The University of Hong Kong
Department of Physics
PHYS2160 Introductory Computational Physics
2022 Spring Course Outlines

Course title: PHYS2160 Introductory Computational Physics

Course website: http://moodle.hku.hk

Aim: This is one of the second level courses in our series of courses that introduces problem solving, mathematical and computational skill sets that are commonly used in the study of university-level physics. This course introduces computational tools, techniques, and methods in physics and related fields using the Python programming language. Students are expected to spend a substantial amount of time in writing computer programs to solve physical problems. After completion, interested students may take the sequel courses PHYS3151, PHYS4150 or PHYS4151 to further their studies in computational physics.

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Prerequisites: Pass in MATH1013 or MATH1821 or MATH1851 or PHYS1150

Classes: This course consists of 31 hours of lectures and tutorials, 18 hours of laboratory work, and 12 hours of project work.

Teaching mode: ***All the lectures will be conducted face-to-face which will be also recorded.***
The recording of each lecture will be uploaded on the Moodle course page.

Laboratory work: Students need to conduct six ***face-to-face laboratory sessions*** in the innovative classroom CPD 3.41 located on the 3/F of The Jockey Club Tower in the Centennial Campus. Students will be asked to write computer programs in laboratory sessions and submit their lab reports as Moodle Assignment via the link on the Moodle course page before leaving the classroom. The laboratory sessions will be held on ***Wednesday, 9:30-12:20*** on ***26 Jan, 9 Feb, 16 Feb, 23 Feb, 2 Mar, 23 Mar***.

Project: Students need to work on a computational project which is the application of *Python* programming for solving a physical problem or simulating a physical system. The topics of the project will be assigned after the add/drop period. Students should submit a report for their projects which includes the followings: (1) theory, (2) algorithm, (3) results, (4) discussion, (5) listing of the *Python* program. They will be asked to give a 10-minute presentation (including 2 min for Q & A session) on their project.

Evaluation:

One two-hour written examination	50%
Laboratory reports	20%
Presentation	10%
Project report	20%

Textbook: Lecture notes provided by Course Coordinator

References:

(1) Christian Hills: *Learning Scientific Programming with Python* (Cambridge University Press, 2016)

(2) Andi Klein ad Alexander Godunov: *Introductory Computational Physics* (Cambridge University Press, 2010)

(3) Hans Petter Langtangen: *A Primer on Scientific Programming with Python* (Springer, 2016, 5th edition)

(4) Mark Newman: *Computational Physics* (CreateSpace Independent Publishing Platform, 2012)

(5) Matt A. Wood: *Python and Matplotlib Essentials for Scientists and Engineers* (Morgan & Claypool, 2015)

Teaching Plan

Week	Date	Topics
1	18 Jan	Introduction
	21 Jan	Python programming for Physicists [1]
2	25 Jan	Python programming for Physicists [2]
	28 Jan	Python programming for Physicists [3]
3	8 Feb	Python programming for Physicists [4]
	11 Feb	Python programming for Physicists [5]
4	15 Feb	Python programming for Physicists [6]
	18 Feb	Object-oriented Programming in Python [1]
5	22 Feb	Object-oriented Programming in Python [2] Scientific Programming with NumPy, Matplotlib, and SciPy [1]
	25 Feb	Scientific Programming with NumPy, Matplotlib, and SciPy [2]
6	1 Mar	Scientific Programming with NumPy, Matplotlib, and SciPy [3]
	4 Mar	Scientific Programming with NumPy, Matplotlib, and SciPy [4]
8	15 Mar	Scientific Programming with NumPy, Matplotlib, and SciPy [5] Errors and Uncertainties in Computation [1]
	18 Mar	Errors and Uncertainties in Computation [2]
9	22 Mar	Numerical Calculus [1]
	25 Mar	Tutorial [1]
10	29 Mar	Numerical Calculus [2] Solutions of Nonlinear Equations [1]
	1 Apr	Tutorial [2]
11	5 Apr	***No Class***
	8 Apr	Solutions of Nonlinear Equations [2] Ordinary Differential Equations [1]
12	12 Apr	Ordinary Differential Equations [2] Revision
	15 Apr	***No Class***
13	19 Apr	Tutorial [3] Q&A for Project
	22 Apr	Project Presentation [1]
14	26 Apr	Project Presentation [2]
	29 Apr	Project Presentation [3]