Study program: Geoinformation Technologies

Qualification: PhD

General Information	
University	Armenian National Agrarian University (ANAU)
Course title	**Precision agriculture**
The responsible lecturer	Professor Gurgen Yeghiazaryan yeghiazaryangurgen@gmail.com Associate Professor Artak Zaqaryan artak_zakaryan@mail.ru
Course type	Elective
Course Goal	The aim of the course is to provide students with scientific and practical skills on crop yield forecasting and monitoring, the application of which will allow to increase the yield of agricultural crops, maintaining soil fertility and environmental balance.
Prerequisites and co-requisites (if applicable):	**Sensors, RS, GIS, satellite image decoding, spatial database**

Duration and ECTS Credits	In credits (ECTS)	In hours	Semester
	5	150 (40 auditorium + 110 individual)	Fall

Learning Outcomes	After completing this course, the students should be able to: - Demonstrate skills and knowledge of the latest methods and technologies - Create a spatial database, analyze and evaluate them in the GIS environment - Master the methods of remote sensing and apply them to the decoding and processing of drone images and drone footage. - Possess the digital tools working with satellite global positioning system and apply them in the management of agricultural problems - Compile electronic maps and 3D models for the accurate solution of agricultural problems

Syllabus **(List of lessons)**	**Module 1**	**The content, purpose and problems of precision agriculture**
		• The need, purpose and problems of precision agriculture • Precision agriculture tools and technologies
	Module 2	**Digital equipment used in precision agriculture**
		• Tachometers, GNSS, optical level • Laser, optical levels • Drones • Artificial satellites
	Assignment #1	Each student will submit a report on the goals, problems, performance and application of digital tools and equipment in precision agriculture
	Module 3	**The working principles of the precision farming system**
		• Multi-factor accurate mapping • Selection of satellite images, download • Processing of satellite images using remote sensing methods
	Assignment #2	Present the results of remote sensing electronic mapping related to the research topic
	Module 4	**Land monitoring and calculation of NDVI index**
		• Creation of electronic maps of land plots • Calculation of vegetation indices • Land monitoring • Monitoring of assessment of land reclamation condition • Yield prediction • Grain yield prediction as a function of irrigation water stress
	Assignment #3	Within the framework of the research topic, present an electronic map of the plot, calculate the vegetation index and forecast the yield
	Module 5	**Classification of satellite images, field work, decoding, accuracy**
		• Spatial, spectral, radiometric resolution • Organization and implementation of field work • Classification, decoding, accuracy determination

	Assignment #4	Submit a report within the framework of individual topics with the content of classification, decoding and accuracy assessment of satellite images
Short description	Description of the latest methods and technologies GIS environment and spatial database RS technologies and their application in agriculture Management of satellite, global positioning and databases Electronic land mapping, construction of 3D models	
Recommended textbooks and links (in order of relevance):	Required text and materials 1. Константинов М. М., Ловчиков А. П., Завражнов А. И. Практикум по точному земледелию. Лань, 2015, **ISBN:** 978-5-8114-1843-5, с**.** 224 2. В. И. Балабанов, А. И. Беленков, Е. В. Березовский, В. В. Егоров, С. В. Железова. Навигационные технологии в сельском хозяйстве. Координатное земледелие. Учебное пособие для высших учебных заведений 3. Практикум по точному земледелию Учебное пособие" Авторы: Под редакцией д. т. н. М.М. Константинова Год издания: 2015. 4. Agric Rubaiya Binte Mostafiz, Ryozo Noguchi and Tofael Ahamed Agricultural Land Suitability Assessment Using Satellite Remote Sensing-Derived Soil-Vegetation Indices 5. Asseng, S., Foster, I., Turner, N.C., 2011. The impact of temperature variability on wheat yields. Global Change Biology 17, 997–1012. https://doi.org/10.1111/j.1365-2486.2010.02262.x 6. Barlow, K.M., Christy, B.P., O'Leary, G.J., Riffkin, P.A., Nuttall, J.G., 2015. Simulating the impact of extreme heat and frost events on wheat crop production: A review. Field Crops Research 171, 109–119. https://doi.org/10.1016/j.fcr.2014.11.0107. 7. Prepared by Dr. Chang-Gil Kim Korea Rural Economic Institute, The Impact of Climate Change on the Agricultural Sector: Implications of the Agro-Industry for Low Carbon, Green Growth Strategy and Roadmap for the East Asian Region	

	https://www.unescap.org/sites/default/files/5.%20The-Impact-of-Climate-Change-on-the-Agricultural-Sector. pdf 8. Marshet Nigatu Gebeyehu* Jimma University, Ethiopia Submission: April 11, 2019; Published: May 10, 2019, Remote Sensing and GIS Application in Agriculture and Natural Resource Management https://juniperpublishers.com/ijesnr/pdf/IJESNR.MS.ID.556009.pdf 9. Satellite Remote Sensing and GIS based Crops Forecasting & Estimation System in Pakistan. Ijaz Ahmad*, Abdul Ghafoor, Muhammad Iftikhar Bhatti ,Ibrar-ul Hassan Akhtar, Muhammad Ibrahim, Obaid-ur-Rehman https://www.fao.org/fileadmin/templates/rap/files/Project/Expert Meeting_17Feb2014_/P2-2_Satellite Remote_Sensing_and_GIS_based_Crops_Forecasting_Estimation_System_in_Pakistan.pdf 10. Precision Agriculture: Technology To Boost Crop Farming. Published in 20.04.2022 Earth Observing System https://eos.com/blog/precision-agriculture/ 11. Using remotely sensed data and GIS to improve farm planning and productivity, Darryl Woodrow http://www.regional.org.au/au/gia/08/259woodrow.htm
Assessment methods and criteria	Final exam with 100% and 20-point grade. To successfully complete this course, students must achieve a passing grade of 50% or higher on the overall course and on the mandatory final project (individual work). Under final project students should develop a research proposal. **Evaluation factors (%) and their actual score on a 100-point scale** | №	Factor:	%
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1	Attendance	15
2	Individual work	40
3	Final exam	45	

Course evaluation scale according to the ECTS evaluation system

Evaluation	Accumulated points (%)	ECTS/ATC Grade	20 point scale	ANAU Grade
Pass	90-100	A	18-20	5
	80-89	B	16-17	4
	70-79	C	14-15	4
	60-69	D	11-13	3
	50-59	E	8-10	3
Fail	0-49	F/FX*	0-7	2