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**Salahaddin University-Erbil**

**Department of Physics**

**Subject: Computer programming**

***Course Book***

***Dr. Isam Khalil Abdullah***

***Academic year: 2022-2023***

***2nd year students***

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| **1. Course name** | **IT (Python programming)** |
| **2. Lecturer in Charge** | **Dr Isam Khalil Abdullah** |
| **3. Department/ College** | **Physics / Science** |
| **4. Contact** | **E-mail: isam.abdullah@su.edu.krd** |
| **5. Time (in hours) per week** | **Theory: 2 /week**  **Practical :2/week** |
| **6. Office hours** | **About 4 hours per week** |
| **7. Course Code** | **SPhM209** |
| **8. Teacher's academic**  **profile** | I am an independent professional and self-motivated with good research and writing ability, also I intend to grow up a positive relationship with peoples who works in high level research centre gathered with special programming languages for solving more complicated problems in Nanotechnology and organic/inorganic device under operation. I was awarded a BSc (my rank was 1st overall students in the College of Science) Physics from the University of Salahaddin in 1987 and an MSc in Nuclear Physics (Distinction) in 1992. After getting master degree, I was appointed as an assistant lecturer at department of Physics/Salahaddin University in 1992. I have taught a wide range of subjects, at undergraduate level , including nuclear physics, quantum mechanics, mathematical physics, computer science, elementary particles, calculus, differential equations, Linear algebra, and practical physics. Most recently, I was awarded a PhD from Cardiff University – UK in 2016 for work in Molecular Nano-Physics including Organic/inorganic materials gathered with exploring a new and attractive technique for Scanning Electrostatic Microscopy (EFM). I enjoy keeping myself busy and put extra effort in my tasks. I enjoy working with other and I have good communication skills with other researchers and academic staff. I speak more than 5 languages: English, Arabic, Kurdish, Turkey, Turkman, and a little of Persian. I regularly update myself with the latest information of my profession, I have many years of experience in teaching and researching so i can lead a team and manage problems that arise. |
| **9. Keywords** | Python, , linspace, else, continue, for, pass, return. |
| **10. Course overview**  Students must have the opportunity to learn and understand computer science. It helps nature problem-solving skills and student creativity. By starting early, students get a foundation for success in any career path. The goal of Python coding is not just for future scientists, researchers, and engineers but it’s a computational thinking: learning to analyze and classify problems, break hard problems down into smaller, simpler ones.  Python is a great language for the beginner programmers and supports the development of a wide range of applications. One of Python's greatest power is the python library which is very portable and cross-platform compatible on Linux, Windows and Mac. Python is easy to learn because it has a few keywords and simple structure which helps student to catch up the language quickly. Python is easy to read and maintain also its freely available. | |
| **11. Course objective**  We intended to introduce students not only to the coding of computer programs, but to programming thinking, the methodology of computer language, and the principles of good program design. The Python programming language is used throughout the course for all examples and homework problem sets. In this course the student learn how to write simple programs using Python, the course offers strong support for integration with other computer languages and tools, with standard libraries, and the basic principles of the language. Many programmers new to Python report substantial productivity gains and feel the language encourages the development of higher quality, more maintainable code. So the student encourage to learn core Python scripts such as variable and how work with lists and sequence. Use Python to read, write, and work with Python standard library. Majority of Python coding, using of Python as a calculator, arrays, histogram, plotting orders, plotting options, type of fittings, scripts, differentiation, integration, loops, input and outputs, and differential equations. Hence, in this stage we promote and provide student with fundamental concepts and clear developments to enter the world of Python program. | |
| **12. Student’s obligation**  Students are expected to learn and understand the basic of computer principles, how to write program and previous experience using a personal computer. Student will need to have access to a personal computer so he/she can write programs and do the homework assignments. Also, student will need to decide on what type of environment he/she want to do program development in. In class we will work through examples using a traditional window environment also we can sort an exceptional environment for using Linux for students who like to work on it as an operating system. Students should attend all lectures without delays and write basic notes about the presented subjects because we organize a new materials for each lecture. As the Python programming is absolutely a new language, the absence cause a difficulty and problem for student to get back on the track. Also students must submit and do all homework presented at the end of each lecture as it helps them to get more progress and understanding. Additionally, students attending to any tests and monthly exams is compulsory. | |
| **13. Forms of teaching**  Personally, I prefer to organize lectures and presentation by using different ways to make the students engage with the lecture like power point, projector, white bard, and slides explanation. At the end of each lecture student will hand a complete leaflet of presented lecture and exercises. | |
| **14. Assessment scheme**  Monthly examination 30%  One quiz per chapter 10%  Final exam. 60 % | |
| **15. Student learning outcome:**  As the Python is not specialized to a specific target users. It is extended through modules and libraries that hook very easily into the other programming languages. Python can be used for any programming task, from GUI programming to web programming with everything else in between. There are libraries for everything you can think of: game programming, web frameworks, and scientific computing .Python community is just (awesome). Once you get into it, there are huge number of folks doing great things with it. Python can be used as a stepping stone into other programming languages and frameworks. It is widely used, including by a number of big companies like Google, Instagram, Yahoo, Nokia, IBM, and many others. As long as many big companies rely on the Python language, you can make good money as a Python developer. That’s because it has a massive support basis and working with different tasks. | |
| **16. Course Reading List and References‌:**   * **Python programming for the absolute beginner (3rd edition ) Mike Dawson** * **Think Python Allen B Doney** * **Dive into Python Mark Pilgrim** * **A beginner’s Python tutorials** | |
| **17. The Topics**  **Week 1**: 1.1 Python programming, 1.2 Why Python, 1.3 Python is a high level language, 1.4 Interpreter and compiler, 1.5 Python Packages.  **Week 2:** 2.1 Installing of python packages 2.2 Dealing with variables, 2.3 Python as a calculator, 2.4 Order of calculation in Python, 2.5 Variable increments, 2.6 Exercise.  Week 3: 3.1 Numpy, 3.2 SciPy, 3.3 Matplotlib, 3.4 Major use of python, 3.4ree Installing python program( release 2.7.14), Exercise.  **Week 4:** 4.1 Arrays and plotting options, 4.2 Calculations with arrays, 4.3 Addition and subtraction, 4.4 Array’s multiplication and division, Excersice.  **Week 5**: 5.1Vector algebra, 5.2 Dot and cross products, 5.3 Plotting in Python, 5.4 Line and scattering plots, Excersice.  **Week 6**: 6.1 Formatting of plots, 6.2 Array statistics, 6.3 Array manipulation and analysing, Exercise  **Week 7:** 7.1 Polynomial in Python, 7.2 Roots of polynomials, 7.3 Generating of polynomial from roots, 7.4 Differentiation and integration of polynomial, 7.5 Histograms,  **Week 8:** 8.1 Python Strings, 8.2 Length of strings, 8.3 Replacing of strings, 8.4 split slicing, Exercise.  **Week 9**: 9.1 Tuples in Python,9.2 Accessing values in tuples, 9.3 deleting tuples, 9.4 basic tuple operations, 9.6 basic built in tuples functions, Excersice.  **Week 10**: 10.1 Python dictionary, 10.2 Accessing and updating dictionary, 10.3 Property of dictionary keys, 10.4 Built in dictionary functions, Exercise.  **Week 11:** 11.1 Functions in python, 11.2 How do you write functions in Python?, 11.3 How you can call functions in Python?, 11.4 Proper functions, , Exercise.  **Week 12:** 7.1 input/output data, 7.2 Upper and lower case, 7.3 splitting of strings, 7.4 Replace and count, 7.5 String Formatting, 7.6 Requesting input, 7.7 Filing input and output, Exercise.  **Week 13:** 9.1 Straight line program, 9.2 Writing scripts, 9.3 Inputting data, Excersice.  Week 14: 14.1 Saving program, 14.2 Running code under python, 14.3 Adding comments in Python, Exercise.  **Week 15:** 8.1 Python loops, 8.2 While loop, 8.3 Flow diagram, 8.4 Conditional expression in python, Excersice.  **Week 16**: 16.1 else statement with while loop, 16.2 else and while flow diagram. Exercise.  **Week 17:** Consolidation.    **18. Practical topics (if there is any)**  We have 2 hours /week practical Python programming. The student should practice all subjects and exercises given in lectures mentioned above on computer. All computers are ready for uses where Python group team downloaded and installed Python and all wanted packages. | |
| **19. Examinations ( Examples):**  ***Q1*/a**: Using ***arange()*** togenerate an array, a , containing the numbers 5 to 23 in increasing order.  **b**: Using ***linspace*** or ***arange()*** to generate an array, b , containing the numbers 23 to 5 in decreasing order.  **c**) Calculate d= a+b and e= a/b (was this integer or float division).  ***Q2/a*** Write a complete Python program to generate and plot a polynomial p(x) = 6x2 +2x-5 between the values -4 and 4, add a legend, grid, title, and labels. Calculate the roots of polynomial and the local minima.  ***b***. Define arrays to represent the following vectors **a** = 6**i** + 5**j** + 1**k** and **b** = 3**i** - 2**j** + 4**k** then generate **c** and **d** which is a result of **a**+**b** and **a**\***b** respectively  **Q3/** In an experiment the length of a spring is measured when different masses are suspended from it according to: **Mass(Kg): 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.8.**  **Length(m): 0.05, 0.75, 0.09, 0.13, 0.14, 0.18, 0.195**  Hook’s law state that the extension of the spring will be proportional to the force applied to it. Write a complete Python program:  1) To plot the above data with all required python plotting codes.  2) Calculate the gradient and intercept of best fitting line.  ***Q4*/a** Write the output for the following  **1-** for letter in 'Python': **2-** x= [] **3-** fruit = ‘banana’  if letter == 'h': x.append(‘Python’) fruit[0:5:2]  continue x.append(120) fruit[1:5]  print 'Current Letter :', letter x.append(‘news’)  print x  ***b/*** Write Python syntax for  1- while and break statements 2- Deleting and renaming files 3- Reading and writing a file    **Q5/a** if S=[ 2, 4, 6, 8, 10, 12, 14, 16, 18, 20] is a set of numbers, write a complete Python program to calculate the sum of the first 7 numbers in S using **for loops and break.**  b/ Write Python program to generate a histogram of 1000 random numbers between 0 and 1 (construct 25 bins). | |
| **19. Extra notes:**  I am Highly recommend that the Python programming to be as an essential subject for teaching in 3rd and final years computer science students as it’s a general purpose programing language and important for scientists and engineers because:   * Python is used by programmers that want to delve into data analysis or apply statistical techniques. * Powerful, fast, and easy to learn. * There are plenty of Python scientific packages for data visualization, machine learning, complex data analysis and more. * Python has a great tool for scientific computation and huge libraries for data science * **Panda:**a library for data manipulation and analysis. The library provides data structures and operations for manipulating numerical tables and time series. * **Sciepy:**a library used by scientists, analysts, and engineers doing scientific computing and technical computing. * **Numpy:**the fundamental package for scientific computing with Python, adding support for large, multi-dimensional arrays and matrices, along with a large library of high-level mathematical functions to operate on these arrays.   If you want to get more information and to know more libraries and tools, you can check this article **THE MOST POPULAR PYTHON SCIENTIFIC LIBRARIES**. | |
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