TITLE OF THE
Curricula/Module

PRECISION
AGRICULTURE

TIIAME/Uzbekistan

March, 2020

Template of the Curriculum/Module Description

Short Name of the University/Countrycode **Date (Month/Year)**	**TIIAME/UZ** **03/2020**
TITLE OF THE Curricula/Module	**Code**
Precision Agriculture	

Teacher(s)	**Department**
Coordinating: **Ilhomjom Aslanov** **Others:** **Astanaqulov Komil** **Amanov Mansur**	Agricultural Machinery

Study cycle	**Level ofthemodule**	**Type of the module**
BA/**MA**/PhD	Master	

Form of delivery	**Duration**	**Langage(s)**
online/offline	16 weeks	English

Prerequisites	
Prerequisites: To know: Analyze using Sensor and GIS technology on Precision Agriculture Yield mapping and practical solution of field data analysis: Smart farming technology types, equipment for variable rate application	**Co-requisites (if necessary):**

ECTS (Credits of the module)	Total studentworkloadhours	Contacthours	Individual workhours
5	154	90	64

Aim of the module (course unit): competences foreseeen by the study programme
"Precision Agriculture" is the formation of the ability to scientifically analyze of using new technologies in agriculture sector, and explanation and understanding problems precision agriculture and their situations, which are the main focus will be technology and software's, application and modeling. The main purpose of the course "Precision Agriculture" is to study new challenges of agriculture and using new technology and software's application to modeling futures farmers and land users.

Learning outcomes of module (course unit)	Teaching/learningmethods	Assessment methods
Toknow: To point: •the field of application of Precision Agriculture and modeling systems; To explain: • structure of modeling systems; To numerate: • principles of the action of sensors used in Agriculture and Smart farming system To recognize: • types of sensors in agriculture and software's using Precision Agriculture; To give examples of: • types of control and sensor devices in PAg; To describe: • understanding problems precision agriculture and their situations, which are the main focus will be technology and software's, application and modeling; To formulate: • basic principles, methods and tasks of PAg.	Lectures, independent study of the material	Quiz
To be able to: • Data Acquisition Technologies in Precision Agriculture; • Analyze using GIS technology Normalized	Implementation of the training project	Presentation of an educational project

Difference Vegetation Index (NDVI); • Using sensors and control systems Smart farming; • Create yield mapping and practical solution of field data analysis.		
Possess: • to use of GIS Technology in agriculture; • to use sensor technology in agriculture; • to use Smart farming technology types, equipment for variable rate application • to use the models, the adoption and perception of Precision Agriculture Technologies.	Implementation of the training project	Presentation of an educational project

Themes	**Contact work hours**							**Time and tasks for individual work**	
	Lectures	Consultations	Seminars	Practiaclwork	Laboratory work	Placements	**Total contactwork**	**Individual work**	**Tasks**
Introduction to Precision Agriculture	2	0	0	4	0	0	**6**	**8**	Study of introduction Precision Agriculture
Sensing Technology for Precision Agriculture	4	0	0	8	0	0	**12**	**8**	Classification of sensors in Precision Agriculture. Typical signal sand methods for connecting sensors. Structure of theme assuring channel.
Data Analysis and Evaluation Technologies	4	0	0	8	0	0	**12**	**8**	Studying methods and tools for data

									preprocessing; The application of the probabilistic model of learning; Solution of problems of the equipment cassation with the use of neural networks;
GIS Technologies in Precision Agriculture	4	0	0	8	0	0	**12**	**8**	Basic technology Using of Big Data and monitoring field monitoring using geoinformation software's and sensors.
Sustainable Intensification in Crop Farming and Yield Monitoring Technology and Operation	4	0	0	8	0	0	**12**	**8**	Study of using model to identify areas for perennial vegetation. 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.
Smart Farming Technology Types, Equipment for Variable Rate Application	4	0	0	8	0	0	**12**	**8**	Establishing simple and sustainable farming, During the practical work modeling smart farm field experiments is important for the future of PA.
Remote mapping of crop water status to assess spatial variability of crop stress	4	0	0	8	0	0	**12**	**8**	Spatial variability of crop water status and irrigation demand is usually very large. Where the spreading system enables variable rate application of water, a crop water status map is necessary as a blueprint to match irrigation to site-specific crop water demand.
Model the Adoption and Perception of Precision Agriculture Technologies	4	0	0	8	0	0	**12**	**8**	Ability to scientifically analyze of using new technologies in agriculture

									sector, and explanation and understanding problems precision agriculture and there situations, which are the main focus will be technology and software’s, application and modeling.
Total	**30**	**0**	**0**	**60**	**0**	**0**	**90**	**64**	

Assessment strategy	**Weight in %**	**Deadlines**	**Assessment criteria**
Running control 1	35	8 week	preliminary presentation of the project
Running control 2	35	14 week	Presentation of an educational project
Final exam	30	16 week	Final quiz

Compulsory literature/ Author	**Year ofissue**	**Title**	**No of periodical or volume**	**Place of printing. Printing house or internet link**
Qin Zhang	2016	Precision agriculture technology for crop farming		CRC Press Washington, USA.
J. Stafford, A. Werner.	2003	Precision Agriculture		Wageningen Academic Publishers, Holland.
Soren M.P., Kim M.L.	2017	Progress in Precision Agriculture		Springer Publications. Switzerland
Whelan B, Taylor J.	2013	Precision agriculture for grain production systems		CSIRO Publishing

Additional literature				
E. J. Van Henten, D. Goense, C. Lokhorst	2009	Precision Agriculture		Wageningen Academic Publishers, Holland.
Oliver M.A.	2010	Geostatistical Applications for Precision Agriculture		Springer Dordrecht Heidelberg London New York
Hermann J. Heege	2013	Precision in Crop Farming		

ANOTATION /course summery

- To have basic theoretical and practical concepts and concepts in the direction of the chosen research:
- know and use scientific research types and effects:
know and choose strategies in scientific research.
- have the ability to prepare and write a dissertation program on the assigned subject.
Scientific research work is divided into three main types depending on its purpose, nature or industry, and scientific depth: fundamental (theoretical), practical, and development.
Practical exercises are an academician in a multimedia classroom. the group should be conducted by a teacher. It is appropriate to use the appropriate pedagogical and informational technologies to facilitate active and interactive methods.

List of themes and short description

Themes	Contact work hours
Introduction of Precision Agriculture Precision agriculture technologies have developed over the last three decades to aid plant agriculture. This book reviews what has happened in the past, what the current situation is, and predicts what the future may hold for these technologies. Top experts who have contributed to the development of precision agriculture provide the information	**6**
Sensing Technology for Precision Agriculture Classification of sensors in Precision Agriculture. Typical signal sand methods for connecting sensors. Structure of theme assuring channel. Features of analog-to-digital conversion of signals from analog sensors. The review of industrial networks of data transmission of field and first level and applied communication devices.	**12**
Data Analysis and Evaluation Technologies Thinking and intellect. The definition of artificial intelligence (AI). Terminology. Philosophical aspects, problems of artificial intelligence systems (possibility of existence, safety, usefulness). History and prospects of the development of AI systems, the field of their practical use.	**12**

Architecture and the main components of AI systems. Expert systems. Basic ideas and practical application nofuzzylogic. Linguistic variables and their description. Operation sover fuzzy sets. The basics tructure and principle of the fuzzy logic system. Fuzzification, rules of logical inferencesanddefuzzification. Example of using a system with fuzzy logic. Geneticalgo rithms.	
Sustainable Intensification in Crop Farming and Yield Monitoring Technology and Operation Basic technology of Big Data and monitoring of field using geoinformation software's and sensors. Thus far, spread pattern checks in mineral fertilizer applications require the labour intensive use of collection crops. Counting fertilizer granules by digital image processing, however, would allow work quality during fertilizing to be checked continuously and without time shift, and would enable collection of data for mapping of fertilizer distribution as actually applied. As part of the development of a novel method, trials are therefore being carried out under laboratory conditions to evaluate the effects of the fertilizer granule properties and the conditions on the detection rate. The possible range of application of such a system is shown, whereupon the use of this technique in practice is discussed.	**12**
Smart Farming Technology Types, Equipment for Variable Rate Application Establishing simple, practical and meaningful on-farm field experiments is important for the future of PA. The process, at present, requires some form of stratification into potential management zones which partition soil and crop variation. The treatment levels, replication number and plot location for each zone can then be determined based on the economic impact on production and the spatial constraints of a minimum plot size and proximity to zone boundaries. A first tentative attempt at such a design is presented. The objective function is divided into two parts. Firstly, designs are selected that meet the economic criterion of x% penalty on expected profit. From those candidate designs the position of the plots are optimised in a biometric sense. An example for a 70 ha field in Eastern Australia is presented and the need for repeating the experiments with the same treatments in the same locations for a number of seasons is discussed.	**12**
Remote mapping of crop water status to assess spatial variability of crop stress Spatial variability of crop water status and irrigation demand is usually very large. Where the spreading system enables variable rate application of water, a crop water status map is necessary as a blueprint to match irrigation to site-specific crop water demand. Aerial thermal remote sensing can provide such maps in sufficient detail and with timely delivery. The classical Crop Water Stress Index (CWSI) concept, as an interpreter of canopy temperatures, had difficulty separating relevant crop temperatures from the background and normalization to environmental conditions. The new approach presented here relies on better temperature separation by high-resolution thermal imagery and use of artificial reference surfaces (ARS) for CWSI normalization. Digital crop water stress maps were generated on cotton and vineyards around Griffith NSW, Australia, using georeferenced thermal imagery and ground based artificial reference surfaces to normalize CWSI. The spatial distribution of the stress levels from the maps corresponded well with ground based observations by the farm operators and	**12**

irrigation history. Numeric quantification of stress levels was provided to support section wise decisions in spatially variable irrigation scheduling.	
Model the Adoption and Perception of Precision Agriculture Technologies Using model to identify areas for perennial vegetation. 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. Our case study at Three Springs showed that significant areas consistently operate at a loss due to zones of infertile, sandy leaky soils. These areas show up clearly in gamma ray and electrical conductivity maps. They are the most readily acceptable by growers for reassigning land use.	**12**
	12