SYLLABUS – A COURSE DESCRIPTION

I. General informaion

1. Course name: **Remote sensing data**
2. Course code:
3. Course type (compulsory or optional): **optional**
4. Study programme name: **Environmental protection**
5. Cycle of studies (1st or 2nd cycle of studies or full master's programme): **2nd cycle of studies**
6. Educational profile (general academic profile or practical profile): **general academic profile**
7. Year of studies (if relevant): **I**
8. Type of classes and number of contact hours (e.g. lectures: 15 hours; practical classes: 30 hours):
   lectures: 10 hours
   laboratory classes: 20 hours
9. Number of ECTS credits: **3**
10. Name, surname, academic degree/title of the course lecturer/other teaching staff:
    dr Maciej Nowak, mcnowak@amu.edu.pl
    dr Paweł Bogawski, bogawski@amu.edu.pl
11. Language of classes: **english**
12. Online learning – yes (partly – online / fully – online) / no: **Possibility of constant exchange of information with students, mainly on the basis of selecting appropriate supplementary literature, consultations of GIS software use and passing final reports.**

II. Detailed information

1. Course aim (aims)
   The aim of the course is to expand students' knowledge and competence in the use of GIS tools focused on remote sensing data analysis.
   During the course, students will be able to analyze and interpret aerial and satellite images and point clouds from laser scanning (LiDAR). Based on remote sensing data, students will get knowledge in the use of geoinformation techniques in biology and environmental protection, acquire spatial information regarding the state of the natural environment and modeling the relationship between organisms and their environment.
   Participation in the module will provide practical preparation for work using GIS at the scientific level, in the private sector and in the area of environmental administration at local and national level.
2. Pre-requisites in terms of knowledge, skills and social competences (if relevant)
   Knowledge of the theoretical foundations of GIS is required, including knowledge of definitions and examples of vector and raster models. Basic skills in operating one of the GIS-type software (e.g. ArcGIS, QGIS, R, SAGA GIS) are also expected, including: - navigating the basic menu, adding layers to the work area, creating new layers; using attribute tables; - simple mathematical and statistical analysis, selection of objects; - editing vector layers;
3. Course learning outcomes (EU) in terms of knowledge, skills and social competences and their reference to study programme learning outcomes (EK)

Course learning	On successful completion of this course, a student will be able to:	Reference to study

outcome symbol (EU)		programme learning outcomes (EK)
EU_01	Student is able to search remote sensing data (satellite and aerial images, data from laser scanning), knows the possibilities of their use and their limitations. Student knows the advantages and limitations of image acquisition using unmanned aerial vehicles (UAVs).	K_W01, K_U01, K_U02, K_U03, K_U10, K_K01
EU_02	Student can process remote sensing data in the form of aerial and satellite images using specialized software. Student can calculate the NDVI vegetation index.	K_W01, K_U01, K_U03
EU_03	Student can perform LiDAR data, i.e. filter point clouds, change recording formats, create DEM, DSM, nDSM, CHM models.	K_W01, K_U01, K_U03
EU_04	Student knows the limitations resulting from differences in the methodological approach to data analysis in the form of reference databases (including BDOT, MPHP, VMap) and thematic databases (including CLC), and data obtained independently - based on the analysis of remote sensing materials.	K_W01, K_U01, K_U02, K_U03
EU_05	Student can analyze and interpret data obtained after processing of raw materials (satellite images, aerial images and point clouds).	K_W01, K_U01, K_U02, K_U03, K_U07, K_K01
EU_06	Student is able to visualize the effects of work in the GIS system, create thematic maps, summaries of the most important results and provide them in an accessible and understandable way.	K_U01, K_U03, K_U07

4. Learning content with reference to course learning outcomes (EU)

Course learning content	Course learning outcome symbol (EU)
Satellite and aerial photos as sources of remotely obtained environmental data - basic features, data acquisition possibilities, advantages and limitations. The use of unmanned aerial vehicles (UAVs) in the acquisition of remote sensing materials.	EU_01, EU_04
Preparation of images for classification, atmospheric and noises correction.	EU_01, EU_02
Supervised and unsupervised classification of satellite images.	EU_01,

	EU_02, EU_05
Visualization of remote sensing analysis results, creation of habitat maps, land cover, hypsometry, slope exposure, slopes, solar radiation potential.	EU_01, EU_02, EU_05, EU_06
Laser scanning (LIDAR) as a source of information about the terrain and the spatial structure of its coverage. Mode of action, possibilities, advantages and limitations.	EU_01, EU_03, EU_04
Analysis of LIDAR data (data filtration, model creation - Digital Elevation Model (DEM), Digital Surface Model (DSM), normalised Digital Surface Model (nDSM) and Tree Crown Model (CHM).	EU_03, EU_04, EU_05
3D modeling of spatial information obtained on the basis of point clouds from aerial scanning.	EU_03, EU_06

5. Reading list

Wydawnictwa książkowe
1. Keranen K.: Making Spatial Decisions Using GIS and Remote Sensing, ESRI Incorporated, San Diego, 2013
2. Jones H.: Remote Sensing of Vegetation, Oxford University Press, London, 2010
3. Lewis P.: LiDAR for vegetation applications, , London, 2011
4. Scally R.: GIS for Environmental Management, Esri Press, San Diego, 2006
Artykuły w czasopismach
1. Nowak M.M., Bogawski P., Dziób K. (2019): Unmanned Aerial Vehicles (UAVs) in environmental biology: A review, European Journal of Ecology, 4(2):56-74
2. Bogawski P., Grewling Ł., Nowak M. M. et al. (2019): Lidar-Derived Tree Crown Parameters: Are They New Variables Explaining Local Birch (Betula sp.) Pollen Concentrations?, Forests, 10(12):1154
3. Kunwar K. Singha,, Amy J. Davisb, Ross K. Meentemeyer (2015): Detecting understory plant invasion in urban forests using LiDAR, International Journal of Applied Earth Observation and Geoinformation, Volume 38
4. Stéphane Dupuya, Gérard Lainéa, Jacques Tassinb, Jean-Michel Sarrailhb (2013): Characterization of the horizontal structure of the tropical forest canopy using object-based LiDAR and multispectral image analysis, International Journal of Applied Earth Observation and Geoinformation, Volume 25

III. Additional information

1. Teaching and learning methods and activities to enable students to achieve the intended course learning outcomes (please indicate the appropriate methods and activities with a tick or/and suggest different methods)

Teaching and learning methods and activities	
Lecture with a multimedia presentation	X
Interactive lecture	X
Problem – based lecture	
Discussions	X

Text-based work	X
Case study work	
Problem-based learning	
Educational simulation/game	
Task – solving learning (eg. calculation, artistic, practical tasks)	
Experiential work	X
Laboratory work	
Scientific inquiry method	
Workshop method	X
Project work	X
Demonstration and observation	
Sound and/or video demonstration	
Creative methods (eg. brainstorming, SWOT analysis, decision tree method, snowball technique, concept maps)	X
Group work	X

2. Assessment methods to test if learning outcomes have been achieved (please indicate with a tick the appropriate methods for each LO or/and suggest different methods)

Assessment methods	**Course learning outcome symbol**					
	EU_1	**EU_2**	**EU_3**	**EU_4**	**EU_5**	**EU_6**
Written exam						
Oral exam						
Open book exam						
Written test	X			X	X	
Oral test						
Multiple choice test						
Project		X	X		X	X
Essay						
Report		X	X		X	X
Individual presentation	X			X	X	
Practical exam (performance observation)						
Portfolio						

3. Student workload and ECTS credits

Activity types	**Mean number of hours spent on each activity type**
Contact hours with the teacher as specified in the study programme	30
Preparation for classes	10
Reading for classes	5
Essay / report / presentation / demonstration	10

preparation, etc.	
Project preparation	15
Term paper preparation	
Exam preparation	15
Total hours	85
Total ECTS credits for the course	3

4. Assessment criteria according to AMU in Poznan grade system

Very good (bdb; 5,0): excellent knowledge, skills, and personal and social competences
Good plus (+db; 4,5): very good knowledge, skills, and personal and social competences
Good (db; 4,0): good knowledge, skills, and personal and social competences
Satisfactory plus (+dst; 3,5): satisfactory knowledge, skills, and personal and social competences, but with substantial shortcomings
Satisfactory (dst; 3,0): satisfactory knowledge, skills, and personal and social competences, but with frequent mistakes
Unsatisfactory (ndst; 2,0): unsatisfactory knowledge, skills, and personal and social competences