PX277-7.5 Computational Physics

21/22

Department
Physics
Level
Undergraduate Level 2
Module leader
Yorck Ramachers
Credit value
7.5
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

This module develops programming in the Python programming language and follows from PX150 Physics Programming Workshop

Module web page

Module aims

To acquire programming skills necessary to solve physics problems with the help of the Python programming language, a language widely used by physicists

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Handling, processing and analysing physics data: plotting distributions, least square and maximum likelihood fit.
2. Monte Carlo simulation for physics modelling. Different types of random numbers, quality of random number generators. Generation of random numbers according to specific

distributions.
Brownian motion and diffusion.
3. Numerical integration and differentiation. Mass and centre of mass of object with variable density. Electric fields generated by distributed charge.
4. Numerical solutions of ordinary differential equations. Mechanical oscillations, motion with resistance.

Learning outcomes

By the end of the module, students should be able to:

- Explain how computers can be used to solve physics problems
- Translate physics problems into a form suitable for implementing in computer program
- Design algorithms and implement them.
- Handle and analyse physics data

Indicative reading list

M. Newman, Computational Physics, CreateSpace Independent Publishing Platform, ISBN: 978-1480145511 (2012).

- H.P. Langtangen, A Primer on scientific programming with Python, Springer e-books (2012): http://link.springer.com/book/10.1007%2F978-3-642-18366-9
- Python documentation: http://www.python.org/doc/
- Scientific Python: http://docs.scipy.org/doc/scipy/reference/

Subject specific skills

Knowledge of programming. Skills in numerical modelling.

Transferable skills

IT skills, analytical, communication, problem-solving, self-study

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Study

Study time

Type	Required
Lectures	5 sessions of 2 hours (13%)
Practical classes	10 sessions of 1 hour (13%)
Total	75 hours

Type	Required
Private study	55 hours (73%)
Total	75 hours

Private study description

Working through lecture notes, formulating problems, programming and testing code, discussing with others taking the module, preparing and submitting coursework

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time	Eligible for self-certification
Assessment component			
Assessed Computing Assignments Programmning and reports	100%		No
Reassessment component			
Reassessment of lab work Coursework as designated by department			No

Feedback on assessment

Timetabled workshops

Availability

Courses

This module is Option list A for:

- Year 2 of UPXA-FG33 Undergraduate Mathematics and Physics (BSc MMathPhys)
- Year 2 of UPXA-F3N1 Undergraduate Physics and Business Studies