Degree of higher education - Bachelor
Specialization 193. Geodesy and Land Management
Educational program «Geodesy and Land management»
Academic year 4, semester 7
Form of study: full
Number of ECTS credits – 4
Language of instruction: English

Lecturer of the course	**Antonina Moskalenko, PhD, Associate Professor.**
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Course page on eLearn	https://elearn.nubip.edu.ua/course/view.php?id=1717

COURSE DESCRIPTION

The course "Remote sensing for Land Resources Monitoring» introduces students how remote sensing can benefit the observation land resources as a tool for acquiring information about the Earth through recording reflected or emitted energy. There are a large number of satellite sensors that vary in temporal, spatial coverage and resolution. Their characteristics and applications for land resources monitoring is observed in the course.

Students will learn the principles of remote sensing, and how relevant information can be derived from remote sensing data over a wide range of spatial and temporal scales and resolutions of sensors. Students will obtain image processing skills and learn how remote sensing data can be used to monitor land resources. The latest state-of-art techniques to analyse and interpret images will be used to understand local and regional changes in land resources.

Course aims: to learn the concepts of remote sensing and to get practical skills of image pre-processing and thematic geoprocessing to be used for monitoring of land resources.

Tasks of the course: to learn theoretical concepts of remote sensing and receiving remote sensing data; to learn general characteristics of optical sensors; to get skills of using methods of digital image processing.

Competencies of the educational program:

General competencies (GC):

GK 01. Ability to learn and master modern knowledge.

GK 02. Ability to apply knowledge in practical situations.

GK 05. Ability to communicate in a foreign language.

GK 06. Ability to use information and communication technologies.

GK 07. Ability to work autonomously.

GK 08. Ability to work in a team.

GK 10. Ability to exercise safe activity.

GK 12. The ability to exercise their rights and responsibilities as a member of society; awareness values of civil (free democratic) society and its necessity sustainable development, the rule of law, rights and human and civil liberties in Ukraine.

GK 13. Ability to preserve, multiply moral, cultural, scientific values and achievements of society based on understanding of history, patterns of development of the subject area, its place in the general system of knowledge about nature and society, as well as in the development of society, technology and technology. activities for recreation and healthy living

Professional (special) competencies (PC):

SC 01. Ability to apply fundamental knowledge to analyze phenomena of natural and man-made origin in the performance of professional tasks in the field of geodesy and land management.

SC 03. Ability to apply regulations, regulatory and technical documents, reference materials in professional activities.

SC 04. Ability to choose and use effective methods, technologies and equipment for professional activities in the field of geodesy and land management.

SC 05. Ability to use modern information, technical and technological support to address complex issues of geodesy and land management.

SC 06. Ability to perform remote, ground, field and in-house research, engineering calculations for processing research results, prepare research results, prepare reports in solving problems of geodesy and land management.

SC 07. Ability to collect, update, process, critically evaluate, interpret, store, publish and use geospatial data and metadata on objects of natural and man-made origin.

SC 08. Ability to carry out professional activities in the field of geodesy and land management, taking into account the requirements of professional and civil safety, labor protection, social, environmental, ethical, economic aspects.

SC 09. Ability to use tools, instruments, equipment, facilities in the performance of geodetic and land management tasks.

SC 10. Ability to monitor and evaluate land.

SC 12. Ability to conduct technical control and assess the quality of topographic, geodetic and cartographic products.

SC 13. Ability to develop documentation on land management and land valuation, cadastral documentation, fill in the data of state land, urban and other cadastres

Program learning outcomes (PLO) of the educational program:

LR 1. Fluent in oral and written forms in state and foreign languages on professional matters.

LR 2. Organize and manage the professional development of individuals and groups.

LR 3. Communicate information, ideas, problems, solutions, personal experience and arguments to specialists and non-specialists.

LR 4. To know and apply in professional activity normative-legal acts, normative-technical documents, reference materials in the field of geodesy and land management and related branches.

LR 7. Perform surveys and survey, topographic and geodetic, cartographic, design and design and survey work in the performance of professional tasks in geodesy and land management.

LR 9. Collect, evaluate, interpret and use geospatial data, metadata on objects of natural and man-made origin, apply statistical methods of their analysis to solve specialized problems in the field of geodesy and land management.

LR 10. Choose and apply tools hardware, hardware and software supplies needed for remote, ground, field and in-house research in in the field of geodesy and land management.

LR 11. Organize and execute remote, ground, field and camera works in the field of geodesy and land management, draw up the results of work, prepare relevant reports.

LR 12. Develop documentation from land management, cadastral documentation and land valuation documentation with application computer technology, geoinformation systems and digital photogrammetry, to fill the state land with data, urban and other cadasters.

LR 13. Plan and execute geodetic, topographic and cadastral surveys, process the results in geographic information systems.

LR 15. Develop and adopt effective decisions on professional activities in the field geodesy and land management, including under conditions uncertainty.

COURSE STRUCTURE

Topic	Hours (lecture/laboratory, practical seminar)	Learning outcomes	Tasks	Assess-ment
Semester 1				
MODULE 1. CONCEPT OF REMOTE SENSING				
Topic 1. Concepts of remote sensing of the Earth. Electromagnetic radiation	2/8/10	To know the classification of methods of remote sensing, atmospheric radiative window and the spectral ranges (bands) used in RS; To understand differences between the reflectance and coefficient of reflectance	Laboratory work #1 part1 Visual interpretation of image elements in various spectral channels. Interpretation of recognized objects.	**5**
			Laboratory work #1 part2 Visual interpretation of image elements in various spectral channels. Interpretation of recognized objects.	**5**
			Laboratory work #1 part3 Visual interpretation of image elements in various spectral channels. Interpretation of recognized objects.	**10**
			Laboratory work #1 part4 Visual interpretation of image elements in various spectral channels. Interpretation of recognized objects.	**10**
			Individual work №1 Professional terminology in remote sensing of the Earth	**5**
Topic 2. Visual interpretation of objects.	2/4/10	To know the direct elements of image interpretation and direct recognition, geometric, brightness's, structural elements of visual image interpretation; To distinguish structural, geometric and spectral characteristics of objects	Laboratory work #2. Measurement of spectral brightness of objects	**10**
			Individual work №2 Image interpretation	**5**
Topic 3. Classification of methods of remote sensing. Sensor systems.	2/0/10	To know classification of remote sensing methods; To be acquainted with low- medium-, high- spatial resolution sensor systems and their use for solving problems of land monitoring	Individual work №3 Remote sensing data acquisition	**5**

Topic 4. Image acquisition. Data formats. Standards in remote sensing	2/3/7	To know main formats of deliverable remote sensing data and data processing levels;	Laboratory work #3. Radiometric image enhancement	10
		To analyze the possibilities of using high spatial resolution sensors and data obtained from UAVs	Individual work №4 Image georeferencing and image transformation	5
Module control			Test	**30**
Total module 1	**8/15/37**			**100**
SEMANTIC MODULE 2. DIGITAL IMAGE ANALYSIS				
Topic 1. Preprocessing of remotely sensed data	2/3/0	To know the main groups of operations for digital image processing: image restoration (correction), radiometric correction of digital imagine (radiance, radiometric correction of the atmosphere, image resampling and geometric correction); To distinguish the peculiarities of the use of methods for image atmospheric correction	Laboratory work #4. Image resampling	10
Topic 2. Image georeferencing and image transformation	1/2/10	To know the basis of image geometric transformation; To be able to choosing control points; To use different methods of image transformation	Laboratory work #5 Unsupervised classification	15
			Individual work №5 Preprocessing of remotely sensed data	5
Topic 3. Image acquisition based on Unmanned Aerial Vehicles (UAVs).	2/0/10	To know the basics of the UAV application in mapping to obtain a geodetic basis for cadastral activities, to ken the main characteristics of multispectral cameras and cameras in the visible range; To be able to use data from multispectral cameras to solve problems of land monitoring	Individual work №6 Image acquisition based on Unmanned Aerial Vehicles (UAVs)	5
Topic 4. Image classification.	2/8/18	To know the basis of image classification methods in remote	Laboratory work #6. Training sites. Signature comparison chart.	10

		sensing: unsupervised classification method (K-Means Classification, Isodata Classification), supervised classification methods (Parallelepiped Classification, Maximum Likelihood Classification, Minimum Distance Classification, Mahalanobis Distance Classification); To apply methods of supervised and unsupervised classification in thematic mapping of land resources	Laboratory work #7. The quality of training sites. Application of algorithms of image classification based on hard rules	20
			Individual work №7 Image classification	5
Module control			Test	**30**
Total module 2	**7/15/38**			**100**
Total for 1 semester				**70**
Final EXAM			Final test	**30**
Total for course				**100**

ASSESSMENT POLICY

Policy regarding deadlines and resits:	Deadlines are defined in e-learn course. Works being submitted after deadlines without a reason are evaluated at a lower grade. Rearrangement of module tests takes place with the permission of the lecturer in case of a specific reasons (for example, illness).
Academic honesty policy:	Copying other materials during individual works, tests and final test (including the use of mobile devices) are forbidden. Abstracts must have correct text references to the literature used.
Attendance policy:	Attendance of lessons is mandatory. According to objective reasons (for instance, illness, international internship) training can take place individually (in distance form (on-line) by agreement with the dean of the faculty)

SCALE OF ASSESSMENT OF STUDENT KNOWLEDGE

Student rating, points	**National grade based on exam results**	
	exams	**credits**
90-100	excellent	passed
74-89	good	
60-73	satisfactory	
0-59	unsatisfactory	not passed

RECOMMENDED SOURCES OF INFORMATION

Basic:

1. Кохан С.С., Востоков А.Б. Методи ДЗЗ. Навчальний посібник. К. ЦП Компринт. 2021. 286 с.

2. Зацерковний В.І. Дистанційне зондування Землі. Фізичні основи. Ніжин : НДУ ім. М. Гоголя, 2018. — 380 с.

3. Kokhan S.S. Vegetation Indices [Monograph] / S.S. Kokhan. – К. : «Komprint», 2015. –231 p.

Addition:

4.   ISO 19101:2002 «Geographic information - Reference model»

5.   Тарасова В. В. Екологічна стандартизація і нормування: Навчальний посібник/ В. В. Тарасова, А. С. Малиновський, М. Ф. Рибак. – К.: Ніка-Центр – 2007. – 276 с.

6.   ISO/TS 19103:2005 «Geographic information - Conceptual schema language».

7.   ISO/TS 19104:2008 «Geographic information – Terminology».

8.   ISO 19107:2003 «Geographic information - Spatial schema».

9.   ISO 19108:2002 «Geographic information - Temporal schema»

10.   ISO 19110:2005 «Geographic information - Methodology for feature cataloguing»

11.   ISO 19115 «Geographic information - Metadata»

12.   ISO 19152:2012 «Geographic information - Land Administration Domain Model (LADM)»

13.   ГІС-Асоціація України (назва з екрану). Режим доступу: http://gisa.org.ua/

14.   GPSworld (назва з екрану). Режим доступу: https://www.gpsworld.com/

15.   Open Source GIS History - OSGeo Wiki Editors". Retrieved 2009-03-21.

16.   Steiniger and Bocher. Archived from the original on 2012-11-12. Retrieved 2011-08-05.