Plant, Soil and Agricultural Systems

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COLLEGE OF AGRICULTURAL SCIENCES

Graduate Faculty:

Bond, Jason P., Professor, Ph.D., Louisiana State University, 1999; 2000. Nematology and plant pathology.
Chong, She-Kong, Professor, *Emeritus,* Ph.D., University of Hawaii, 1979; 1979.
Choudhary, Ruplal, Associate Professor, Ph.D., Oklahoma State University, 2004; 2009. Biosystems Engineering.
Cook, Rachel L., Assistant Professor, Ph.D., University of North Carolina, 2012.
Diesburg, Kenneth L., Assistant Professor, Ph.D., Iowa State University, 1987; 1989. Turfgrass science.
Doerr, William A., Associate Professor, *Emeritus,* Ph.D., Southern Illinois University Carbondale, 1973; 1965.
Fakhoury, Ahmad M., Associate Professor, Ph.D., Purdue University, 2001; 2003. Molecular plant pathology and fungal genetics.
Henry, Paul H., Associate Professor, Ph.D., North Carolina State University, 1991; 1992. Ornamental horticulture.
Jones, Karen L., Professor and *Chair,* Ph.D., Texas A&M University, 1996; 1999.
Kantartzi, Stella, Associate Professor, Ph.D., Aristotle University of Thessaloniki, 2006; 2008. Soybean breeding and genetics.
Klubek, Brian P, Professor*, Emeritus,* Ph.D., Utah State University, 1977; 1978. Soil microbiology.
Legacy, James, Professor, *Emeritus,* Ph.D., Cornell University, 1976; 1977.
Lightfoot, David A., Professor, Ph.D., University of Leeds, 1984; 1991. Agricultural molecular biology and biotechnology.
McGuire, James M., Professor, *Emeritus,* Ph.D., North Carolina State University, 1961; 1993.
Meksem, Khalid, Professor, Ph.D., University of Cologne, Germany, 1995; 2000. Genomics, plant genetics, plant molecular biology and biotechnology.
Midden, Karen L., Professor, M.L.A., University of Georgia, 1983; 1988. Landscape design and sustainable landscape practices.
Olsen, Farrel J., Professor, *Emeritus,* Ph.D., Rutgers University, 1961; 1971.
Pense, Seburn L., Associate Professor, Ph.D., Oklahoma State University, 2002; 2003. Agricultural education.
Preece, John E., Professor, *Emeritus,* Ph.D., University of Minnesota, 1980; 1980.
Schmidt, Michael, Associate Professor, *Emeritus,* Ph.D., Southern Illinois University Carbondale, 1994; 1979. Plant breeding.
Shoup, W. David, Professor, *Emeritus,* Ph.D., Purdue University, 1980; 1999.
Stitt, Thomas R., Professor, *Emeritus,* Ph.D., Ohio State University, 1967; 1967.
Stucky, Donald J., Professor, *Emeritus,* Ph.D., Purdue University, 1963; 1970.
Taylor, Bradley H., Associate Professor, Ph.D., Ohio State University, 1982; 1982. Fruit production.
Tweedy, James A., Professor, *Emeritus,* Ph.D., Michigan State University, 1966; 1966. Herbicides and weed control.
Varsa, Edward C., Professor, *Emeritus,* Ph.D., Michigan State University, 1970; 1970. Soil chemistry, fertility, and management.
Walters, S. Alan, Professor, Ph.D., North Carolina State University, 1997, 1998. Vegetable production.
Watson, Dennis G., Ph.D., Michigan State University, 1987; 2002. Agricultural Systems Technology.
Wolff, Robert L., Professor, *Emeritus,* Ph.D., Louisiana State University, 1971; 1972.

The Department of Plant, Soil and Agricultural Systems offers programs of study leading to the Master of Science degree with a major in plant, soil and agricultural systems with concentrations in the areas of crop, soil, and horticultural sciences with an emphasis in environmental studies in agriculture available in each of these three concentrations, as well as a concentration in ecological urban landscapes. The concentrations in crop, soil, and horticultural sciences can be pursued with either a thesis-option or a research paper (non-thesis) option. We offer graduate work in agricultural education and information and agricultural technologies.

Supporting courses in education, communication, engineering, plant biology, microbiology, chemistry, statistics, and other areas essential to research in the student's chosen field may be selected. Supporting courses are selected on an individual basis by the student and the advisory committee. Once the general field has been selected, the research and thesis may be completed in any one of the many divisions of that field. In field crops, the research may be directed toward crop production, management and precision farming, weeds and pest control, or plant breeding, genetics and biotechnology; in horticulture, the research and thesis may be in landscape design, vegetables, tree-fruits, small-fruits, floricultural and ornamental plants, plant tissue culture, or turf management; in soils, the research may relate to soil fertility, soil physics, soil microbiology, soil chemistry, or soil and water conservation; in environmental studies, the research may be directed toward water pollution, reclamation of strip-mined soil, or agricultural chemical pollution problems. Often two of these more restricted areas can be combined in one thesis/research problem.

The concentration in ecological urban landscapes is a non-thesis, non-paper, fully online graduate program with the exception of one required class, the ecological urban landscape practicum. This concentration offers to the student a core understanding of ecological systems in relation to urban landscape and urban agriculture design and management skills. Students in this program will be prepared in decision-making related to outdoor urban spaces using ecological principles and a sound design process with the interest of profiling the environment, the users and the professionals.

Agricultural education coursework is designed for instructors in secondary schools, for students preparing for employment at junior colleges, and for those desiring to continue their education by obtaining a Ph.D. degree. Agricultural information coursework is designed to provide graduate training for extension agents, agricultural communication professionals, product-education specialists, and others who are interested in agricultural information processing and transfer to a variety

of non-student clientele. Agricultural technologies coursework is designed to offer students interested in technology based systems the opportunity to study one or more of the following areas: (a) power and machinery; (b) product handling; processing, and storage, (c) farm equipment evaluation; and (d) precision farming. Each of these areas offers application in agricultural environmental studies.

Students interested in plant, soil and agricultural sciences at the doctoral level can be admitted to a program of study leading to the Ph.D. degree in agricultural sciences, plant biology or through the Environmental Resources and Policy Ph.D. program. The program, which is administered by the Graduate School through the College of Agricultural Sciences, the Department of Plant Biology, or the Colleges of Agricultural Sciences, Liberal Arts, and Science (Environmental Resources and Policy) is adequately flexible to allow students to explore such interests as plant physiology, plant nutrition, chemical control of plant growth, plant genetics, etc.

Admission

Application for admission must include an online application available at gradschool.siu.edu, a statement of interest, college transcripts, and four letters of recommendation. Letters should be requested from four persons who can evaluate the student's academic ability. Final admission to the program and a particular concentration administered by the Department of Plant, Soil and Agricultural Systems is made by the department. Minimal admission requirements to the program are: a) completion of the plant, soil and agricultural systems or agricultural systems undergraduate requirements and b) a minimal grade point average of 2.7 (*A* = 4.0). The students who do not meet the requirement of completing the required courses in the undergraduate program in plant, soil and agricultural systems or agricultural systems may apply to enroll as nondeclared students to make up these deficiencies. Undergraduate coursework taken to correct these deficiencies will not apply to the minimum requirements for the master's degree. Students entering the Plant, Soil and Agricultural Systems graduate program with a GPA below 2.70 are accepted on a conditional basis and must enroll in 12 hours of structured courses at the 400–500 level and make a GPA of 3.0 or be suspended from the program.

Application for admission into the Ecological Urban Landscapes concentration must include an online application available at gradschool.siu.edu, a statement of interest and college transcripts. Final admission to this concentration is made by the department chair. Minimal admission requirements to this program is a minimal grade point average of 2.7 (A = 4.0). Students entering the Ecological Urban Landscapes concentration with a GPA below 2.70 are accepted on a conditional basis and must make a GPA of 3.0 in the first semester of coursework or be suspended from the program.

This program requires a nonrefundable $65 application fee that must be submitted with the application for Admissions to Graduate Study in Plant, Soil and Agricultural Systems. Applicants must pay this fee by credit card.

Program Requirements

The crop, soil, and horticultural sciences concentrations can be pursued as a 30 credit hour with thesis program or a 40 credit hour with research paper (non-thesis) option. The ecological urban landscapes concentration is 30 credit hours, 27 online credit hours and three credit hours of an applied practicum. These are described below:

Thesis option: If the student submits a thesis, minimum coursework requirements for the master's degree may be fulfilled by satisfactory completion of 30 semester hours of graduate credit. At least 20 hours of that credit must be from structured courses. At the 500 level 15 hours of course credit are required, of which no more than 10 hours may be from unstructured courses. Graduate seminar is required but is not a structured course. Overall, at least 15 semester hours must be from departmental courses.

Research paper (non-thesis option): If the student submits a research paper (non-thesis option) minimum coursework requirements for the master's degree may be fulfilled by satisfactory completion of 40 semester hours of graduate credit. At least 30 hours of that credit must be from structured courses. At the 500 level 18 hours of course credit are required, of which no more than 10 hours may be from unstructured courses. Graduate seminar is required but is not a structured course. Overall, at least 25 semester hours must be from departmental courses.

Students who wish to teach in agriculture education must complete a minimum of 15 hours in agriculture (including agricultural education), six hours of research methods or statistics, and six hours in education or community development. M.S. students usually take four to six hours of research or thesis, and complete the additional hours by taking courses in education or agriculture.

Each student, whether in the thesis or non-thesis option, will be assigned a mutually agreed upon major professor to direct the program. The major professor will serve as chair of the student's advisory committee which will consist of at least two members from within the department and may include one member from another department or program. Each master's degree candidate must pass a comprehensive oral examination covering graduate work including the thesis or research paper.

Ecological urban landscapes concentration: Students in the ecological urban landscapes concentration must complete 30 credit hours from the following curriculum which must include the required FOR 528, PSAS 548, FOR 415 and PSAS 583. All of the courses are online except the required practicum which meets five-six days at a site to be announced each semester.

Semester	Course
Fall	
PSAS 480-3	Designing Outdoor Spaces
PSAS 563-3	Plants for the Ecological Landscape
FOR 528-3	Urban Tree Management
PSAS 548-2	Fundamentals in Urban Soils
PSAS 565-1	Bee Management in Urban Spaces
Spring	
PSAS 469-3	Organic Gardening
GEOG 521-3	Urban Sustainability
FOR 415-3	Urban Ecosystem Management
PSAS 564-3	Growing Fruit in the Urban Environment
PSAS 562-3	Sustainable Landscape Practices

Summer
PSAS 583-3 Urban Ecological Landscape Practicum

PSAS 590 Readings and PSAS 592 Special Problems - available for students who have completed a course for another degree and need additional coursework to fulfill 30 credit hours.

Courses (PSAS)

Field trips are required for certain courses.

PSAS 400-3 Trends in Soil Science and Agronomy. (Same as CSEM 400) A discussion session format will be employed as a means of acquainting students with recent literature and allowing them to remain current with latest developments in their area of specialty. Special approval needed from the department.

PSAS 401-2 Agricultural Plant Pathology. A study of macro and micro-organisms and environmental factors that cause disease in plants of agricultural importance; of the mechanisms by which these factors induce disease in plants; and of the methods for managing diseases and reduce the damage they cause. Special approval needed from the department.

PSAS 402A-3 Problems in Agricultural Education. (Same as AGSE 402A) Designed to improve the techniques related to award programs and application processes of agricultural education specialists through discussion, application, organization, and assignment to problems in the field of agricultural education. Emphasis will be placed on conceptual understanding of FFA and Agricultural Education award programs, applications, Supervised Agricultural Experience Program, and National Chapter Award Program, affiliated professional partnerships, and external sources for developing the entire Agricultural Education program.

PSAS 402B-1 to 6 Problems in Agricultural Technologies. (Same as AGSE 402B) Designed to improve the techniques of agricultural mechanization workers through discussion, assignment, and special workshops on problems related to their field. Emphasis will be placed on new innovative and currently developed techniques for the field. A limit of six hours will be counted toward graduation in Master`s degree program. Special approval needed from the department.

PSAS 403A-2 Field Crop Diseases. A survey of major diseases of important field crops in the United States. Disease identification, cycles, and management strategies will be addressed. Special approval needed from the department.

PSAS 403B-2 Horticultural Crop Diseases. A survey of major diseases of important horticultural crops in the United States. Disease identification, cycles, and management strategies will be addressed. Special approval needed from the department.

PSAS 403C-1 Turfgrass Diseases. A survey of major diseases of important turfgrasses in the United States. Disease identification, cycles, and management strategies will be addressed. Special approval needed from the department.

PSAS 403D-1 Tree Diseases. A survey of major diseases of important tree species in the United States. Disease identification, cycles, and management strategies will be addressed. Special approval needed from the department.

PSAS 405-3 Plant Breeding. (Same as CSEM 405) Principles of plant breeding emphasized together with their application to the practical breeding of agronomic, horticultural and forest plants. Special approval needed from the department. Field trip costs approximately $10.

PSAS 408-3 World Crop Production Problems. Ecological and physiological factors influencing production in various areas of the world. Natural limitations on world crop production. Non-agricultural factors influence world crop output. Prerequisite: CSEM 200.

PSAS 409-3 Crop Physiology. (Same as CSEM 409, HORT 409) Principles of basic plant physiology. Topics include cell structure, photosynthesis, respiration, water and mineral relations, vascular transport and plant growth regulators. Prerequisites: PLB 200, CHEM 140B. Course fee: $50.

PSAS 411-3 Human Resource Development Programs in Agriculture. (Same as AGSE 411) Principles and procedures of human resource development (HRD) programs in agriculture with emphasis on program determination and methods. Special approval needed from the department.

PSAS 412-3 Methods of Agriculture Mechanization. (Same as AGSE 412) Theory and use of educational materials and devices adaptable to the needs and interests of educators involved in agricultural mechanization laboratories. There is a $15 laboratory fee for this course.

PSAS 414-3 Adult Education Procedures, Methods and Techniques. (Same as AGSE 414) Determining adult education needs and interests of the community. Securing and organizing the information needed for adult education programs and planning teaching activities.

PSAS 415-3 Beginning Teacher Seminar. (Same as AGSE 415) The application in the professional field setting, of principles and philosophies of the education system. Includes application of principles of curricula construction, programming student and community needs. Special approval needed from the department.

PSAS 418-3 Applications of Integrated Software in Agriculture. (Same as AGSE 418) Design of agricultural or educational applications of integrated software. Spreadsheet, database, word processing, graphic and communications software will be applied to the solution of agricultural problems. Individual student projects will be the focus of the applied nature of the class. Prerequisite: AGSE 318. Restricted to junior standing or consent of instructor.

PSAS 419-3 Plant Molecular Biology. (Same as PLB 419 and CSEM 419) A survey of molecular phenomena unique to plant systems. Topics will include: genome organization and synteny between plant genomes, transcriptional and post-transcriptional control of gene expression, signal transduction, epigenetics, plant-pathogen interactions and responses to biotic-and abiotic-stresses. Special approval needed from the department.

PSAS 420-4 Crop Pest Control. (Same as CSEM 420) Study of field pests of forest, orchard, field and garden crops; pest control principles and methods; control strategy; and consequences of pest control operations. Special approval needed from the department. Lab fee: $35.

PSAS 421-3 Turf Management Issues and Strategies. (Same as HORT 421) Issues in environment, technology, management, society, politics, business, and sports that interact with turf management. Students will utilize periodicals and other references for preparing papers addressing these issues. Prerequisite: HORT 322 or permission of instructor. Lab fee:

$25.

PSAS 422-3 Turfgrass Science and Professional Management. (Same as HORT 422) Basic concepts of physiology, growth, and nutrition of turfgrasses and their culture. Application of turfgrass science to management of special areas, such as golf courses, athletic fields, sod farms, and to the turfgrass industry. Prerequisite: CSEM 240 and HORT 322 or equivalent or consent of instructor. Lab fee: $50.

PSAS 423-3 Greenhouse Management. (Same as HORT 423) Principles of greenhouse management controlling environmental factors influencing plant growth; greenhouses and related structures; and greenhouse heating and cooling systems. Prerequisite: HORT 220 or consent of instructor. Laboratory fee: $40.

PSAS 424-4 Floriculture. (Same as HORT 424) Production, timing and marketing of the major floricultural crops grown in the commercial greenhouse. Each student will have an assigned project. Special approval needed from the department. Laboratory fee: $40.

PSAS 425-4 Environmental Physiology of Plants. (Same as PLB 425; Same as CSEM 425) The environmental physiology of plants focuses on the 1) influence of abiotic factors (e.g., light, water, temperature, nutrients, pollutants) on growth, development, and yield; 2) mechanisms by which plants respond to these abiotic factors; 3) use of biotechnology to increase abiotic stress tolerance in model and crop plants. Prerequisite: PLB 320 or CSEM 409. A $35 laboratory fee will be assessed.

PSAS 426-4 Genomic and Bioinformatics. (Same as CSEM 426) The course is designed to introduce students from a variety of backgrounds and departments to the scope and methodology of genomic and bioinformatic sciences. Real problems and solutions from genome data analysis are studied in this course to see how high throughput genomics is driving bioinformatics, and changing the biological sciences in revolutionary ways. Special approval needed from the department.

PSAS 427-5 Plant Biochemistry. (Same as PLB 427; CSEM 427) Exploration of fundamental biochemical pathways in plants with an emphasis upon carbon and nitrogen metabolism. Special approval needed from the department. Lab fee: $35.

PSAS 428-3 Advanced Landscape Design I. (Same as HORT 428) Development of the design process, graphics and verbal communication of landscape projects. Emphasis on large-scale projects and residential design. Special approval needed from the department. Laboratory fee: $25.

PSAS 429-3 Advanced Landscape Design II. (Same as HORT 429) Development of the design process, graphics and verbal communication of landscape projects. Emphasis on construction details, color rendering and portfolio development. Special approval needed from the department. Laboratory fee: $25.

PSAS 430-4 Plant Propagation. (Same as HORT 430) Fundamental principles of asexual and sexual propagation of horticultural plants. Actual work with seeds, cuttings, grafts and other methods of propagation. Prerequisite: HORT 220. Field trip costs approximately $5. Lab fee: $40.

PSAS 431-4 Landscape Construction. (Same as HORT 431) An introduction course in the basic elements of landscape construction dealing with wood, concrete, masonry and stone. Emphasis will be placed on safety, construction interpretation of construction drawings, specifications for specific structures, materials selection, cost estimation, site preparation, and construction techniques. Prerequisite: HORT 220. Laboratory fee: $170.

PSAS 432-4 Garden Center and Nursery Management. (Same as HORT 432) Principles and practices in both field and container production or ornamental landscape materials and the marketing of landscape plant materials at the nursery and retail garden center. Business management of both nurseries and garden centers will be included. Special approval needed from the department. Laboratory fee: $50.

PSAS 433-3 to 7 Introduction to Agricultural Biotechnology. (Same as AGSE 433, ANS 433, CSEM 433, HORT 433, PLB 433) This course will cover the basic principles of plant and animal biotechnology using current examples; gene mapping in breeding, transgenic approaches to improve crop plants and transgenic approaches to improve animals will be considered. Technology transfer from laboratory to marketplace will be considered. An understanding of gene mapping, cloning, transfer, and expression will be derived.

PSAS 434-3 Woody Plant Maintenance. (Same as HORT 434) Care and management of ornamental shrubs and trees commonly used in the landscape. Topics to include trimming, pruning, fertilization, transplanting and diagnosis of woody plant problems. Special approval needed from the department.

PSAS 435-1 to 4 Agricultural Molecular Biotechnology Seminar. (Same as CSEM 435) Molecular Biology is rapidly making important contributions to agricultural science through biotechnology. An appreciation of the techniques of molecular biology and their application to plant improvement is important to all in agriculture and biology. The relationships between plant molecular biology and the biotechnology industry will be discussed. Presentations on particular research problems will be made. Graded S/U only.

PSAS 436-4 Successful Fruit Growing. (Same as HORT 436) Learn how to grow and use temperate fruit trees for your pleasure and/or economic benefit. Learn to use the basic principles of plant-environment interaction to understand and solve common problems found in the culture of tree fruit crops in the landscape, garden or orchard. Master the secrets of fruit growing through emphasis on hands-on experiential laboratories. Focus on Midwest culture of tree fruit and nut crops. One-day field trip. Required textbooks mandatory. Special approval needed from the department. Laboratory fee: $135.

PSAS 437-4 Vegetable Production. (Same as HORT 437) Culture, harvesting, and marketing of vegetables; with morphological and physiological factors as they influence the crops. Special approval needed from the department. Laboratory fee: $25.

PSAS 438-3 Plant and Animal Molecular Genetics Laboratory. (Same as AGSE 438, PLB 438, CSEM 438, ZOOL 438) Arabidopsis and Drosophila model organisms, lab-based training in laboratory safety, reagent preparation, phenotype analysis, genetics, DNA and RNA analysis, PCR, cDNA construction, cloning and sequencing of genes. Includes plant and bacterial transformation, and a population level analysis of genetic variation using RAPD markers in grasses and Alu insertion in humans. Two 2-hr labs and one 1-hr lecture per week. Prerequisite: BIOL 305 or equivalent or consent of instructor. Lab fee: $30.

PSAS 439-3 Introduction to Landscape Design Software. Introduces students to a popular software program used to create landscape designs. Emphasis is on learning the software program rather than learning the design process. Prerequisite: HORT 328A and HORT 328B.

PSAS 441-3 Soil Morphology and Classification. (Same as CSEM 441) Development, characteristics, and identification of soils, study of profiles; and interpretation and utilization of soil survey information in land use planning. Special approval needed from the department. Field trip costing approximately $5.

PSAS 442-3 Soil Physics. (Same as CSEM 442) A study of the physical properties of soils with special emphasis on soil and water relationships, soil productivity and methods of physical analysis. Prerequisite: CSEM 240.

PSAS 443-3 Soil Management. (Same as CSEM 443) The soil as a substrate for plant growth. Properties of the soil important in supplying the necessary mineral nutrients, water and oxygen and for providing an environment conducive to plant root system elaboration. Soil management techniques that are important in optimizing plant growth. Prerequisite: CSEM 240.

PSAS 445-3 Irrigation Principles and Practices. (Same as CSEM 445) This course will cover basic principles of irrigation sciences; water requirements of crops; soil water relationship; water application methods including flooding, sprinkler and drip (or trickle) systems; water conveyance, distribution and measurement; evaluation of irrigation efficiency; and irrigation scheduling. Considerations will also include crop production effects and economic aspects of irrigation. Special approval needed from the department.

PSAS 446-3 Soil and Water Conservation. (Same as CSEM 446) Covers the principles of hydrologic processes and soil erosion. Consideration will be given to the occurrence of soil erosion as it affects humans, food production and the environment. The methods and technologies for protecting against and controlling of erosion will also be discussed. Special approval needed from the department.

PSAS 447-3 Fertilizers and Soil Fertility. (Same as CSEM 447) Recent trends in fertilizer use and the implications of soil fertility build up to sufficiency and/or toxicity levels; the behavior of fertilizer material in soils and factors important in ultimate plant uptake of the nutrients; the plant-essential elements in soils and ways of assessing their needs and additions; tailoring fertilizer for different uses and management systems; implication of excessive fertilization in our environment. Concurrent enrollment in PSAS 448 required. Special approval needed from the department.

PSAS 448-2 Soil Fertility Evaluation. (Same as CSEM 448) A laboratory course designed to acquaint one with practical soil testing and plant analysis methods useful in evaluating soil fertility and plant needs. One hour lecture, two hours laboratory. Concurrent enrollment in PSAS 447 required. Special approval needed from the department. Laboratory fee: $15.

PSAS 454-4 Soil Microbiology. (Same as MICR 454) (Same as CSEM 454) A study of microbial numbers, characteristics and biochemical activities of soil microorganisms with emphasis on the transformation of organic compounds, nitrogen phosphorus, sulfur, iron and other plant essential nutrients. Prerequisite: CSEM 240 or MICR 301. Lab fee: $15.

PSAS 455-3 Biology of Plant-Microbe Interactions. (Same as CSEM 455) The molecular basis of post-pathogen interactions and disease development in plants is examined with a critical review of original and current literature focusing on the mechanisms of pathogenesis, virulence, disease development and resistance, and response mechanisms in plants. Special approval needed from the department.

PSAS 461-3 Programming for Agricultural Systems. (Same as AGSE 461) Computer programming concepts and strategies are applied to agricultural problems and systems. Students will analyze problems, design solutions, develop software and test solutions. Student will be expected to develop a software project related to their academic interests. Special approval needed from the department. Lab fee: $10.

PSAS 463-3 Agricultural Electrical and Electronics Systems. (Same as AGSE 463) Electrical and electronic knowledge and basics skills are developed and implemented with practical exercises and projects. Electrical and electronics circuits and control systems will be planned and constructed, with emphasis on automation, convenience, codes and safety. Laboratory fee: $40.

PSAS 466-4 Vine and Small Fruit Culture. (Same as HORT 466) Study of the developmental patterns and environmental responses of important vine and small fruit crops; strawberries, brambles, blueberries, grapes and exotic crops. Learn to adapt these crops to profitable culture for the amateur or professional with a Midwest focus. Practical hands-on experience in the classroom and the field. Two one-day field trips required. Required textbooks mandatory. Special approval needed from the department. Lab fee: $150.

PSAS 467-3 Wines of the World. (Same as HORT 467) Varieties, terroir, culture and connoiseurship. Study the impact of varieites, terroir and culture on important wines from regions around the world. Learn wine geography and its effect on wine character with practical hands-on experience and expand connoiseurship skills. A team approach to wine appellation presentations and a term project involved in the wine trade will teach industry production, marketing and networking skills. Meet once a week for 4 hours; 2 hr lecture, 2 hr lab. Meeting time arranged for convenience of majority interested in taking the class, with instructor approval. Prerequisite is successful completion of HORT 333, From the Vine to its Wine, with a grade of C or better. Must be 21 years of age prior to the beginning of class to enroll. Proof of age and signature on informed consent form required at first class meeting. Purchase and use of required textbook mandatory. Laboratory fee of $192.

PSAS 468-3 Weeds - Their Control. (Same as CSEM 468) Losses due to weeds, weed identification and distribution, methods of weed dissemination and reproduction, mechanical, biological and chemical control of weeds. State and Federal legislation pertaining to weed control herbicides. Herbicide commercialization. Special approval needed from the department. Field Trips costing approximately $5.

PSAS 469-3 Organic Gardening. (Same as HORT 469) This class will focus on the philosophical background of organic farming, as well as the biological, environmental and social factors involved in organic food production. The student will learn the basic principles of successful organic gardening without the need to use man-made synthetic chemical sprays and fertilizers. Topics covered will include soils and organic

fertilizers, composting and mulches, companion planting and crop rotation, organic cultivation of fruit, vegetable and ornamental flowers/shrubs, organic pest and disease control, permaculture, and organic garden planning design and maintenance.

PSAS 470-2 Post Harvest Handling of Horticultural Commodities. (Same as HORT 470) Fundamental principles of post harvest physiology, handling, and evaluation of horticultural commodities will be covered. Specific details will be given on vegetable, fruit, ornamental and floricultural commodities. Prerequisite: HORT 220 and PLB 320. Field trip costing approximately $30.

PSAS 472-3 Precision Agriculture. (Same as AGSE 472) A study of the core components of Precision Agriculture including the Global Positioning System (GPS), multispectral and hyperspectral remote sensing technology, Geographic Information Systems (GIS), soil sampling, yield monitoring, and analysis & decision making systems applied for site specific management of production agriculture resources. Laboratory fee: $5.

PSAS 473-3 Agricultural Automation. (Same as AGSE 473) This course introduces students to topics such as power distribution, programmable controllers, sensors and components, ladder control circuits and diagrams, and motor controls. The lab will address automation issues for different industrial processes such as pasteurization. Lab fee: $20.

PSAS 475-4 Golf Course Green Installation and Maintenance. (Same as HORT 475) This course will mainly focus on the requirements, installation, care and maintenance of the rooting media of golf course putting green and turfgrass on disturbed soils. Prerequisite: CSEM 240.

PSAS 476-3 Agricultural Safety and Health. (Same as AGSE 476) Analysis of safety and health issues important to managers and supervisors in agricultural operations. Topics include agricultural accident data, causes and effects of accidents, hazard identification, strategies for accident prevention, response to accidents and health risks and safeguards. Development and documentation of accident and illness prevention activities in the workplace. Special approval needed from the department.

PSAS 480-3 Designing Outdoor Spaces. (Same as HORT 480) This course will instruct and challenge the student to design outdoor spaces that cultivate a sense of place as related to the site and the user. The course will review fundamental landscape planning process including principles and elements of design with an emphasis on "green" decision making. Special approval needed from the department.

PSAS 483-3 Agricultural Processing Systems. (Same as AGSE 483) This course provides students with an understanding of the design principles, equipment, procedures and processes utilized in handling, processing and storing agricultural products. Prerequisite: AGSE 371.

PSAS 488-3 Food Engineering Technology. (Same as AGSE 488) This course introduces the basic principles of facilities planning for larger operations and complexes of the food processing industry, and to gain management/technology insight in food engineering technology. Special approval needed from the instructor.

PSAS 489-3 Brewing and Distilling Technology. (Same as AGSE 489, FERM 489) The primary focus of this course is to introduce basic facilities planning for operations of the brewing and distilling industry, and to gain management and technology insight in brewing/distilling production. Prerequisite: FERM 480 with a grade of C or better. Restricted to Junior/Senior standing in Ag Systems Technology or Fermentation Science and instructor approval.

PSAS 495-3 Food and Pharmaceutical Packaging. (Same as AGSE 495) Applied packaging and food engineering principles used in packaging, storing, preserving, and transporting food and drug products. Topics include packaging functions, graphic design, printing, sterilization, and food safety. Utilization of paper, glass, plastics, laminates, and metals. Applications of machinery and equipment. Prerequisite: AGSE 371.

PSAS 497-3 Agricultural Operations Management. (Same as AGSE 497) A capstone course in product support, interpretation of financial reports, preparing and monitoring budgets, time and process management, critical thinking, advanced problem solving. Prerequisites: AGSE 318, 371, 375.

PSAS 499-3 Agriculture Information for K-12th Grade Teachers. (Same as AGSE 499) A general inquiry into the agriculture literacy appropriate for K-12th grade students. A framework for evaluating content appropriate for K-12th grade students in the pursuit of agriculture literacy will be developed. Special approval needed from the instructor.

PSAS 500-3 Agricultural Systems Research Methodology. Research methodology for agricultural education and agricultural systems technology including defining research problems, preparing project proposals and sources of data. Special approval needed from the department.

PSAS 501-3 Recent Research in Agricultural Education. A study of recent research and development in agricultural education. The course includes an analysis of regional and national scholarly publications, procedures and products. Special approval needed from the department.

PSAS 518-3 Principles of Herbicide Action. Chemistry and mode of action of herbicides. Nature of herbicidal action. Illustrates the various types of chemical weed control procedures in current use. The physiology of herbicidal action examined using the different mechanisms established for various chemical groups of herbicides. Prerequisite: PSAS 468, PLB 320.

PSAS 520-3 Growth and Development of Plants. (Same as PLB 520) Physiological control of developmental processes. Emphasis on exogenous growth-regulating compounds and their behavior in plants. Special approval needed from the department.

PSAS 524-3 Gene Regulatory Networks. (Same as PLB 524) An examination of the integration of genes into networks including developmental, abiotic stress response, metabolic and photoreceptor gene regulatory networks. Includes motif discovery, cis-regulatory elements, discussion of transcription factor families, RNA interference, network theory, feedback loops, cytoplasmic inheritance, maternal effect, post-transcriptional and post-translational regulation. Includes 2 lectures and a 2 hr computational bioinformatics lab per week. Prerequisite: PLB 471 or permission of instructor.

PSAS 525-3 Program Development in Agricultural Education. Analysis and appraisal of current trends in agricultural education program development. Attention is given to implications for educators at the high school, post-secondary and in extension

education positions. Offered each year, alternating spring and summer semesters.

PSAS 526-4 Cytogenetics. Special approval needed from the department.

PSAS 527-3 Professional Development in Agricultural Education. Recent developments and trends in agricultural education are presented for review and discussion. The role of the agricultural instructor in determining educational priorities is emphasized. Offered each year, alternating fall and summer semesters.

PSAS 530-3 Plant Ecophysiology. (Same as PLB 530) A study of the physiological processes that influence the growth, reproduction, adaptation, and geographic distribution of plants. The ecophysiology of plant stress and plant interactions. Special approval needed from the department.

PSAS 531-3 International Agricultural Systems. (Same as AGSE 431) Introduction to world agriculture, farming systems, world crops, agricultural trade, and food production and processing. Influence of population and climate. Ethical issues surrounding rain forests, global agriculture, finance, world trade, crops and livestock, and the environment. Appropriate technologies and their social and economic impact on developing countries. Special approval needed from the department.

PSAS 547-2 Soil and Environmental Quality. A study of the interaction between plants and soil-water, and their effects on soil and water pollution. Reactions and processes governing the solubility and mobility of metals, organic compounds and nutrients in soil, sustainable management practices, and soil/water resource remediation improving environmental quality will be discussed. Prerequisite: CSEM 240 or consent of instructor.

PSAS 548-2 Fundamentals in Urban Soils. Study of the function, structure, and management of soils and engineered soils in the urban environment. Emphasis is on urban horticulture, turf, urban forests, landscape plants and urban settings. Course will focus on understanding and implementation of basic soil concepts, with an emphasis on sustainability and management of urban soils to minimize maintenance and maximize utility.

PSAS 550-3 Plant Disease Management and Epidemiology. This course will provide understanding of approaches to managing plant diseases, strategies for developing and implementing integrated disease management programs, and methods for monitoring and analyzing epidemics.

PSAS 551-4 Plant Nematology. This course will provide an understanding of plant parasitic nematode anatomy and morphology, identification, life cycles, and management strategies. Emphasis will be placed on practical or applied aspects of information presented. Special approval needed from the department.

PSAS 555-4 Nanotechnology for Agricultural and Food Industries. This course will cover fundamentals and application of nanotechnology applied to the agri-food sector. Novel techniques such as encapsulation and delivery of agricultural and food molecules, diagnostics and sensing for plant and animal health will be covered. Application in production, processing and packaging of food and feed, to improving safety, quality and security will also be covered by student participation and guest lecturers. Prerequisite: basic undergraduate physics and chemistry or consent of instructor.

PSAS 560A-3 Field Plot Technique. Design of field plot and greenhouse experiments including appropriate statistical analyses for each of the designs. Data interpretation. Prerequisite: EPSY 506 or ZOOL 557 or consent of instructor. Special approval needed from the department.

PSAS 560B-2 Field Plot Technique. Each of the designs discussed in (A) will be illustrated with a type problem and solved by computer processes using primarily MINITAB and SAS software programs. Prerequisite: PSAS 560A or concurrent enrollment or consent of instructor.

PSAS 561-3 Control Programming. Course in the logic and procedures of computer programming for automating, controlling, and monitoring of agricultural processes. Students will analyze problems, design solutions, develop software and test solutions. Students will be expected to develop a control, monitoring, and automated data collection project related to their research interests. Special approval needed from the department. Laboratory fee: $10.

PSAS 562-3 Sustainable Landscape Practices. (Same as HORT 462) Landscape practices designed and maintained with respect to natural systems offer ecological benefits, functional solutions and aesthetic value to outdoor spaces. This course will introduce best practices and construction methods of sustainable landscape features as green roofs, green walls, and permeable pavers with an emphasis on construction details, material selection and case studies. Students will expand critical thinking skills as applied to landscape planning.

PSAS 563-3 Plants for the Ecological Landscape. (Same as HORT 463) Introduction to alternative plant selections for the urban landscape associated with the use of native plants and creating edible landscapes. Emphasis is placed on site location, whether on the ground, in containers or on a green roof, to determine best practices and appropriate choices in urban environments.

PSAS 564-3 Growing Fruit in the Urban Environment. Learn why and how to grow perennial fruit crops in limited and special spaces in the urban environment. The potential uses of temperate perennial fruit plants in the urban landscape are examined. Theoretical obstacles to successful fruit growing are explored. The unique advantages and disadvantages of growing long-lived perennial plants in urban landscape are examined. Methods of developing practical crop scheduling for intended outcomes (low vs. high inputs) are talked about. Efficient utilization of urban meso-climate niches are covered.

PSAS 565-1 Bee Management in Urban Spaces. Study of the role of bees in the urban landscape. Behavior, biology and pests of bees will be examined. Practical management of bees will be explained in connection with maintaining healthy bee ecosystems. The demonstrator species will be the honey bee Apis mellifera.

PSAS 571-4 Genomics of Eukaryotes: Bioinformatics. (Same as PLB 571) Genomics, Proteomics and Bioinformatics are rapidly making important contributions to the Life Science through biotechnology. An appreciation of the genomic tools is important to all in agriculture and biology. The relationships between molecular biology bioinformatics and the biotechnology industry will be explored. Short independent practical projects in genomics, proteomics or bioinformatics will be pursued.

PSAS 572-3 Current Research in Agricultural Systems. A study and analysis of current problems, research findings and innovations in agricultural systems. Technical reports and journal articles will be discussed and analyzed. Students will

select articles related to their own research interests and begin writing a thesis or research proposal. Special approval needed from the department.

PSAS 575-3 Introduction to Agricultural Systems. Operational functions and processes that are integrated to accomplish a designated, well-defined purpose in production and processing. Topics include planning and evaluating reliability, manpower, scheduling, economy, packaging, human and animal factors. Prerequisites: AGSE 318, 371, or instructor approval. Lab fee: $10.

PSAS 580A-3 Colloquium in Bioinformatics for Computer Engineers. Bioinformatics makes important contributions to the Life Sciences through biotechnology. The use of Bioinformatics is important to all in agriculture, biology, computer engineering and computer science involved in the analysis of genes; proteins; and genomes by computers and networks. Short independent practical projects in bioinformatics or computer networking may be pursued. Graduate Student status required. Sections A, B, and C. May be taken online.

PSAS 580B-3 Colloquium in Bioinformatics for Computer Engineers. Bioinformatics makes important contributions to the Life Sciences through biotechnology. The use of Bioinformatics is important to all in agriculture, biology, computer engineering and computer science involved in the analysis of genes; proteins; and genomes by computers and networks. Short independent practical projects in bioinformatics or computer networking may be pursued. Graduate Student status required. Sections A, B, and C. May be taken online.

PSAS 580C-3 Colloquium in Bioinformatics for Computer Engineers. Bioinformatics makes important contributions to the Life Sciences through biotechnology. The use of Bioinformatics is important to all in agriculture, biology, computer engineering and computer science involved in the analysis of genes; proteins; and genomes by computers and networks. Short independent practical projects in bioinformatics or computer networking may be pursued. Graduate Student status required. Sections A, B, and C. May be taken online.

PSAS 581-1 to 4 (1,1,1,1) Seminar. Individual presentations on subjects and problems relating to soils, field and horticultural crops, education, information, and technologies and other phases of plant, soil and general agriculture. Graded S/U only.

PSAS 581A-1 to 4 (1,1,1,1) Seminar. Individual presentations on subjects and problems relating to soils, field and horticultural crops, education, information, and technologies and other phases of plant, soil and general agriculture. Graded S/U only.

PSAS 581B-1 to 4 (1,1,1,1) Seminar. Individual presentations on subjects and problems relating to soils, field and horticultural crops, education, information, and technologies and other phases of plant, soil and general agriculture. Graded S/U only.

PSAS 582A-2 Colloquium in Plant and Soil Science-Genetics and Plant Breeding. Recent developments and trends in specialized areas of plant and soil science will be discussed in genetics and plant breeding.

PSAS 582B-2 Colloquium in Plant and Soil Science-Research Methods. Recent developments and trends in specialized areas of plant and soil science will be discussed in research methods.

PSAS 582C-2 Colloquium in Plant and Soil Science-Physiology and Ecology. Recent developments and trends in specialized areas of plant and soil science will be discussed in physiology and ecology.

PSAS 583-3 Urban Ecological Landscape Practicum. Critical analysis and innovative design/solutions of urban landscape practices and urban agriculture from an ecological perspective. This practicum culminates the objective of integrating natural systems in the design and practice of sustainable landscape systems including urban food production. Learning opportunities will be presented through site visits and case studies. Students will demonstrate practical application of theories and systems through discussions and presentations.

PSAS 588-1 to 8 International Graduate Studies. Residential graduate study programs abroad. Approval of department required both for the nature of program and number of hours of credit. Special approval needed from the department. Graded S/U only.

PSAS 590-1 to 4 Readings. Contemporary books and periodicals on selected subjects within the fields of plant, soil and agricultural systems. Special approval needed from the department.

PSAS 592-1 to 3 Special Problems. Directed study of specialized areas of crop production, horticulture, soils or agricultural systems depending on the program of the student. Discussion, seminars, readings and instruction in research techniques. Special approval needed from the department.

PSAS 593-1 to 6 Individual Research. Directed research on approved projects investigating selected fields of plant, soil and agricultural systems. Special approval needed from the department.

PSAS 595-1 to 4 Agricultural Occupation Internship. Prepares coordinators to fulfill their responsibilities in selected areas in agricultural related occupations through an internship in the area of specialization and through orientation to related technical information. Special approval needed from the department.

PSAS 599-1 to 6 Thesis. At least three hours of thesis credit is required for the Master`s degree under the thesis option. Special approval needed from the department.

PSAS 601-1 per semester Continuing Enrollment. For those graduate students who have not finished their degree programs and who are in the process of working on their dissertation, thesis or research paper. The student must have completed a minimum of 24 hours of dissertation research, or the minimum thesis, or research hours before being eligible to register for this course. Concurrent enrollment in any other course is not permitted. Graded S/U or DEF only.