# Computational Physics | PHZ 3151C (4 credits) | Fall 2016

Instructor: TBA **Class Meetings**

Office: TBA Time: TBA

Phone: TBA Location: TBA

Email: TBA **Office Hours**

Website: TBA Time: TBA

## Course description

This course will cover selected topics in numerical computation and compute-assisted analysis, with applications to physical systems.

## Course prerequisites and co-requisites

The prerequisites for this course are Calculus with Analytic Geometry III (MAC 2313) and Survey of Modern Physics (PHY 3101C), or equivalent.

## Required texts and materials

S. Hassani. *Mathematical Methods Using Mathematica®: For Students of Physics and Related Fields*. Springer, 2003.

Students in this course will also need a computer capable of running *Mathematica*, and a valid license either through FAU’s site license program or by purchasing their own student license.

## Course objectives

On completing the course, students should be able to:

* Enter, manipulate and typeset algebraic expressions and lists in *Mathematica*.
* Find the roots of equations analytically and numerically using *Mathematica*.
* Produce sophisticated graphical output in *Mathematica* for both continuous functions and discrete data, including 2D plots, 3D surface plots, contour and density plots.
* Use *Mathematica* functions to numerically solve non-linear ordinary differential equations, and present the results graphically.
* Understand and compute the error, accuracy and precision of approximated real numbers.
* Approximate continuous functions using interpolation, least-squares fitting and truncated series.
* Derive numerical differentiation and integration techniques, implement them in *Mathematica* and use them to solve problems up to a given precision or accuracy.
* Develop algorithms to solve first-order ordinary differential equations using the Euler, predictor-corrector and Runge-Kutta techniques, and adapt these algorithms for systems of equations, higher order equations, and boundary-value problems.
* Use the finite-difference method to solve boundary-value ordinary differential equations, and a basic second order partial differential equation.
* Verify all algorithms and solutions using built-in *Mathematica* functions.

## Course evaluation

Grades in this course will be computed from a weighted average of:

* Class attendance 15%
* Homework assignments 10 × 5%
* Midterm exam 15%
* Final exam 20%

## Course grading scale

Final grades will be based on a curve derived from the total scores of all students enrolled.

## Disability policy statement

*In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS)—in Boca Raton, SU 133 (561-297-3880); in Davie, LA 203 (954-236-1222); or in Jupiter, SR 110 (561-799-8585) —and follow all SAS procedures.*

## Code of academic integrity policy statement

*Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see* [*http://www.fau.edu/regulations/chapter4/4.001\_Code\_of\_Academic\_Integrity.pdf*](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf)

## Course outline

A rough outline of this course is as follows. We will spend roughly one week of class time on each topic. Homework will be due as assigned.

1. Basics and Algebra
2. Advanced Algebra and Symbolic Computation
3. Functions and Plotting I
4. Functions and Plotting II
5. Lists, Arrays and Boolean Logic
6. Calculus and Differential Equations
7. Basic Programming
8. Numerical Approximations
9. Functional Approximations
10. Numerical Calculus
11. Numerically Solving Differential Equations
12. Advanced Ordinary Differential Equations
13. Partial Differential Equations
14. Animation and Applet Programming