TITLE OF THE Curricula/Module

PRECISION AGRICULTURE

TAI/Turkmenistan

May, 2020

Template of the Curriculum/Module DESCRIPTION

Short Name of the University/Country code Date (Month / Year)	TAI-TKM 05/2020
TITLE OF THE Curricula/Module	**Code**
PRECISION AGRICULTURE	

Teacher(s)	Department
Coordinating: **Dovlet Durdyyev** **Others:** **Babageldi Kurbanov** **Batyr Nuryyev**	Applied Mechanics Agricultural land reclamation Computer technology

Study cycle	Level of the module	Type of the Module
BA/MA/PhD	Bachelor's degree	

Form of delivery	Duration	Language(s)
offline	14 week	English

Prerequisites	
Prerequisites: To know: Agrochemistry Modern computer technologies Geodesy Geology Soil science Fundamentals of animal husbandry Agricultural machines Use of machine-tractor fleet Geoinformation systems	**Co-requisites (if necessary):**

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
3	70	42	28

Aim of the module (course unit): competences foreseen by the study module

The aim of the course is to develop the skills and abilities of students in the use of modern equipment, information technology and the application of the results obtained in the production of agricultural products.

Course questions:

- to form the basic concepts of precision farming;
- provision of new knowledge about global positioning systems, geographic information systems (GIS) and GIS technologies used in agriculture;
- teach the peculiarities of using systems for mapping and monitoring crops, tractors using GPS receivers and systems that control the movement of self-propelled agricultural machines;
- develop the ability and willingness to use high-tech tools and equipment for the introduction of precision agricultural technologies;
- developing a habit to assess and predict the impact of agricultural machinery and technologies on the environment.

Learning outcomes of module (course unit)	Teaching/learning methods	Assessment methods
To know: – Technologies that reduce costs and reduce environmental impact; – Electronic maps of land plots; – Global Positioning Systems; – GPS equipment; – innovative technologies of feeding and preparation of animal feed.	General trainings, presentations, seminars, practical trainings, self-employment	Annual work, software management, test questions, summaries, account, examination

To be able to: – Creation of field maps using geographic information systems (GIS) and GPS equipment; – precise sowing and tillage; – determination of yield using yield sensors during harvest; – differential application of fertilizers and plant protection products using GPS equipment; – using innovative methods of monitoring and managing herd health.	Execution of the annual work	Presentation of the implementation of the curriculum
Possess: – management strategies that use information technology to make informed decisions on the technology of harvesting planned crops; – information technology in obtaining high quality livestock products.	Execution of the annual work	Presentation of the implementation of the curriculum

Themes	**Contact work hours**							**Time and tasks for individual work**	
	Lectures	Consultations	Seminars	Practiacl work	Laboratory work	Placements	**Total contact work**	**Individual work**	**Tasks**
Module I. PRECISION FARMING									
Introduction to Precision Agriculture	1			2			**3**	**4**	Study of introduction Precision Agriculture
Global positioning systems and technologies	1			2			**3**		
Geographic information systems and technologies in agriculture	1			4			**5**	**6**	Basic technology Using of Big Data and monitoring field monitoring using geoinformation software's and sensors.
Productivity mapping and monitoring systems	1			2			**3**	**4**	Study of using model to identify areas for perennial vegetation.
Software and hardware for precision farming systems	1			2			**3**		
Remote sensing in agriculture	1			4			**5**	**8**	The independent layers of evidence included gross margins, drainage values, soil properties, remotely sensed biomass and proximally sensed gamma-ray emission and soil electrical conductivity.
Precision farming sensory systems	1			2			**3**	**6**	Classification of sensors in Precision Agriculture. Typical signal sand methods for connecting

									sensors. Structure of theme assuring channel.
Differentiated technologies for the use of fertilizers and plant protection products	1			2			**3**		
Precision irrigation systems	1			2			**3**		
Automated systems of agricultural production management	1			2			**3**		
Module II. PRECISION LIVESTOCK									
Precision livestock technologies	1			2			**3**		
Precision agricultural economics	1			2			**3**		
Total	**14**			**28**			**42**	**28**	

Assessment strategy	Weight in %	Deadlines	Assessment criteria
Running control 1	15	Week 4	Computerized test
Running control 2	15	Week 8	Computerized test
Running control 3	15	Week 13	Computerized test
Final exam	55		Final exam

Compulsory literature/ Author	Year of issue	Title	No of periodical or volume	Place of printing. Printing house or internet link
Gurbanguly Berdimuhamedow	2015	Ösüşiň täze belentliklerine tarap. Saýlanan eserler. 8-nji tom		Aşgabat: Türkmen döwlet neşirýat gullugy
	2019	Türkmenistanyň Prezidentiniň ýurdumyzy 2019-2025-nji ýyllarda durmuş-ykdysady taýdan ösdürmegiň Maksatnamasy		Aşgabat: Türkmen döwlet neşirýat gullugy
Е.В.Труфляк, Е.И.Трубилин, В.Э.Буксман, С.М.Сидоренко	2015	Точное земледелие: учеб. пособие		Краснодар: КубГАУ
Е.В.Труфляк	2016	Основные элементы системы точного земледелия		Краснодар: КубГАУ
Whelan B, Taylor J.	2013	Precision agriculture for grain production systems		CSIRO Publishing
J.H.Hermann	2013	Precision in Crop Farming		Springer Science+Business Media Dordrecht
А.И.Завражнов	2015	Практикум по точному земледелию		СПб.: Издательство «Лань»
Qin Zhang	2016	Precision agriculture technology for crop farming		CRC Press Washington, USA.
S.M.Pedersen, K.M. Lind	2017	Precision agriculture: technology and economic perspectives		
K.R.Krishna	2013	PRECISION FARMING Soil Fertility and Productivity Aspects		
Additional literature				
Т.М.Белавцева	2009	Технологии точного земледелия, их перспективы и возможности использования на		

		мелиорированных землях. Научно-технический обзор		
Ilan Halachmi	2015	Precision livestock farming applications		Wageningen Academic Publishers. The Netherlands
C. Lokhorst	2009	Precision livestock farming ’09		Wageningen Academic Publishers. The Netherlands

1. www.turkmenistan.gov.tm
2. www.nicopa.eu
3. http://www.ignss.org/
4. www.grdc.com.au
5. http://kubsau.ru
6. http://www.claas.com
7. http://www.deere.ru

ANOTATION /course summery

The aim of the course is to develop the skills and abilities of students in the use of modern equipment, information technology and the application of the results obtained in the production of agricultural products.
Course questions:

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List of themes and short description

Themes	Contact work hours
Module I. PRECISION FARMING	
Introduction to Precision Agriculture General information about Precision Agriculture. Precision Farming. Precision livestock. Scientific and technical basis of precision farming and livestock. Soil diversity in terms of yield, relief, crop condition, weed contamination, pest and disease level. Quantitative indicators of individual symptom variability. On-line and off-line methods of diversity analysis. Basic elements and components of an precision farming system. Intellectual equipment for precision farming. The use of robotic techniques in plants. ISOBUS and CANBUS standard interfaces. ISO 11783 (ISOBUS) Integrated International Standard for Electronic Data Communication between Tractors and Agricultural Machinery, CANBUS Communication System. World experience in the use of precision farming elements. Economic and ecological aspects of exact farming.	**3**
Global positioning systems and technologies Location technologies, characteristics and key areas of modernization. Basic elements of satellite global navigation systems. A modern positioning system (GPS). Modern satellite navigation systems: GLONASS, Galileo, IRNSS, BeiDou, QZSS. Global Navigation Rules. Accuracy of determining the location of the object. The main causes of GPS errors and the ability to configure them. Ways to increase accuracy. Signal Adjustment Systems. Requirements for the accuracy of location-based systems for the implementation of precision farming technologies and measures. Features of use of GPS systems in agricultural production.	**3**
Geographic information systems and technologies in agriculture Concept of Geo-Information Systems (GMU). Areas of use of geoinformation systems. Classification of geoinformation systems. Geographic information systems and technologies in agriculture. Composition of geoinformation systems, compulsory GIS modules, their main capabilities. Types of data representation in GIS. Vector and raster GIS systems. GIS equipment.	**5**

ArcGIS, QGIS, MapINFO software. Features of the use of geoinformation systems in agricultural production.	
Productivity mapping and monitoring systems Mapping and monitoring the productivity of agricultural crops, their importance for agricultural production, economic and environmental assessment. Technologies and equipment used for crop mapping and monitoring. Types of yield cards. Harvest mapping and monitoring systems for CLAAS combine harvesters. Harvest mapping and monitoring systems for John Deere combine harvesters.	**3**
Software and hardware for precision farming systems Automated systems for controlling the movement of tractors and self-propelled agricultural machines based on GPS navigation, their advantages over the conventional management of agricultural machinery in the performance of field work. Systems of parallel control and autopilots. Assessing the accuracy of management. Terms of use of parallel management. Telematics. ISOBUS concept and technology. Wireless network applications. Comparison of telematics equipment and tools. Equipment and equipment for automatic control of the movement of tractors and combines. Trimble's steering wheel is an AgGPS EZ-STEER-built, AgGPS EZ-Guide 250/500 parallel control system. Possible patterns of movement of agricultural aggregates according to field conditions.	**3**
Remote sensing in agriculture The concept of remote sensing. Interaction of objects with electromagnetic energy. Spectral, spatial and temporal expansion. Aerial photographs and space photos. Remote sensing systems, their properties and performance indicators. Sources of information obtained by remote sensing (satellites, planes, unmanned aerial vehicles). Use of remote data. Diagnosis of insects, weeds and diseases by remote sensing. Creating control zones through remote sensing.	**5**
Precision farming sensory systems Fundamentals, general concepts and definitions of sensory. Sensor systems for agriculture. Sensor to determine soil characteristics. Determination of soil density. Determination of soil moisture, salinity and texture by electrical conductivity Determination of the amount of organic matter (sand) stored in the soil. Relief determination using digital height models. Sensors for measuring the properties of plants. Sensors for computer monitoring and mapping of yields. The operating mode of the sensors in the combines. Sensors for detecting diseases, pests and weeds in crops. Systems based on optical and optoelectronic sensors. Sensors for remote monitoring using satellite systems and aircraft.	**3**
Differentiated technologies for the use of fertilizers and plant protection products Types of technologies for the implementation of differentiated measures for the use of fertilizers and plant protection chemicals. Single-phase technological solutions On-line based on the use of sensors. Two-phase Off-line technological solutions based on the use of digital cards. Technical means and equipment for carrying out differentiated activities. Features of agricultural machinery used in the use of fertilizers and plant protection chemicals in a differentiated manner on precision farming technologies. AMAZONE AMATRON + on-board computer and ISOBUS-terminal AMAZONE AMATRON 3. AMAZONE SBS (Soft Ballistic System) mineral fertilizer shedding systems. AMAZONE Automated systems that change the movement of GPS-Switch field machines. Economic and environmental efficiency of crop management in a differentiated manner, taking into account the diversity of the fields and optimizing the technological processes.	**3**
Precision irrigation systems Irrigation systems for precision irrigation, characteristics of rainfall and micro-irrigation systems, materials, components, technological and management aspects. Constructive features of irrigation, hydraulic problems, practical formulas, pressure, pipe diameter, irrigation system management, moisture acclimatization. Automation and robotization of irrigation systems, Controlled irrigation technologies. Irrigation service, integrated systems, sensor networks for real-time and remote data acquisition in field conditions, data processing, transfer of processed data to irrigation systems or users. New technologies that determine the inappropriate use of water for irrigation.	**3**
Automated systems of agricultural production management Accurate precision agricultural information technology. Digital data management in agricultural production, IT technologies in agro-industrial complex. Automated systems of agricultural production management. Functions of Data Management Systems (DMS). Structure and characteristics of the main departments at DMS: data collection; data processing, analysis and interpretation; data description (description); data storage; automation of management decisions.	**3**

A set of GIS-based software, management and capabilities for managing agricultural enterprises. Composition and characteristics of a set of software and hardware.	
Module II. PRECISION LIVESTOCK	
Precision livestock technologies Quality control of livestock products. Electronic database of production process. Identification and monitoring of specific types of livestock (control of feeding ration, weight gain, weight gain, body temperature and activity). Surveillance of the herd's health. Robotization of dairy operations. Automatic adjustment of the microclimate and monitoring of harmful gases.	**3**
Precision agricultural economics Precision agricultural economics. Labor productivity in precision agriculture. Precision agriculture economics study. Examples of economic analysis of precision agricultural systems. Methods for precision agricultural economic research. Indicators for economic analysis. Implementation of precision technologies in agriculture. Accurate Precision agricultural production.	**3**