Study program	Level of studies	**Third cycle**
	Title of the study program	**Doctoral studies in physics**
Course title	**COMPUTATIONAL PHYSICS**	

Course ID	Semester	Course status	ECTS credits	Teaching hours
PTH7031	**I /II**	**Elective**	**10**	**30**

Course aims and expected learning outcomes	**The aim of the course is that student acquire competences in numerical methods and their application in modeling various physical systems. Each project assignment consists of modeling and solving some of the physical problems that are related to students' PhD thesis work. Student will become familiar with available models and modeling techniques and trained to solve specific physical problems in that manner.**

COURSE CONTENT

Comparison of programming languages Fortran – C/C++ – Pyton.
Special functions. Solving linear algebraic equations. The eigenvalue problem. Laplace equation, heat conduction equation.
Monte Carlo methods. Minimization and maximization of functions.
Fourier transforms and spectral methods.
Nonlinear systems.
Application of higher level software packages - Matlab (Octave), Mathematica. Using the GSL libraries. Parallelization.
Project Jupyter (Jupyter Notebook, JupyterHub, and JupyterLab).

LITERATURE

- W.H. Press, S.A. Teukolsky, W.T. Vetterling, B.P. Flannery, *Numerical Recipes*, Third Edition, Cambridge University Press 2007.
- M. Hjorth-Jensen, *Computational Physics*, University of Oslo, 2007.
- R.H. Landau, M.J. Páez Mejiá, *C. C. Bordeianu, Computational Physics: Problem Solving with Python*, 3rd Edition, Wiley- VCH 2015
- D. Landau and K. Binder*, Guide to Monte Carlo Simulations in Statistical Physics*, Third Edition, Cambridge University Press 2009.
- GSL Reference Manual, https://www.gnu.org/software/gsl/

ASSESSMENT OF LEARNING

Assessment Method	Points
Homework	30
Seminar paper	30
Final exam	40
Total	100

Remarks