

# Scientific calculations and numerical methods - course description

General information	
Course name	Scientific calculations and numerical methods
Course ID	13.7-WF-FizP-SCNM-S17
Faculty	<a href="#">Faculty of Physics and Astronomy</a>
Field of study	Physics
Education profile	academic
Level of studies	First-cycle Erasmus programme
Beginning semester	winter term 2017/2018

Course information	
Semester	5
ECTS credits to win	3
Course type	obligatory
Teaching language	english
Author of syllabus	<ul style="list-style-type: none"><li>dr Krzysztof Maciesiak</li></ul>

Classes forms					
The class form	Hours per semester (full-time)	Hours per week (full-time)	Hours per semester (part-time)	Hours per week (part-time)	Form of assignment
Class	45	3	-	-	Credit with grade

## Aim of the course

Learning basic both theoretical and practical skills in numerical methods. Moreover, writing computer codes and using already existing procedures to analysing research results, especially statistics. Computer simulations e.g. Monte Carlo or simple genetic algorithm.

## Prerequisites

Finished course: *Programming basics, Programming languages and paradigms*.

## Scope

- Interpolation – equations (Lagrange, Newton), selection of interpolation nodes and converging of interpolation processes.

- Approximation – least squares, polynomial, trigonometrical, fast Fourier transform.

- Numerical integration.

- Obtaining pseudorandom numbers with a set distribution.

- Approximate solving non-linear equations.

- Methods of solving boundary conditions for ordinary differential equations.

- Monte Carlo simulations in astronomy.

- Basics of genetic algorithms.

## Teaching methods

Programming exercises

## Learning outcomes and methods of theirs verification

Outcome description	Outcome symbols	Methods of verification	The class form
Student uses numerical methods as a tool to solve physical and astronomical tasks		<ul style="list-style-type: none"><li>an ongoing monitoring during classes</li></ul>	<ul style="list-style-type: none"><li>Class</li></ul>
Student can write and analyse an algorithm of astronomical problem and is able to write it in a form of computer code in a chosen programming language, also using already existing procedures		<ul style="list-style-type: none"><li>an ongoing monitoring during classes</li></ul>	<ul style="list-style-type: none"><li>Class</li></ul>
Student knows programming basics and numerical methods use in astronomy		<ul style="list-style-type: none"><li>an ongoing monitoring during classes</li></ul>	<ul style="list-style-type: none"><li>Class</li></ul>

## Assignment conditions

Get a pass from minimum 75% programming tasks.

## Recommended reading

[1] Z. Fortuna, B. Macukow, J. Wąsowski, *Metody numeryczne*, WNT, Warszawa 1982.

[2] S. Brandt, *Analiza danych*, Wydawnictwo Naukowe PWN, 1999.

[3] D. Chrobak, *Fortran, praktyka programowania*, Mikom, 2003.

## Further reading

[1] T. Pang, *Metody obliczeniowe w fizyce*, Wydawnictwo Naukowe PWN, 2001.

[2] J. V. Wall, C. R. Jenkins, *Practical Statistics for Astronomers*, Cambridge University Press 2003.

## Notes

Modified by dr hab. Maria Przybylska, prof. UZ (last modification: 30-07-2018 23:13)

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