SYLLABUS – A COURSE DESCRIPTION

I. General informaion

1. Course name: **Basic R programming for scientists_2020en**
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 and II 2nd cycle of studies**
8. Type of classes and number of contact hours (e.g. lectures: 15 hours; practical classes: 30 hours):
   lectures: 6 hours
   practical classes: 24 hours
9. Number of ECTS credits: **3**
10. Name, surname, academic degree/title of the course lecturer/other teaching staff:
    dr Paweł Bogawski, bogawski@amu.edu.pl
    dr Łukasz Grewling, grewling@amu.edu.pl
11. Language of classes: **english**
12. Online learning – yes (partly – online / fully – online) / no: **There is a possibility to use b-learning methods for the whole course. Also, b-learning methods may be used as a supporting tool to enhance the learning outcome and for consultations.**

II. Detailed information

1. Course aim (aims)

   Computer programming is a process of designing and creating a software, application that is produced to complete a specific computing result. It is common and still developing in many branches of human activity. Programming is also a practical ability that enables to create solutions that does not exist. Therefore, it is necessary in science - using a programming language it is possible to better, quicker, more accurately and more specifically achieve the purpose of the study. Among scientists, R programming language is very popular. Its most advantages are that it is perfectly suited to do statistics, is dynamically evolving, has a large community and every scientific modelling task may be done entirely from the data processing to visualisation using R only. This module aims to learn:
   - basics of R syntax
   - importing data to R and data cleaning
   - managing the data with basic commands from dplyr package
   - simple calculations on data frames
   - simple statistical modelling in R
   - accessing different biological and climatic data using R
   - handling of spatial data, packages lidR (LiDAR), and raster (satellite images)
   - visualisation of the results and mapping - ggplot2 R package
2. Pre-requisites in terms of knowledge, skills and social competences (if relevant)

   Basic computer skills. No programming experience required, this course aims to start from the basics.

3. Course learning outcomes (EU) in terms of knowledge, skills and social competences and their reference to study programme learning outcomes (EK)

Course learning outcome symbol (EU)	On successful completion of this course, a student will be able to:	Reference to study programme learning outcomes (EK)
EU_01	knows and is able to apply basic R syntax	K_W01, K_W04
EU_02	is aware of different data types in R such as vectors, matrices, lists, data frames and data classes such as numerics, integers, logical, characters or factors	K_U01, K_W02, K_U03
EU_03	is able to import a spreadsheet or csv file to R and can switch between R and other software	K_U03
EU_04	is able to manage the loaded data, clean, organize, change format from narrow to wide, add and remove columns, join tables and others	K_U03, K_U04
EU_05	is able to plan how to resolve simple computing task in R and how to apply R to test biological and ecological hypotheses	K_U02, K_U06, K_K02, K_K03
EU_06	is able to prepare basic types of plots such as scatterplot, boxplot, barplot on the basis of the owned data and explain what they present	K_U07
EU_07	is able to manipulate 3-dimensional laser scanning and satellite data and measure plant characteristics using remote sensing in R	K_W04, K_W06
EU_08	is able to search the Internet for solutions and can adapt existing codes to his/her own purposes as well as discuss the specific task with the other R user	K_U11, K_U10, K_U08, K_K01, K_K05
EU_09	is able to prepare simple predictions based on simple statistical models and interpret them	K_U04

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

Course learning content	Course learning outcome symbol (EU)
Learning of Basic R syntax	EU_01

Importing data to R, managing data, clean and organize data, converting between wide and narrow formats, exporting results from R to other software	EU_01, EU_02, EU_03, EU_04
Learning of different R data types, classes, functions and additional packages	EU_02, EU_06, EU_07
Adapting and modifying the existing code for student's own purposes	EU_08
Simple calculations on data frames, converting units, joining tables by column, by row and other operations	EU_03, EU_02, EU_04
Processing of 3-dimensional LiDAR point clouds and other remote sensing data using lidR and raster R packages	EU_07
Preparing simple statistical models and performing their assessment	EU_09, EU_08
Visualisation of the results, creating boxplots, barplots and scatterplots using base and ggplot2 R package	EU_06, EU_04
Preparing reports on the basis of a statistical outcome, interpreting and explaining the results to the general public or R users, discussing problem solutions with other students.	EU_08, EU_06

5. Reading list

Wydawnictwa książkowe

1. Paradis E.: R for beginners: https://cran.r-project.org/doc/contrib/Paradis-rdebuts_en.pdf, , , 2005

2. : Quick-R tutorial: https://www.statmethods.net/r-tutorial/index.html, , ,

3. : Statistical tools for high-throughput data analysis: http://www.sthda.com/english/, , ,

4. : Other R tutorials, Videos freely available in the Internet, , ,

Artykuły w czasopismach

1. Wang K. et al. (2010): Remote Sensing of Ecology, Biodiversity and Conservation: A Review from the Perspective of Remote Sensing Specialists., Sensors, 10, 9647-9667

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	
Case study work	
Problem-based learning	

Educational simulation/game	
Task – solving learning (eg. calculation, artistic, practical tasks)	X
Experiential work	
Laboratory work	
Scientific inquiry method	X
Workshop method	
Project work	
Demonstration and observation	
Sound and/or video demonstration	
Creative methods (eg. brainstorming, SWOT analysis, decision tree method, snowball technique, concept maps)	
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**	**EU_7**	**EU_8**	**EU_9**
Written exam									
Oral exam									
Open book exam	X	X	X	X	X	X	X	X	
Written test									
Oral test									
Multiple choice test									
Project									
Essay									
Report									X
Individual presentation									
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	20
Reading for classes	5
Essay / report / presentation / demonstration preparation, etc.	15

Project preparation	
Term paper preparation	
Exam preparation	20
Total hours	90
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): acceptable knowledge, skills and personal and social competences but with serious scarcities
Satisfactory (dst; 3,0): acceptable knowledge, skills and personal and social competences but with numerous mistakes
Unsatisfactory (ndst; 2,0): unacceptable knowledge, skills and personal and social competences