UNIVERSITY OF GOTHENBURG

DEPARTMENT OF PHYSICS

FYP205 Programming and numerical analysis, 7.5 credits

Programmering och numerisk analys, 7,5 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Physics on 2020-02-03 and was last revised on 2021-03-01 to be valid from 2021-08-30, autumn semester of 2021.

Field of education: Science 100%
Department: Department of Physics

Position in the educational system

The course is included in the Physics and Medical Physics programs and is also offered as a standalone course. Within these programs it replaces the course MMG410 numerical analysis from the autumn semester 2020.

The course can be part of the following programmes: 1) Bachelor of Science in Physics (N1FYS) and 2) Medical Physicist Programme (N1SJU)

Main field of studies	*Specialization*
Physics	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

For admission to the course, completed courses from the first year of the Physics program are required, or that the equivalent knowledge has been acquired elsewhere.

Learning outcomes

After completion of the course, the student is expected to:

Knowledge and understanding

- classify and divide into categories basic numerical methods;
- identify numerical methods suitable for specific problems;
- describe and explain basic concepts, structures and methods in the programming language Python;
- discuss pros and cons using Python in comparison with other programming languages;
- discuss and describe the differences, both in principle and performance, between low level and high level languages as well as between; compiled languages vs interpreted languages;

Competence and skills

- write computer programs in Python;
- be able to systematically detect errors and debug programs written in Python;
- identify and implement numerical methods for problems in linear algebra and differential calculus;
- apply Python for solving problems numerically;

Judgement and approach

- assess the suitability of different numerical methods for a given problem and be able to determine the most appropriate method;
- analyze the efficiency of Python-code and make suggestions for potential improvements;
- judge the reliability of numerically obtained results.

Course content

Basic concepts in the programming language Python such as, data types, operators, built-in functions, conditional branching, loops and other control structures. Numerical differentiation and integration. Numerical solutions to linear and nonlinear equations. Numerical solutions to systems of equations. Numerical solutions to ordinary differential equations and systems of ordinary differential equations.

Sub-courses

1. **Lab sessions** *(Laborationer),* 5 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
   Computer- and programming exercises.

2. **Programming** *(Programmeringsteknik),* 2.5 credits
   Grading scale: Pass (G) and Fail (U)

Grading scale: Pass (G) and Fail (U)
Abilities and conceptual knowledge within programming corresponding to the learning outcomes of the course.

Form of teaching
Lectures and computer exercises.

Language of instruction: Swedish

Assessment
Sub course 1: Assessments of computer exercises (in class, via reports and/or oral presentations).
Sub course 2: Oral examination.

Grades
The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
To obtain a Pass grade (G) on the entire course requires Pass grades (G) on Sub course 1 and Sub course 2. To obtain the grade Pass with distinction (VG) on the entire course requires Pass with distinction (VG) on Sub course 1 and Pass (G) on Sub course 2.

Course evaluation
After the course all participating students will be given the opportunity to give feedback via an anonymous survey. A meeting between the course responsible and student representatives will then be held to discuss the feedback. Notes from this meeting should be made available via the university learning platform.