MODULE INFORMATION SHEET

Name of Module Unit	**Scientific Programming and Data Analysis**
Name in Polish language	Programowanie Naukowe i Analiza Danych
Module type	compulsory / ~~elective~~
Form of studying	full-time day courses
Level of study	graduate course (M.Sc. level)
Type of study (for extra-mural courses)	-
Programme	Environmental Engineering
Speciality	Environment Protection Engineering
Responsible department	Chair of Environmental Protection and Management
Responsible person	Prof. Lech Łobocki

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
2				60		4

Learning outcomes (knowledge, skills, competences)

Ability to develop computer programs using a modern, high-level language imperative, functional and object-oriented, ability to apply programming in the analysis of spatial data on the environment. Developing self-learning skills.

Prerequisites

Information Technology, Computational Methods in Environmental Engineering

Rules for integrated grade setting

N/A

Recommended readings

General: Johansson R., Numerical Python, Apress 2019
Numerous textbooks as well as tutorials, video lessons, reference documentation available on the Web
Recommendations regarding specific topics are given at the course web page.

Contents of computer exercises

	Topics	Time (hrs.)	Scope (S / Ex)
1	General course info. Linux environment, networking, remote access.	2	S
2	An overview of the Python language and programming tools	2	S
3	Data types in Python and its selected libraries (NumPy, Pandas)	2	S
4	Python operators, operator overloading	2	S
5	Python simple statements	2	S
6	Functions in Python	2	S
7	The NumPy module. Matrix operations. Linear algebra examples.	2	S
8	Numpy and Scipy modules. Ordinary differential equations.	2	S
9	Plotting basics. The Matplotlib module	2	S
10	Symbolic algebra (SymPy). Solving ordinary differential equations.	2	S
11	Object-oriented programming. Application examples.	2	S
12	Program development using Integrated Development Environment	2	S
13	Elements of graphic user interface (GUI) programming	2	S
14	Developing portable GUI applications	2	S
15	Using R modules in Python: the openair package	2	S
16	Diagnosis of local air quality problems using OpenAir (assignment)	2	S
17	Standard data formats in geosciences: NetCDF, CF-1 convention	2	S
18	3-D visualization software – the Unidata's Integrated Data Viever	2	S
19	Network Data Access Protocol – OpenDAP, THREDDS Data Server	2	S
20	Geoscientific graphics: the Cartopy package, NCAR Command Language and PyNGL	2	S
21	Map projections, plotting maps	2	S
22	Contour analysis, "quiver" plots, streamline plots	2	S
23	Publication-quality geoscientific graphics (assignment)	2	S
24	Specialized geoscientific packages: MetPy	2	S
25	Spectral analysis: basic concepts and theorems	2	S
26	Discrete Fourier Transform: principles, limitations and errors.	2	S
27	Aliasing, energy spectrum, Parseval theorem, red and blue noise	2	S
28	Time serie analysis of climatological data (assignment)	2	S
29	Parallel computations – basic concepts, architectures and platforms	2	S
30	Course summary	2	S
	Total	**60**	**hours**

S – topics listed in the legal study programme standards from 12.07.2007
Ex – extended topics

Persons responsible for computer exercises

prof. dr hab inż. Lech Łobocki dr inż. Maciej Jefimow

Assessment method for computer exercises

Assignment reports grading, assessment of active participation in classes