BIRZEIT UNIVERSITY
Faculty of Science كلية العلوم
Department of Physics دائرة الفيزياء

PHYS338 – Computational Physics

First Semester 2020

Instructor: Prof. Abdallah Sayyed-Ahmad | **E-mail:** asayyeda@birzeit.edu | **Office:** SCI210

Introduction:

This course is intended for physics students to train them on tackling problems in various physics topics that cannot be solved analytically. In addition to studying general topics such as numerical solutions of differential equations, numerical integrations and numerical linear algebra, students will work on physical problems of interest in classical and quantum mechanics as well as electromagnetism. This course will also cover some discussions and explanations of various high-performance computing topics and concepts.

Prerequisites:

COMP131, MATH331

Class Schedule:

MW 12:50 – 14:00 through BBB on moodle (itc.birzeit.edu)

Learning Objectives:

- Demonstrate an appreciation and understanding of common applications of computational physics
- Be able to solve a range of new problems of interest in various physics topics.
- Be able to present and analyze computational results in a concise and publication quality format.

Computational Resources:

Student must have access to a descent computer with appropriate software installed. The formal programming language adopted for this course is C. Students can also use matlab. Any student who intend to use different programming language should contact me.

Required Text:

The textbook for this course is "*An Introduction to Computational Physics*", 2nd edition, by Tao Pang (Cambridge press, 2006). http://www.physics.unlv.edu/~pang/cp2.html

Recommended Additional Texts:

- Landau, RH; Paez, J and Bordeianu CC "*A Survey of Computational Physics: Introductory Computational Science*", Princeton University Press, 2008
- Thijssen, J "*Computational Physics*", 2nd edition Cambridge University Press, 2007
- Press, WH; Flannery, BP; Teukolsky, SA and Vetterling, WT "*Numerical Recipes in C: The Art of Scientific Computing*", 2nd edition, Cambridge University Press, 1992
- Eijkhout, V; Chow, E and van de Geijn, R *"Introduction to High Performance Scientific Computing",* MIT Press, 2011

Useful code libraries:

- Netlib Repository: http://www.netlib.org/
- Guide to mathematical software: https://gams.nist.gov/

Course Outline:

- An introduction to the utility of computers in physics
- Numerical Calculus
- Numerical solution to ordinary differential equations
- Numerical Linear Algebra
- Numerical solution to partial differential equations
- Monte Carlo Simulations
- Genetic Algorithms (if time permits)

Evaluation:

Weekly Assignments	30%
Team Projects, reports and presentations	20%
Final Project and Presentation	20%
Final Exam	30%
	100%