NORTHWEST TECH
NORTHWEST KANSAS TECHNICAL COLLEGE

2023-2024
NWKTC Catalog and Student Handbook

Precision Agriculture Technology

Description: The Precision Agriculture Technology teaches modern farming technology and methods used in the field and office for precision farming operations. The Precision Agriculture Technology program will develop students' competencies in the areas of geospatial science; agronomic and geospatial data collection; Geographic Information Systems; spatial analysis; operations management; computer systems; tractor guidance technology; implement and application control; water management systems; and sustainable agriculture practices.

Upon successful completion of the program, students will be prepared to work in precision farming operations or for entry into industry as precision agriculture technicians or agronomic support technicians.

Degree/Certificates awarded:
AAS
Tech Cert A
Tech Cert B

Program Learning Outcomes:
Upon successful completion of this program, students will be able to:

1. Display knowledge of the basic concepts of precision farming and sustainable agriculture.
2. Identify field, crop, and regional considerations, and the technologies best suited for addressing various agronomic and farming operation challenges.
3. Properly collect, store, analyze and make farming decisions from all the data collected from farm related machinery, remote sensors, soil sensors, weather monitors, and GIS analytics.
4. Conduct the proper method of crop related sampling and measuring.
5. Develop variable rate and prescriptive mapping solutions.
6. Collect soil data using sampling and electrically conductive methods.
7. Collect plant data using sampling and remotely sensed infrared methods.
8. Collect field related spatial data such as yield, moisture, and as-applied information using farm machinery and data collection equipment.
9. Demonstrate the ability to use a Geographic Information System to organize and analyze agricultural data, and use it to make farming applications and operations decisions.
10. Demonstrate the ability to install, initialize, calibrate, operate and maintain a machine guidance system.
11. Identify geospatial equipment, software, system types, and applications of each.
12. Identify the major components of a computer system and network.
13. Exhibit the proper method of presentation of geospatial and agronomic data for consultant and end-user use in operations decision making.

Program Schedule:
Students will attend class and lab from 8:00 am to 3:30 pm Monday through Friday.

Miscellaneous:
Students may choose to complete an OWE during the fourth semester instead of completing the courses indicated on the program guide.

PROGRAM GUIDE

YEAR I: FIRST SEMESTER

Course #	Course Name	Credits
AG 110	Information Technology in Agriculture	3
AG 115	Applied Geospatial and Navigation Technologies	3
AG 120	Geographic Information Systems	3
AG 130	Precision Cropping Systems	3
ENGL 110 or 112	English Composition I (Required)	3
HUM 102	Workplace Ethics	3
SO 100	Student Success Seminar (Required)	1

YEAR I: SECOND SEMESTER

Course #	Course Name	Credits
AG 150	Advanced Geographic Information Systems	3
AG 155	Data Collection and Management	3
AG 160	Remote Sensing and Aerial Data Processing	3
AG 165	Agricultural Power Systems	3
AG 190	Internship*	3
SCI 176	General Education Science	5

YEAR II: FIRST SEMESTER

Course #	Course Name	Credits
AG 210	Precision Farming Systems	4
AG 212	Crop Protection and Fertilizing Technologies	3
AG 220	Soil Sensing and Mapping Technologies	4
AG 225	Precision Operations Management	3
BA 215	Personal Finance (Required)	3
MATH 115 or 117	College Algebra (Required)	3

YEAR II: SECOND SEMESTER

Course #	Course Name	Credits
AG 250	Precision Farming Operations	4
AG 252	UAS Applications in Agriculture	3
AG 260	Water Management Technology	3
AG 265 OR	Integrated Technologies	3
AG 290	Occupational Work Experience	

COURSE DESCRIPTIONS

AG 110 INFORMATION TECHNOLOGY IN AGRICULTURE
3 CR
This course explores the concepts of precision farming and how it can improve profitability in a crop management system. The student will learn the principles of precision agriculture and the advanced technologies involved, including; geospatial science, advanced navigation technology, computer information systems, farm operations management technologies, Geographic Information Systems (GIS), data collection methods, remote sensing, machine control and other integrated solutions. Attention is also given to the economic and environmental challenges confronting agriculture today and how these technologies are being utilized to meet these demands.

AG 115 APPLIED GEOSPATIAL AND NAVIGATION TECHNOLOGIES
3 CR
This course provides an overview of geospatial science and advanced navigation technologies. Students will be involved in using radiometric positioning technologies including: the Global Positioning System (GPS), the Global Navigation Satellite System (GNSS), Real-Time Kinematics (RTK), Virtual Reference Systems (VRS), and Inertial Measurement Units (IMU). The use of these technologies will be coupled with their applications in the fundamentals of geospatial mapping such as: coordinate systems, projections, datums, township and range, legal descriptions, elevations, bearings and distance measurements. Students will gain hands-on experience with using various navigation equipment/GPS tools to get started working with geospatial information and software. Basic analysis and problem-solving skills are addressed in this course.
Prerequisites: None

AG 120 GEOGRAPHIC INFORMATION SYSTEMS
3CR
This is a foundation course that provides students with the basic knowledge of Geographic Information Systems (GIS) with regard to theoretical, technical, and application issues. It provides direct experience with the techniques used to display and analyze spatial data using GIS, with a concentration on agricultural and land management applications. Basic cartography, map production, data transformations and annotation are covered. ESRI ArcGIS and Autodesk Map 3D software platforms are emphasized.
Prerequisites: None

AG 130 PRECISION CROPPING SYSTEMS
1 CR
This course will cover the fundamentals of precision cropping systems. In this class, students will gain an understanding of the operations necessary to produce the major field crop commodities in the Central United States, corn, sorghum, wheat, soybeans, and some specialty crops. Students will gain hand-on experience with technologies used to conduct precision farming operations relative to each step of the crop production system. Material will cover all steps involved in producing a crop including, soil analysis, crop system planning, tillage, sowing, fertilizer application, crop protection, harvesting, commodity handling, and commodity marketing. Students will gain the ability to relate the implementation of Precision Cropping Systems and Technology to Return-on-Investment and overall production success.
Prerequisites: None

AG 150 ADVANCED GEOGRAPHIC INFORMATION SYSTEMS
3CR
Students will gain additional experience using ESRI ArcGIS in performing spatial analysis for addressing relevant land use, agricultural, hydrological and natural resource challenges. Students will become proficient in performing queries, setting up auto correlation functions, and determining spatial relationships. The class will cover geoprocessing, geodatabases, links, and topologies. Basic Python programming will be introduced. Agronomic applications will be emphasized.
Prerequisites: AG 120

AG 155 DATA COLLECTION AND MANAGEMENT
3 CR
Introduces the student to the collection methods, equipment, planning, operations, survey principles, and data formats associated with using the Global Navigation Satellite System and other radiometric data collection systems. Students gain hands-on experience in the field with equipment, GPS/GNSS receivers, mobile applications and post-processing software, including: Trimble Yuma, Trimble Business Center, TSC3 field computer, ESRI ArcPad, and Farmworks Mobile. Attention is also given to data storage methods; server systems, back-up equipment, database structure, cloud technologies, and data transfer tools.
Prerequisites: AG 125

AG 160 REMOTE SENSING AND AERIAL DATA PROCESSING
3 CR
This course provides an overview of photogrammetric and remote sensing principals, as well as practical experience in the extraction of earth surface information from digital aerial imagery. Topics include electromagnetic radiation principles, aerial sensors, collection systems (satellite, aircraft, UAV), LiDAR technology, laser, multispectral/hyperspectral sensing, mission planning, accuracy, data interpretation, and processing methods. The application of remote sensing technologies in agriculture and other land management fields is emphasized. Students will receive hands-on software experience using Exelis ENVI and Trimble eCognition to perform coverage measurements, classification, change detection, biomass calculations, and mapping.
Prerequisites: AG 115 and AG 120

AG 165 AG POWER SYSTEMS
3 CR
In this course, students will gain knowledge regarding several power systems used in the implementation of emerging agricultural technologies. Systems covered will include, Fluid Power systems (Hydraulic and Pneumatic), Electrical Systems, and Computer information systems. In each system, the class will gain experience with the processes of assembling and disassembling the power systems and creating relative connectors/couplers. Students will gain hands on experience with equipment utilizing stand-alone or combination systems for agricultural applications. Students will also gain experience with reading schematics to gain knowledge of system functions and to assist in hands-on troubleshooting with each of the power systems

AG 190 INTERNSHIP
3 CR
This course will teach students how to meet goals and deadlines. The student will learn to exhibit their quality of work, respect for customers, coworkers, management and punctuality. They will learn problem solving skills and how to exhibit trust, responsibility, honesty, proper appearance and both oral and written communications.

AG 210 PRECISION FARMING SYSTEMS
4 CR
Students are introduced to machine control applications, development and history. Focus is placed on operations and equipment considerations, tractor type options, control systems, antenna types, and related GNSS and VRT hardware. The student will successfully perform a system installation, including; navigation controller, steering interface, cabling, antennas, console setup, firmware update, and steering calibration. Special emphasis will be made on solenoid/valve control, connector types, signal voltages, hydraulic efficiency, dead zones, cross track errors, and common troubleshooting issues. John Deere, Trimble and AGCO systems will be used.
Prerequisites: AG 115 and AG 125

AG 212 CROP PROTECTION AND FERTILIZING TECHNOLOGIES
1 CR

This course will cover the fundamentals of implementing precision crop protection and crop/soil fertility technologies, with an overview of crop protection, plant nutrition, and soil fertility. In this class, students will learn about different types of technology used in the precision application of pesticides, fertilizers, soil amendments, or other agricultural chemicals for the purposes of controlling weeds, crop disease, or increasing fertility. Students will get hands-on experience with different application technology including those applying chemicals and fertilizers through dry spreading, liquid application, or banding.

AG 220 SOIL SENSING AND MAPPING TECHNOLOGIES
4CR
This course provides an in-depth study into the concepts, technologies and methodologies utilized in collecting soil data for agriculture applications. The student will gain hands-on experience using electrical conductivity and electromagnetic sensors to map soil texture, moisture content, topsoil depth, organic matter, pH and salinity for use in determining management zones, grid sampling locations, nitrogen efficiency and other prescription applications. Students will be introduced to traditional grid sampling methods using GPS/GNSS. Ground-Penetrating Radar (GPR) and seismic technologies will be discussed.
Prerequisites: AG 115, AG 150 and AG 155

AG 225 PRECISION OPERATIONS MANAGEMENT
3CR
This course explores the use of agri-business GIS software for managing farm operations. Students will gain practical experience using Trimble Farm Works and John Deere Apex software platforms for managing machine and farm data. Students will learn how to perform field input tracking and cost analysis, track labor costs, generate accounting reports, visualize soils and nutrient variability, manage water resources, calculate coverages, visualize topographic information, input land records, and generate a prescription map.
Prerequisites: AG 115 and AG 150

AG 250 PRECISION FARMING OPERATIONS
4CR
The student will learn various precision navigation and application procedures using equipped machinery. Focus is placed on field guidance and operations, including; configuring system settings, calibration, establishing guidance patterns, field boundaries, creating implement profiles, and managing client/field data. A special focus will be given to configuring and using rate control systems for planters, sprayers, and seeders, including; population monitoring, section control, and variable rate systems (PWM, Servo and Rawson). The student will also become proficient at importing and executing prescription map data for variable rate applications. Yield monitoring systems will be demonstrated.
Prerequisites: AG 125 and AG 210

AG 252 UAS APPLICATIONS IN AGRICULTURE
3CR
This course will guide students deeper into Unmanned Aerial Systems (UAS). Topics will include: FAA regulations, advanced level components, autopilot programming and flight plan development. Students will work with UAS autopilot simulators and will also be introduced to flying professional UAS systems. Students will apply what they have learned conducting simulated and real life flight missions in the field. This course focuses on applying Unmanned Aerial Systems to agricultural applications such as aerial imagery, thermal sensing, 4-band sensing (for NDVI generation), and aerial video.

AG 260 WATER MANAGEMENT TECHNOLOGY
3CR
This course provides an in depth study into the concepts, controls, and data integration associated with the

operation of a variable rate irrigation (VRI) system. Students will learn about working with electromagnetic (EM) and electrical conductivity (EC) data, the utilization of variability/prescription maps, VRI chemical applications, speed control systems, zone (nozzle) control systems, GPS tracking, and remote management technologies. A special emphasis will be made on the

AG 265 INTEGRATED TECHNOLOGIES
3 CR
This course introduces the student to various integrated and emerging technologies, including: electromagnetic (EM) soils mapping, GreenSeeker NDVI sensing, mobile telematics, data logging systems, augmentation and visualization tools, remote weather stations, asset management systems, internet tools, smartphone applications, planning simulations, and security solutions.
Prerequisites: AG 250

AG 290 OCCUPATIONAL WORK EXPERIENCE
13 CR.