and sanitizers; water and wastewater treatment; plant and equipment design; HACCP systems in food processing and foodservice; personnel training and motivation. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 3000, 4000**
***Selected Topics I and II***
Special projects designed to meet individual needs of students in the specialized fields of food and agriculture. Projects will be arranged on a one-to-one basis with a department faculty member and with the approval of the Department Chairperson. 3 hours of student/faculty instruction per week — 1 credit each

**FS 3120**
***Introduction to Nutrition***
Chemical composition of nutrients, their digestion, transport and metabolism, and their occurrence in foods are introduced. Nutrition throughout the life cycle is discussed, as well as topics of current interest such as sports nutrition and relationship of diet and behavior. 3 hours Lecture — 3 credits

**FS 3122**
***Food Engineering I***
This course introduces the student to mass and energy balances, and the concept of unit operations. Emphasis is placed on the solution of problems using data from different sources. Topics covered include fluid mechanics, heat transfer, and mass transfer. Prerequisite: Physics II or Physical Sciences and Food. 2 hours Lecture and 2 hours Practicum — 3 credits

**FS 3211**
***Food Chemistry***
The objective of this course is to increase the student's knowledge of the chemical and physical-chemical properties of foods. Topics covered include the nature and stability of colloidal systems; emulsions, gels and foams; crystallization and its effects on the texture of foods; polysaccharides, their structure and properties; proteins; lipids and their reactions; browning reactions in food; colors and flavors. Prerequisite: Biochemistry. 3 hours Lecture and 3 hours Laboratory — 4 credits

**FS 3218**
***Food Microbiology***
This course deals with characteristics of microorganisms found in foods, their enumeration by cultural and rapid methods, and control by preservation methods. Spoilage, traditional food fermentations, and production of ingredients by fermentation are discussed. Skills in sterile laboratory technique are developed. Prerequisite: General Microbiology. 3 hours Lecture and 3 hours Laboratory — 4 credits

**FS 3223**
***Dairy Products Processing***
The chemical composition, physical properties and microbiology of milk are introduced. Manufacture of milk into cultured products, cheese, butter, dried and concentrated milks, and ice cream is discussed. Students

learn laboratory techniques used in quality control and carry out processing procedures in the pilot laboratory. Offered in Spring Semester of odd numbered years. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 3224**
***Food Engineering II***
A continuation of Food Engineering I. Topics include unit operations such as aseptic processing, drying, evaporation, filtration, membrane separation, size reduction, extrusion, particle size analysis, and refrigeration; consideration of electricity and its uses will be included. Prerequisite: Food Engineering I. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 3225**
***Purchasing, Storage, and Handling of Foods***
The fundamentals of food service purchasing are introduced in this course. The functions of forecasting, ordering, purchasing, delivery, receiving, storage, inventory control, and legal responsibilities are discussed. Specifications, quality control and storage are discussed for individual food and nonfood products. Prerequisite: Introduction to Food Service Systems or permission of Instructor. Offered in Fall Semester of odd numbered years. 3 hours Lecture — 3 credits

**FS 3226**
***Service Systems Management***
This course covers typical "front of the house" operations of the dining room: organization of the dining room, service styles, beverage and alcohol service, cashiering and payment management, and supervision and staff training. Prerequisite: Introduction to Food Service Systems or permission of Instructor. Offered in Spring Semester of even numbered years. 3 hours Lecture — 3 credits

**FS 3227**
***Foodservice Accounting and Cost Control***
This course builds on the introductory management and accounting courses so that the student will be able to interpret, plan, and activate food, beverage, and labor cost control systems. Prerequisite: Accounting I or Accounting Fundamentals. Offered in Fall Semester of even numbered years. 3 hours Lecture — 3 credits

**FS 4004**
***Industrial Fermentations***
This course introduces the student to the principles involved in bioreactor design and the separation and concentration steps which are used to purify the product. Applications such as biomass, alcohol, organic acids, enzymes, and antibiotics are considered. Prerequisite: Biochemistry or permission of Instructor. Offered in Fall Semester of even numbered years. 3 hours Lecture — 3 credits

**FS 4010**
***Introduction to Winemaking***
This course introduces the student to wine grape varieties, history, their growth, factors which affect quality and the basic steps in winemaking. Prerequisite: Age 21. 2 hours Laboratory — 1 credit

**FS 4015**
***Waste Treatment and Control***
This course surveys techniques for evaluating, modifying and disposing of industrial wastes. Emphasis is on the handling of solid and liquid wastes produced by agricultural and food processing activities. Offered in Fall Semester of odd numbered years. 2 hours Lecture — 2 credits

**FS 4041**
***Senior Research***
Selected seniors engage in supervised investigations involving library work and laboratory or field experiments related to the food industry. Requirement: Permission of Department Chairperson. 1-3 credits

**FS 4042**
***Sensory Evaluation of Foods***
This course covers the physiology, psychology and chemistry of sensory response; the principles and application of discriminative, descriptive and preference testing; objective methods of food evaluation related to sensory properties of foods; selection and training of panelists; data analysis and interpretation. Offered in Spring Semester of even numbered years. 1 hour Lecture and 3 hours Laboratory — 2 credits

**FS 4112**
***Principles of Food Processing and Preservation***
This course covers the background of food processing and maintenance of nutritive quality. This course covers the general characteristics of raw food materials, principles of food preservation, processing factors that influence quality, packaging, water and waste management, and sanitation. Lecture classes dealing with the principles of science and engineering rational of various processing systems and their unit operations. Preparation and preservation of perishable foods by modified atmosphere, low temperature, thermal processes, dehydration and other

processes will be discussed in relation to processing variables. Topics included are control of microbiological, chemical and physical deterioration; physical, chemical and nutritional changes in food; and the equipment and packaging used in food preservation. Concluding lectures will cover management approaches to assuring efficiency of energy usage, quality maintenance, and product safety in the processing. 3 hours Lecture — 3 credits

**FS 4119**
***Food Distribution Systems***
This course emphasizes the methods used to channel fresh and processed foods from producer to consumer. The areas discussed include assembling, transportation, warehousing and distribution to the retail level. Offered in Fall Semester of odd numbered years. 3 hours Lecture — 3 credits

**FS 4126**
***Food Analysis***
This course introduces the student to common methods of analysis used in the food industry. The properties of food components and reasons for testing are discussed as related to the tests used. Instrumental and "wet" methods will be covered. Emphasis is placed on the basic principles involved in the analytical procedure. Prerequisite: Food Chemistry or Permission of Instructor. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 4131**
***Foodservice Facilities and Equipment***
A discussion of the selection and use of foodservice equipment. Features and special uses of the equipment will be discussed along with basic operation, cleaning and maintenance. Also included will be purchasing of new and used equipment, equipment design, and basic kitchen design. Prerequisite: Introduction to Food Service Systems or Permission of Instructor. Offered in Spring Semester of even numbered years. 3 hours Lecture — 3 credits

**FS 4149**
***Quality Assurance and Regulation***
This courses focuses on an examination of statistical tests, interpretations and sample plans as applied to the control of food production systems and product evaluations. The requirements placed on quality assurance systems to insure compliance with regulatory mandates are covered. Particular attention is given to documents for the Food and Drug Administration, the Food Safety and Inspection Service and the Agriculture Marketing Service. Other regulatory laws that impact on the food industry are examined. 2 hours Lecture and 2 hours Laboratory — 3 credits

**FS 4212**
***Refined Foods and Food Ingredients***
Food ingredients derived from plant materials and food products manufactured from those ingredients are the topics of this course. Starches and sweeteners, fats and oils, spices, as well as the manufacture of snack foods, confections, baked products, and nonalcoholic beverages will be discussed. Offered in the Spring Semester of even numbered years. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 4213**
***Introduction to Brewing Science***
This course introduces the student to the basic methods of producing a malt beverage and the factors which influence beverage quality. Prerequisite: Age 21 and senior standing. 2 hours Laboratory and Discussion — 1 credit

**FS 4222**
***Quantity Food Production***
In this course, the student is introduced to the principles and practices of production management. Students perform all aspects of meals, including planning, ordering, preparing and presenting. Quality control is stressed. Prerequisite: Principles of Professional Cooking. 2 hours Lecture and 3 hours Laboratory — 3 credits.

**FS 4223**
***Seminar***
A review and discussion of the literature concerned with advancements in the food industry are features in this course. Prerequisite: Senior Standing or permission of Instructor. 1 hour Lecture and Discussion — 1 credit

**FS 4224**
***Food Product Development***
Criteria considered in the development and production of a food product are the topics of this course. The format of the course is designed to draw upon and expand by application material from the Food Science areas of chemistry, nutrition, microbiology, statistics, and engineering. Sensory evaluation, packaging, and engineering economics will also be introduced. Prerequisite: Senior standing in Food Science and Food Technology Specialization or permission of Instructor. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 4228**
***Meat and Meat Products***
A study of slaughtering, post mortem handling, meat fabrication, and further process and package systems. The microstructure and microbiology of meats is covered in conjunction with meat inspection, safety systems and quality evaluation. 2 hours Lecture and 3 hours Laboratory — 3 credits

**FS 4229**
***Foodservice Marketing Strategy***
This course takes the traditional marketing concepts and applies them directly to the restaurant and foodservice industry. Current trends and consumer behavior are discussed along with the importance of menu design and pricing, advertising, and promotions. Prerequisite: Principles of Marketing or permission of Instructor. Offered in Spring Semester of odd numbered years. 3 hours Lecture — 3 credits

**FS 4232**
***Legal Aspects of Foodservice Management***
This course is designed to help food service managers and owners prevent legal problems, or minimize the harmful effects of legal situations. Federal, state, and local laws and regulations are discussed on topics including liability, patron civil rights, employee relation, contracts, and security. How to choose and work with an attorney will also be discussed. Offered in Spring Semester of odd-numbered years. 3 hours Lecture — 3 credits

***Employment Program***

**FS 2370**
***Employment Program***
Each student in Food Science and Management is required to spend 500 hours in approved jobs related to the student's major. Registration for each Employment Program must occur prior to the beginning of a relevant experience. Registration materials are available from the Office of Career and Life Education, located in Segal Hall — 4 credits.

# HORTICULTURE (HT)

**HT 1101**
***Exploring Horticulture, Science and the Environment***
The objectives of this course are to define the field of horticulture, to indicate what horticulturists produce, to explore the various disciplines and areas of specialization and the challenging career opportunities in business, science, education and industry. 2 hours Lecture — 2 credits

**HT 2003**
***Fruits and Vegetables for Food, Fun and Profit***
This course tells how horticulture is a delicious, healthful diet source, gardening pastime, physical fitness routine, science, business, profession, art, industry, and a life sustaining career learning experience. 1 hour Lecture — 1 credit

**HT 2005**
***Plant Physiology***
A study of the life processes of plants with laboratory experiments designed to illustrate the physiochemical principles controlling plant growth. Prerequisite: Botany of Vascular Plants. 2 hours Lecture and 3 hours Laboratory — 3 credits

**HT 2101**
***Botany of Vascular Plants***
A survey of the Plant Kingdom with emphasis on vascular plants. Principles of seed plant structure and function are presented with stress on the plant's relationship to its environment. Prerequisites: Biological Science I. 2 hours Lecture and 3 hours Laboratory — 3 credits

**HT 2112**
***Commercial Fruit Production***
A study of the commercial production and handling of the deciduous tree fruit crops. Production and marketing of fruits are studied in reference to the selection of sites, soils, choice of varieties, plants, pruning, cultivation, fertilization, pests, spraying and dusting, harvesting, grading, packing, storing, and marketing. Non-majors must have permission of the Department Chairperson. 2 hours Lecture and 3 hours Laboratory — 3 credits

**HT 2211**
***Commercial Vegetable Production***
A study of the culture of the principal vegetable crops, emphasizing production of vegetable plants in hotbeds, coldframes, greenhouses and fields, variety choice, soil adaptation, planting, fertilization, cultivation, pest control, harvesting, storage and marketing. Non-majors must have permission of the Department Chairperson. 2 hours Lecture and 3 hours Laboratory — 3 credits