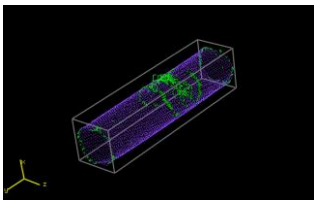
The Hashemite University
Faculty of Science
Course Syllabus



Department of Physics

Course Title: Computational Physics
Course Number: 110102383
Pre-requisite: 110102382
Credit Hours: 3
Designation: Elective
Instructor: Dr. Sufian Alnemrat
Instructor's E-mail: smalnemrat@hu.edu.jo
Office Hours: 12-1 (Sunday, Tuesday) or by appointment using above email address

Course Description:

This course provides an introduction for undergraduate physics students to computational techniques in physics. Initially, we will learn basic programming techniques in Python and apply this knowledge to solve various physics problems numerically.

Text Book:

Computational Physics: Problem Solving with Python, 3rd Edition
Rubin H. Landau, Manuel J Páez, Cristian C. Bordeianu.

References:

1- Computational Physics by Tao Pang, Cambridge University Press.
2- Computational Physics by N. J. Giardino and H. Nakanishi, Prentice Hall.
3- Franz J. Vesely, Computational Physics: an introduction, 2001.

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Major Topics Covered:

Topics	No. of Weeks	Contact Hours*
Introduction to python and Python Tools	1	5
Python programming language basics	5	15
Numerical techniques	7	15
Applications of numerical techniques in physics	2	10
Total	**15**	**45**

*Contact Hours include lectures, homework's and exams.

Course Learning Outcomes:

The main goal of the course is to make the students familiar with Python as a powerful and scientific scripter/programming language and use it with major numerical techniques in solving complex problems in physics. Upon completion of this course, the student is expected to be able to:

	Course Learning Outcomes	(SO*)
CLO1.	use Python interactively, execute a Python script using the shell prompt, use Python statements, understand assignments, and use strings.	(a), (k)
CLO2.	write and call simple functions and utilize high-level data types such as lists.	(a), (k)
CLO3.	import and utilize a module, read from and write to a text file, understand interpreter and compilers, and mastering use of some Pythons modules such as matplotlib.	(a), (b), (k)
COL4.	learn numerical basics and Errors/Uncertainties.	(a), (k)
COL5.	use of midpoint and error-extrapolation methods in numerical differentiation.	(a), (k)
COL6.	use trapezoidal rule, Simpson's rule, Romberg integration, and treatment of singularities at the endpoints, midpoint rule in numerical integration.	(a), (k)
COL7.	use bisection, Newton-Raphson, and fixed point methods in roots finding.	(a), (k)
COL8.	learn and use least squares fitting and data manipulation.	(a), (k)
COL9.	use Euler and Runge-Kutta methods in numerical solution of ordinary differential equations.	(a), (k)
COL10.	applications of numerical techniques in solving physics' problems.	(a), (b), (e), (k)

*(SO) = Student Outcomes Addressed by the Course.

- **Student Outcomes (SO) Addressed by the Course:**

#	Outcomes Description Applied and Natural Sciences Student Outcomes	Contribution
(a)	an ability to apply knowledge of mathematics, science, and applied sciences	H
(b)	an ability to design and conduct experiments, as well as to analyze and interpret data	L
(c)	an ability to formulate or design a system, process or program to meet desired needs	
(d)	an ability to function on multidisciplinary teams	
(e)	an ability to identify and solve applied sciences problems	M
(f)	an understanding of professional and ethical responsibility	
(g)	an ability to communicate effectively	
(h)	the broad education necessary to understand the impact of solutions in a global and societal context	
(i)	a recognition of the need for, and an ability to engage in life-long learning	
(j)	a knowledge of contemporary issues	
(k)	an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.	H

H = High, **M** = Medium, **L** = Low

Grading Plan:

Midterm exam:	25 points	18/03/2018
Lab midterm exam:	10 points	11/03/2018
Homework's':	25 points	One homework every week
Final Exam:	40 points	To be announced later

General Notes: (Attendance Policy) students are expected to attend every class and arrive on time in compliance with HU regulations. In case you find yourself in a situation that prevents you from attending class or exam, you have to inform your instructor. If you miss more than 6 classes for the (Sunday, Tuesday, and Thursday model) or 4 classes for the (Monday and Wednesday Model), you cannot pass the course. Makeup excuses will be accepted only for very limited justified cases, such as illness and emergencies. Changing your section without informing your instructors is not accepted at all.