TITLE OF THE
Curricula/Module

REMOTE SENSING

TUIT/Uzbekistan

June, 2020

Curriculum/Module DESCRIPTION

TUIT/Uzbekistan 25 (June/2020)	
TITLE OF THE Curricula/Module	**Code**
REMOTE SENSING	2.03

Teacher(s)	Department
Coordinating: • Temurbek Kuchkorov **Others:** • Allamuratova Z.J	Computer systems, Computer engineering faculty

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

Form of delivery	Duration	Language(s)
offline	15 weeks	UZ/EN

Prerequisites	
Prerequisites: **To know:** – Basics of web technologies – Basics of programming skills (C/C++, Javascript or Python) **Possess:** – Basics of Geo-information systems and platforms such as WebGIS,	**Co-requisites (if necessary):**

ECTS (Credits of the module)	Total student workload hours	Contact hours	Individual work hours
5	150	45	105

Aim of the module (course unit): competences foreseen by the study programme		
The purpose of teaching the subject is to teach students the basic types of remote sensing systems and the characteristics of the data they provide, remote sensing methods and algorithms, basic knowledge of technology and the ability to solve practical problems using remote sensing and use special tools. The task of science - science solves practical problems of students on the basis of theoretical knowledge, practical skills, the use of modern methods and tools of remote sensing.		
Learning outcomes of module (course unit)	**Teaching/learning methods**	**Assessment methods**
To know: – Basic concepts of remote sensing, basic principles of remote sensing systems, basic characteristics of data, understanding of space systems of remote sensing; – Knowledge of methods and algorithms for data processing of remote sensing systems, solving	Lectures, independent study of the material	Quiz

problems of digital processing of digital space images; – Know the methods and algorithms for interpreting remote sensing data, solve thematic problems of digital space imagery and be able to use them in solving specific problems;		
To be able to: – Create a tutorial dataset in the Erdas Imagine application, work with existing datasets, teach the model and thereby solve the problem of classification and clustering; – use remote sensing data processing and analysis systems and solve automated cartography problems using GIS technologies, solve practical problems solved using remote sensing systems.	Implementation of the training project	Presentation of an educational project
Possess: – Complete mastery of theoretical and methodological concepts of science, the ability to accurately reflect the results of the analysis, independent observation of the studied processes and the implementation of tasks and assignments in the current, intermediate forms of control, submission of written work on the final control.	Implementation of the training project	Presentation of an educational project

Themes	**Contact work hours**							**Time and tasks for individual work**	
	Lectures	Consultations	Seminars	Practical work	Laboratory work	Placements	**Total contact work**	**Individual work**	**Tasks**
Fundamentals of remote sensing, main concepts and types	6	0	0	3	0	0	9	21	Introduction to the subject "Remote sensing technologies and applications" and its basics. Remote sensing systems and structure. Image display systems.

									Remote sensing data interpretation and processing systems
Data acquisition process and main technologies	6	0	0	3	0	0	9	20	Radiation in the optical range of the spectrum. Radiation components. Interaction of electromagnetic radiation with the Earth's atmosphere Methods of preliminary processing of remote sensing data. Main technologies for getting satellite images Accuracy of remote sensing systems.
Satellite image quality improving and resolution	6	0	0	3	0	0	9	22	Accuracy of remote sensing systems. Correction of geometric errors of images Improving the visual reception quality of images.
Satellite image processing and working with multiple images	6	0	0	3	0	0	9	20	Types of spatial processing and filtration of images. Noise removal models. Statistical evaluation of image quality. Multilevel data processing. Merge images.

Fractal analysis of satellite images, classification and applications of remote sensing	6	0	0	3	0	0	9	22	Fractal analysis of space images. Thematic classification Basics of using remote sensing data in solving practical problems
Total	**30**	**0**	**0**	**15**	**0**	**0**	**45**	**105**	

Assessment strategy	**Weight in %**	**Deadlines**	**Assessment criteria**
Running control	50	10 week	preliminary presentation of the project
Final exam	50	15 week	Final quiz

Compulsory literature/ Author	**Year of issue**	**Title**	**No of periodical or volume**	**Place of printing. Printing house or internet link**
Шовенгердт Р. А.	2010	Дистанционное зондирование. Модели и мето-ды обработки изображений. М.		Техносфера,.
Khorram S., van der Wiele C.F., Koch F.H., Nelson S.A.C., Potts M.D.,	2016	Principles of Applied Remote Sensing		Springer Science+Business Media ,New York
Baghdadi N., Zribi M.	2016	Land Surface Remote Sensing in Continental Hydrology		ISTE Press – Elsevier
Additional literature				
Топаз А.А., Казяк Е.В.	2017	Цифровая обработка космических снимков в программе ERDAS IMAGINE: пособие		практикум. – Йошкар-Ола
Домрачев А.А., Ануфриев М.А.	2019	Основы дистанционного зондирования Земли (на примере ENVI 4.8)		https://sentinel.esa.int/documents/247904/685211/Sentinel-2_User_Handbook
Internet links				
https://www.geospatialecology.com/				
https://www.dataplus.ru/news/arcreview/all.php				

ANOTATION /course summary

This course teaches students the basic types of remote sensing systems and the characteristics of the data they provide, the basic knowledge of remote sensing methods and algorithms and technologies, to solve practical problems using remote sensing and to develop the ability to use special instrumental software.

List of **themes and short description**

Themes	Contact work hours
Fundamentals of remote sensing, main concepts and types Introduction. Basic concepts and methods of remote sensing. Physical bases of remote sensing. Spectral characteristics and images of objects. Areas of application, available applications and their capabilities. Remote sensing system structure, terrestrial and orbital segments. Spatial and radiometric characteristics. Spectral characteristics. Time characteristics. Grouping of the Earth's satellites. Remote sensing data processing and analysis systems: ERDAS Imagine, ENVI, Google Earth Engine, SNAP, MultiSpec, ER Mapper, integrated GAT IDRISI. Analysis of the advantages and disadvantages of systems and principles of operation.	**9**
Data acquisition process and main technologies The short-wave infrared range of the spectrum. Earth's radiation components. Direct radiation from the atmosphere. Characteristics of solar radiation. Gaseous composition and structure of the atmosphere. Molecular absorption and distribution. Methods of processing remote sensing data. Methods of preliminary processing of remote sensing data: radiometric and geometric correction. Methods of image improvement: modification of histograms, methods of spatial filtration. Data integration issues. Photographic images. Methods of surface scanning. Infrared radiometric and radar images. The importance of multi-zone imaging. Hyperspectral images.	**9**
Satellite image quality improving and resolution Spectral accuracy. Radiometric accuracy. Time and spatial accuracy. Distribution point function of an optical system. The concept of pixels, geometric error (distortion). Methods of correction of geometric errors and their classification. Polynomial processing. Raster recalculation algorithms. Ortotransformation. Global processing of contrast. Linear and logarithmic processing of contrast. Histogram equalization. Contrast color images. Color model. Color processing from RGB system to HIS system.	**9**
Satellite image processing and working with multiple images Types of spatial processing. Linear and nonlinear filtration in the spatial part. Filtration in the part of spatial frequencies. Fure analysis of the image. Fure filtration based filtration. Amplitude-frequency characteristic of the filter. Noise removal in image. Global noise. Local noise. Using the main component method. Periodic and band interactions. Global linear agreement of detectors. Character space. The essence of spectral processing. Vegetation indices. Analysis of key components. Combining images of different spatial resolution. Multi-scale merging.	**9**
Fractal analysis of satellite images, classification and applications of remote sensing Fractal dimensions of images. Methods for calculating fractal dimensions. Analysis of spatial images. Fractal processing of spatial representations. Importance of image accuracy and scale. Character separation. Classifier designation and training. Non-parametric classification. Parametric classification. Spatial-spectral segmentation. Classification algorithms for hyperspectral data. Atmospheric pollution factors. Detection of forest fires. Control of water resources: identification of sources of water pollution and control of the scale of distribution. Monitoring of soil salinization, desertification, changes in forest areas and boundaries.	**9**
Total	**45**