THE FEDERAL UNIVERSITY OF TECHNOLOGY, AKURE

Department of Physics

PHY 407 – Computational Physics

Course Code: PHY 407
Course Title: Computational Physics
No. of Units: 3
Course Duration: Three hours per week for 15 weeks.
Status: Compulsory
Course Email Addresses: aipopoola@futa.edu.ng or ispopoola71@gmail.com
Course Webpage: http://www.phy.futa.edu.ng/courseschedule.php?coursecode = PHY407

COURSE INSTRUCTOR

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COURSE DESCRIPTION

To learn some of the numerical methods available to tackle mathematical problems that occurs in physics.

COURSE OBJECTIVES

The objectives of this course are to:

- Develop the student's capacity to solve many mathematical problems that occur in Physics
- Provide students with opportunities to learn coding in BASIC, FORTRAN to solve mathematical problems.
- Introduce students to available tools - MATLAB.

COURSE LEARNING OUTCOMES / COMPETENCIES

Upon successful completion of this course, the student will be able to:
(*Knowledge base*)

- Identify correctly, the solution method (analytical or numerical) for any Physics problem.
- Understand the purpose and function of each solution method.
- Students are provided with the ability to write codes and use available tools - MATLAB.

(*Skills*)

- To select good solution methods and techniques.
- To learn how to use MATHEMATICA, MATLAB etc.
- To use codes to iteratively some mathematical problems.

GRADING SYSTEM FOR THE COURSE

This course will be graded as follows:

Assignments	20%
Periodic Tests	20%
Formal Examination	60%
TOTAL	100%

GENERAL INSTRUCTIONS

To attain success in this course, students are required to familiarize themselves with some basic programming languages – BASIC, FORTRAN. Students are also encouraged to always get in-touch with the instructor whenever they have difficulties.

READING LIST

Numerical Methods for Physicists - Anthony O'Hare
Numerical Methods For Physics, Alejendro Garcia
Numerical Analysis: Mathematics of Scientific Computing, Kincaid & Cheney
Computational Physics, Koonin & Meredith

COURSE OUTLINE

Week	Topic	Remarks
1	Introduction and course overview	Introduction to PHY 407. Difference between numerical and analytical techniques.
2 & 3	Finding the roots of an equation; Fitting Curves to Data.	Students will be thought on the use of methods such as: Newton-Raphsen method, the bisection method and the linear interpolation. Linear Interpolation
4 & 5	Numerical Integration	Trapezium Rule, Simpson's Rule, Booles Rule
6 & 7	Methods For Ordinary Differential Equations.	Stability, Crank Nicholson Method, Implicit Schemes
8 & 9	Methods For Partial Differential Equations.	Gauss Siedel Method, Successive Over-Relaxation
10 & 11	Linear Algebra	Gaussian Elimination, Back Substitution and Matrix inverse .
12 & 13	Eigen systems	Similarity Transformations , Jacobi Method, Power Method ,

		Power Method with Scaling, Deflation, Lanczos Method
14 & 15	Fourier Series	Non-periodic Functions, Fourier Transforms, Optics