

uous fuel-injection systems). Service, maintenance, repair and troubleshooting of each different system type is covered in detail. *Spring*

**AVMT228 (1-3)**  
**Maintenance: General, Airframe, or Powerplant Review**  
 A review of all subjects from a selected curriculum. A minimum of five examinations per curriculum area is required. Prerequisites: All applicable curriculum subjects must have been completed. *Fall, Spring*

**AVMT237 Alt (4)**  
**Aircraft Hydraulic, Pneumatic, and Landing Gear Systems**  
 Operation and maintenance of aircraft hydraulic systems, pneumatic systems, landing-gear systems, and the inspection, checking, servicing, trouble-shooting, and repair of these systems and system components. *Spring*

**AVMT304 Alt (4)**  
**Aircraft Metal Structures**  
 A study and application of the processes used in the fabrication and repair of aircraft metal structures. Welding theory and practice with emphasis on weld-quality identification. Riveted, aircraft, aluminum, sheet-metal structures including the fabrication and repair of such structures. *Fall*

**AVMT306 Alt (2)**  
**Aircraft Non-metal Structures**  
 A study of wood and fabric as used in the construction of aircraft and a study of the methods, tooling, inspection, processes, and repair of composite aircraft structures. Includes the application, identification, and functions of aircraft protective finishes. *Spring*

**AVMT308 Alt (2)**  
**Aircraft Assembly, Rigging and Inspections**  
 Study of the nomenclature and design features of both fixed-wing and rotor-wing aircraft and the assembly, alignment of aircraft structures, and rigging and balancing of control system. A detailed inspection of the entire aircraft or rotorcraft is covered as it applies to the airframe 100-hour and other required inspection. *Spring*

**AVMT310 Alt (4)**  
**Gas Turbine Engines**  
 Principles and theory of jet-engine propulsion, design, types of, and associated systems. Maintenance, overhaul, installation-removal, repair, trimming, and troubleshooting of turbine engines. *Fall*

**AVMT314 Alt (3)**  
**Aircraft Propellers and Engine Inspections**  
 Theory and limited work on propellers, both wood and metal. Encompasses fixed, adjustable, controllable, feathering, reversible, and the control of the latter by mechanical, hydromatic, or electrical control systems. The inspection practice of performing the 100-hour inspection on aircraft engines and propellers. *Spring*

**AVMT316 Alt (7)**  
**Reciprocating Engine Systems and Overhaul**  
 A study of reciprocating engine theory, overhaul methods, and practices and the installation of reciprocating engines. Also includes a study of the following engine systems: exhaust, cooling, induction, and lubrication. *Spring*

# AGRICULTURE

Smith Hall, Room 109  
 (269) 471-6006  
 FAX: (269) 471-3009  
 agri@andrews.edu  
 http://www.andrews.edu/COT/AG

## Faculty

Thomas N. Chittick, *Chair*  
 Stanley Beikmann  
 Katherine Koudele  
 Ralph C. Wood

Academic Programs	Credits
BS: Agriculture	40
BS: Animal Science	40
Pre-Veterinary Medicine Management	
BS: Horticulture	40
Landscape Design	
Landscape/Turf Management	
BT: Agribusiness	60
BT: Horticulture	60
Landscape Design	
Landscape/Turf Management	
AT: Agriculture	36
Crop Production	
Dairy Herd Management	
Veterinary Assistant	
AT: Horticulture	35
Landscape Design	
Landscape/Turf Management	
Minors in Agriculture, Animal Science or Horticulture	20
Pre-Professional Program in Veterinary Medicine	

## Programs

**Bachelor of Science.** The BS degree prepares individuals to pursue advanced degrees for careers in teaching or research. Students may major in agriculture, animal science or horticulture with a minor to complement their intended purpose.

**Bachelor of Technology.** The BT degree is a career specialist's degree. Graduates are prepared for supervisory and management positions in production agriculture, horticulture, or the ornamental horticulture industry.

**Associate of Technology.** The two-year AT degree programs provide students with adequate skills and working knowledge to apply for entry-level positions in their area of specialization.

### BS: Agriculture

#### Major requirements—40

AGRI100, 118, 206, 300, 304, 308, 405; ANSI114; HORT105, plus 13 major elective credits chosen in consultation with advisor.

#### Cognate requirements—18

BIOL165,166; CHEM131, 132

**BS: Animal Science****Major requirements—40**

AGRI100, 405; ANSI114, 305, 425, plus 24-25 credits in a special area of emphasis and 4-5 major electives chosen in consultation with an advisor.

**Cognate requirements—18**

BIOL165, 166; CHEM131, 132

**Animal Science Areas of Emphasis**

Students may choose an area of emphasis from the following or develop a personalized program in consultation with their advisor to meet specific career goals.

**Pre-Veterinary Medicine—24**

AGRI137 (2); ANSI340 (3 species), 379, 420, 440, 445.

Recommended electives for entry into veterinary college:

\* BCHM421, 422; CHEM231, 232; MATH166, 167; PHYS141, 142.

\* Courses may vary depending on entrance requirements of the veterinary college of choice.

**Management—25**

AGRI137 (2), 395; ANSI340 (4 species); ACCT121; ECON226.

Electives can be tailored to meet a specific student's interest, such as animal behavior, business management or marketing, journalism, or communication.

**BS: Horticulture****Major requirements—40**

AGRI100, 118, 240, 308, 405; HORT105, 378, plus 18 credits in a special area of emphasis.

**Cognate requirements—18**

Select 8-10 credits from BIOL165, 166; BOT430, 475; ZOOL459; CHEM131, 132.

**Horticulture Program Emphases in BS Degree Programs**

Students may choose an area of emphasis from the following or develop a personalized program in consultation with their advisor to meet specific career goals.

**Landscape Design—18**

Select from the following: HORT135, 226, 228, 315, 350, 355, 365, 375, 429, 448

**Landscape/Turf Management—18**

Select from the following: HORT135, 208, 211, 212, 217, 226, 228, 315, 346, 350, 359, 360, 367, 417

**BT: Agribusiness****Major requirements—44**

AGRI100, 118, 206, 240, 300, 304, 308, 405; ANSI114; HORT105, 378; plus 10 major elective credits chosen in consultation with advisor.

**Cognate requirement—4**

CHEM110

**Business Emphasis—18**

ACCT121, 122; BSAD341, 355; ECON226; FNCE317

**BT: Horticulture****Major requirements—60**

AGRI100, 118, 240, 308, 405; HORT105, 135, 226, 228, 315,

346, 378, plus 16-17 credits in a special area of emphasis, and 7-8 major elective credits chosen in consultation with advisor.

**Cognate requirement—4**

CHEM110

**Horticulture Areas of Emphasis in BT Degree Programs**

Students may choose an area of emphasis from the following or develop a personalized program in consultation with their advisor to meet specific career goals.

**Landscape Design—16**

HORT350, 365, 355, 429, 448. The landscape design program emphasizes the development of technical drawing skills, an understanding of the principles of design, and a knowledge of plant material.

**Landscape/Turf Management—17**

HORT208, 211, 217. Select 9 credits from the following: HORT212, 346, 350, 359, 360, 367, 417. The landscape management emphasis features proper horticultural practice, identification of landscape plants, selection of appropriate equipment, and the concept of total maintenance.

**AT: Agriculture****Major Requirements—25-36**

AGRI100; ANSI114, 305, 340, plus 15-24 credits in a special area of emphasis (see below) and 0-1 major elective credits chosen in consultation with advisor.

**Agriculture Program Emphasis in Associate Degree Programs**

Students may choose an area of emphasis from the following or develop a personalized program in consultation with their advisor to meet specific career goals.

**Crop Production—24**

AGRI118, 206, 240, 300, 395; HORT105

**Cognate requirement—4**

CHEM110

**Dairy Herd Management—25**

AGRI270, 304, 395; ANSI250, 278, 430, 440

**Cognate requirements—4**

CHEM110

**Veterinary Assistant—15**

AGRI395; ANSI240, 379, 420

**Cognate requirements—15**

CHEM110; CLSC101, 102, 230, 250, 260

**AT: Horticulture****Major requirements—35**

AGRI100, 118, 405; HORT105, plus 13-16 credits in a special area of emphasis (see below) and 7-10 major elective credits chosen in consultation with advisor.

**Cognate requirement—4**

CHEM110

**Horticulture Program Emphases in Associate Degree Programs**

Students may choose an area of emphasis from the following or develop a personalized program in consultation with their advisor to meet specific career goals.

**Landscape Design—13**  
HORT135, 226, 228, 350

**Landscape/Turf Management—16**  
HORT208, 211, 217, 226, 228, 239

## Minors in Agriculture, Animal Science or Horticulture—20

Selected from AGRI, ANSI or HORT courses in consultation with advisor.

### Pre-Professional Program in Veterinary Medicine

Katherine Koudele, *Director*  
(269) 471-6299

Entrance requirements vary among the colleges of veterinary medicine. Therefore, interested students must write to the schools of choice for the most current and detailed information. A list of accredited colleges of veterinary medicine may be obtained from the American Veterinary Medical Association, 930 North Meacham Road, Schaumburg, IL 60196; <http://www.avma.org>.

*Students in consultation with their advisors in the Agriculture Department can design individualized programs of study to meet the entrance requirements of the veterinary school of choice.* The required prerequisite pre-veterinary courses are usually general biology, general and organic chemistry, physics, biochemistry, mathematics, courses in animal science, and general education.

## Courses

(Credits)

See inside front cover for symbol code.

### AGRICULTURE

**AGRI100** (1)  
*College Success Seminar*

A survey of the history of agriculture in the U.S. and career opportunities in production agriculture, animal science, landscaping and related areas. Students also learn how to improve their study skills and become familiar with the academic resources available to them on campus. *Fall*

**AGRI118** \$ (5)  
*Soil Science*

Factors affecting soil formation, soil texture, particle size, pore space and their impact on soil air/water relations, and chemical characteristics of soils, including pH, ion exchange, and maintenance of soil fertility. Weekly: 4 lectures and a 3-hour lab. *Spring*

**AGRI137** (1-3)  
*Practicum in \_\_\_\_\_*

Fifty hours per credit of supervised practical experience in one area of concentration. May be repeated in different areas for a maximum of 6 credits. Topics to be chosen in consultation with an advisor. *Fall, Spring*

**AGRI206** \$ Alt (3)  
*Farm Machinery*

Selection and operation of farm equipment, based on the initial cost and economic performance, including factors governing the

site and type of farm machines, their capacity, efficient use, adjustment and repair. Weekly: 2 lectures and a 3-hour lab. *Fall*

**AGRI240** Alt (3)  
*Fundamentals of Irrigation*

Design, installation, drawing, interpretation and maintenance of plastic or metal irrigation systems and control devices for proper sprinkler coverage. *Fall*

**AGRI270** Alt (3)  
*Management of Agriculture Enterprises*

An introduction to acquiring and analysis of management information for decision making; an understanding of basic economic principles that impact biological production systems and implementation of the principles for total quality management for increased productivity. *Fall*

**AGRI300** Alt (3)  
*Field Crop Production*

Importance, distribution, economic adaptation, and botany of leading farm crops, emphasizing rotation, seedbed preparation, and economic production. *Spring*

**AGRI304** Alt (3)  
*Forage Crop Production*

Basic principles of forage crop production, emphasizing choice of crop, establishment, growth, maintenance, harvesting, storage, feeding, and other management decision. *Spring*

**AGRI308** \$ Alt (3)  
*Principles of Weed Control*

Control of weeds in horticultural and field crops, utilizing biological, cultural, mechanical, and chemical practices. Class study also involves preparation and testing for pesticide applicator's license. Weekly: 2 lectures and a 3-hour lab. *Fall*

**AGRI345** (1-4)  
*Topics in \_\_\_\_\_*

A class based on selected topics of current interest in agriculture. Repeatable in different areas.

**Concepts of International Agriculture**  
**International Ag Implementation**  
**Horse Judging**  
**Livestock Judging**  
**Viticulture**  
**Solanaceous and Vine Crops**  
**Tree Fruit Production**

**AGRI395** (1-4)  
*Internship in \_\_\_\_\_*

Supervised internship of on-the-job work experience in some field of agriculture under the direction of the employer and evaluated by a departmental faculty member. Students submit report of their experience and must complete a minimum of 120 hours of work experience for each credit earned.

**AGRI405** (1)  
*Research Seminar*

Research work in agriculture; reports given by students, staff, and visiting lecturers. *Spring*

**AGRI499** (1-5)  
*Project in \_\_\_\_\_*

Individual research in some field of agriculture under the direction of the staff. Repeatable to 10 credits.

**ANIMAL SCIENCE****ANSI114 (3)*****Introduction to Animal Science***

Basic farm animal anatomy, reproductive and digestive physiology, housing, health management with information on how animal products are processed and marketed. Efficient, effective management is emphasized throughout course. *Fall*

**ANSI240 \$ Alt (4)*****Fundamentals of Veterinary Clinical Techniques***

Topics covered and skills learned include (not limited to) animal restraint and handling, anesthesia, surgical instruments and aseptic technique, surgical assistance, post-surgical nursing, pain management, wound management and bandaging, euthanasia and client bereavement, diagnostic imaging. Laboratory included.

**ANSI250 \$ Alt (3)*****Dairy Facilities***

A study of various types of milking systems, housing and manure handling systems of dairy cattle of all ages and production levels. Ventilation, stall and barn dimensions, and bedding will be some of the topics covered. Weekly: 2 lectures and one 3-hour laboratory. *Summer*

**ANSI278 \$ Alt (3)*****Dairy Health and Disease***

A study of the cause, prevention and treatment of infectious and metabolic diseases of dairy cattle. Weekly: 2 lectures and one 3-hour laboratory. *Spring*

**ANSI305 \$ Alt (3)*****Animal Nutrition***

Principles of digestion, absorption, metabolism of feeds by farm species are examined for practical, profitable feeding. Common and non-traditional feedstuffs, feed-related diseases and ration formulation are included. Weekly: 2 lectures and a 3-hour lab. Recommended: CHEM110 or 131. *Fall*

**ANSI340 \$ (3)*****Production/Management of \_\_\_\_\_***

Production methods and management practices of domesticated livestock species including nutrition, reproduction, housing, health and specialized care of a particular species. Course is repeatable for study of avian, beef cattle, dairy cattle (includes a lab), equine (includes a lab), porcine, and wool and lamb production. *Fall, Spring*

**ANSI379 Alt (2)*****Small Animal Health and Disease***

A survey of proper handling and care, nutritional needs, and common health problems of companion animals such as dogs, cats, and birds. *Fall*

**ANSI420 \$ Alt (4)*****Canine Gross Anatomy***

Study of macroscopic skeleton, muscles, internal organs, blood vessels and nerves using preserved, latex-injected specimens. Comparisons made with the live dog through palpation. Weekly: 2 lectures and 2 three-hour labs. Recommended: BIOL166. *Fall*

**ANSI425 Alt (3)*****Issues in Animal Agriculture, Research and Medicine***

Study of the ethical issues that challenge animal researchers, producers, caretakers, and veterinarians to treat animals humanely yet effectively in society today. *Spring*

**ANSI430 Alt (2)*****Lactation Physiology***

Anatomy and physiology of the udder, milk secretion, disease prevention and treatment, milking management and milking systems.

**ANSI440 \$ Alt (3)*****Animal Reproduction***

Study of anatomy and physiology of farm animal reproduction including lactation, which explores the cellular component as well as the management aspects. Weekly: 2 lectures and a 3-hour lab. Recommended: BIOL166. *Spring*

**ANSI445 \$ Alt (3)*****Physiology of Farm Animals***

Physiology of digestive, reproductive, lactation, cardiovascular, pulmonary, excretory, nervous, and skeletomuscular systems in domesticated ruminants and monogastrics. Weekly: 2 lectures and a 3-hour lab. Recommended: BIOL166. *Fall*

**HORTICULTURE****HORT105 \$ (5)*****Plant Science***

Intended to acquaint students with the requirements of plant growth and development. Understanding of these processes is gained by studying topics such as plant cells, tissue, and organ structure; photosynthesis, cellular respiration, plant reproduction, including flowering, fruit development, seed set, the role of hormones, and plant nutrition. Weekly: 4 lectures and a 3-hour lab. *Fall*

**HORT135 \$ (4)*****Landscape Drafting and Design***

Develops proficiency in technical drafting for landscape design including symbols, title blocks, plant legends and plan organization. Principles of design, site analysis, functional diagraming, circulation, spatial planes, design schematics and plant selection are explored. Laboratory puts the design process to work in drawing plans for residential design. Weekly: 3 lectures and a 3-hour lab. *Fall*

**HORT208 \$ Alt (3)*****Propagation of Horticultural Plants***

Intended to acquaint students with the processes of asexual reproduction, especially as it applies to the horticultural industry. Asexual reproduction investigates methods of clonal reproduction utilizing non-flowering plant parts such as cutting, grafting, layering, and micropropagation (tissue culture). Weekly: 2 lectures and a 3-hour lab. Recommended: HORT105. *Spring*

**HORT211 \$ Alt (2)*****Landscape Equipment***

Assessment of and exposure to current equipment needed to run a landscape installation and maintenance business. Experience in physical operation of equipment, preventative maintenance and minor repair is practiced. Weekly: 1-hour lecture and a 3-hour lab. *Fall*

**HORT212 \$ Alt (3)*****Floriculture Production***

Intended to acquaint students with the production and uses of bedding and potted plants. Topics covered include seed physiology and propagation, germination, production and post-production growing techniques, growing media and containers. Weekly: 2 lectures and a 3-hour lab. *Spring*

- HORT217** Alt (3)  
**Turfgrass Management**  
 Principles of turfgrass management for parks, grounds, golf courses, and athletic fields. Topics include cool and warm season genera, growth and adaptation criteria, cultural considerations including irrigation, mowing, soil fertility, compaction and drainage; thatch, plant protection (weeds, insects, diseases) establishment and renovation. *Fall*
- HORT226** Alt (3)  
**Woody Plant Identification**  
 Introduction to the identification and recognition of shape, size, color, texture, environmental requirements and landscape value of common deciduous and evergreen trees, shrubs and vines. *Fall*
- HORT228** Alt (3)  
**Herbaceous Plant Identification**  
 Identification and recognition of shape, size, color, texture, and environmental requirements of the nonwoody plants providing color and ground cover in the landscape. *Fall*
- HORT315** \$ Alt (4)  
**Landscape Construction**  
 Course combines weekly hands-on construction processes of installing softscapes and hardscapes with an understanding of the vast array of hardscape materials available in the form of pavements, edgings, fencing, retaining walls, decks, pool shelters, etc. Weekly: 3 hours lecture and 3 hours lab. *Fall*
- HORT346** \$ Alt (2)  
**Landscape Administration and Maintenance**  
 Administration of a landscape business, employment and supervision of employees and record-keeping practices explored. Managing maintenance of hardscapes and softscapes in residential landscapes, parks, golf courses and corporate environments. Focuses on training in pruning, planting, cultivation and pest management. Weekly: 4 hours of lecture/lab. *Spring*
- HORT350** Alt (3)  
**History of Landscape Design**  
 A study of landscape history throughout civilization and its impact upon society and the environment. The origin of landscape architectural styles and their characteristics will be explored. An introspective look at personalities of landscape designers through the ages and their influence upon the American landscape. *Spring*
- HORT359** \$ Alt (3)  
**Greenhouse Environment and Construction**  
 Controlling the plant environment to enhance plant growth and optimal development through temperature, humidity, light, nutrients, sanitation and carbon dioxide levels. Structures, coverings and mechanical systems used are explored to produce the most cost-effective horticultural crops. Weekly: 2 hours lecture and a 3-hour lab. *Fall*
- HORT360** \$ Alt (3)  
**Arbiculture**  
 Care of shade and ornamental trees living under environmental stress of urbanization, their legal protection and value. Includes tree anatomy and physiology, soils nutrition and water relations, transplanting, diseases and insect control, mechanical injury and pruning to develop a healthy tree. Weekly: 2 lectures and a 3-hour lab. *Fall*
- HORT365** \$ Alt (3)  
**Urban Landscape Design**  
 Designing landscapes to meet the environmental challenges and conditions of urban settings. Circulation patterns for conducting business, aesthetic and functional aspects of design for corporate/institutional, governmental agencies and municipal areas. Weekly: 2 lectures and a 3-hour lab. Recommended: HORT135. *Spring*
- HORT367** Alt (3)  
**Golf Course Supervision**  
 Management and culture for modern golf courses and country clubs. Topics include integration of turfgrass agronomics with the administrative components of budgeting, supervision and personnel management, country club organizational structures, and design of construction and environmental issues. Golf course history, U.S. golf association rules and U.S. Golf Course Superintendents' Association certification program will be covered. *Spring*
- HORT375** Alt (3)  
**Landscape Estimating**  
 An introduction to the estimating process for landscape design, construction and maintenance work. Various schedules and forms are used to assign costs of equipment, plants, hardscape materials, labor and overhead. The many variables from project to project are explored and then formulas are applied to arrive at making landscape installations an efficient and profitable business. *Spring*
- HORT378** Alt (4)  
**Integrated Pest/Disease Management**  
 Study of significant diseases and pests of agricultural and horticultural plant materials, including life cycles and influence of environmental conditions; determination of effective control methods for crop, ornamental and turfgrass production. *Spring*
- HORT417** Alt (3)  
**Advanced Turfgrass Management**  
 Principles of advanced turfgrass management based on turf genera, cultivar, vegetative seed identification and optimal use criteria; detailed analysis of soil fertility management and research results; development of comprehensive management plan incorporating principles of integrated pest management into a cultural program to optimize the performance based on use systems. Use systems studied include golf courses, parks, lawns, athletic fields, bowling greens, cricket fields, and grass tennis courts. *Spring*
- HORT429** \$ (3)  
**Computer Landscape Design**  
 Principles and practices of computer-aided landscape design, including creating scale perimeter plot plans, using drawing tools, plant/site relationships, plant selection and use leading to a computer-generated landscape drawing. Laboratory emphasizes skill development and proficiency in integrating software and hardware to create CAD-generated landscape designs. Prior landscape drawing course work is recommended. *Spring*
- HORT448** \$ Alt (4)  
**Advanced Landscape Design and Graphics**  
 Landscape design concepts relating to the more challenging problems of residential design. Field application of grading relating to contours, specifications, exploring deck design, planting combinations, and exercises in graphics and rendering for presentations. Weekly: 3 lectures and a 3-hour lab. Recommended: HORT135. *Spring*