# Covenant University
# College of Science and Technology
# Department of Computer and Information Sciences

**COURSE CODE:** CSC431
**COURSE TITLE:** Computational Science and Numerical Computation
**UNITS:** 3
**SEMESTER:** Alpha
**COURSE LECTURERS:** Prof. Jelili, O. Oyelade, and Mr. Osofuye, Damilola

## COURSE DESCRIPTION

This course provides fundamental introduction to numerical methods and computer programming for the solution of a number of classes of scientific and engineering problems. The course is interdisciplinary in nature, incorporating a number of case studies in biology, physics, chemistry, and engineering. It introduces students to how problem that cannot be solved analytically can be otherwise solved. Students will learn how the problems will be solved numerically using programming language like Java or Python environment.

## COURSE OBJECTIVES:

At the end of this course, it is expected that you should be able to:

- Understand the key mathematical algorithms that lie at the core of many numerical computational science.
- Identify problems that cannot be solved analytically and apply relevant numerical techniques to solve such problems.
- Having the conceptual knowledge of different industrial application areas that can be solved using numerical computations

## METHOD OF TEACHING/TEACHING AIDS:

**Lecture Delivery**

- The use of white board and the overhead projector.

**Teaching Aids:**

- Use of computer to show how solutions can be gotten via programs.

## COURSE OUTLINE

**Module 1: Error Analysis and Methods of Solving Non-Linear Equations**
**Week 1:** Error Analysis and Bisection Method
**Week 2:** Newton-Raphson Method

**Module 2: Solution of Linear Systems**
**Week 3:** Guassian Elimination and Pivoting Method
**Week 4:** Gauss-Seidel Method
**Week 5:** Gauss-Jacobi Method

**Module 3: Finite Difference Arithmetic**
**Weeks 6-7:** Finite Difference Methods

**Mid-Semester Examination**

**Module 4: Interpolation and Polynomial Approximation**
**Week 8:** Interpolation: Lagrange Approximation and Newton Polynomials. Extrapolation.

**Module 5: Solution of Differential Equations**
**Weeks 9-10:** Differential Equations: Euler's and Taylor Series Methods.
**Weeks 11-12:** Runge-Kutta Methods, Convergence and Stability.
**Week 13:** Revision, Tutorials and Evaluation**.**

**METHOD OF GRADING**:
Assignments – 10 marks
Mid-Semester Exam. – 20 marks
Semester Exam. – 70 marks.

**CLASS BEHAVIOUR:**
- 90% attendance mandatory
- Eating in the class will not be tolerated
- Students are expected to ask questions in class, consult the recommended textbooks and write programs in any language of their choice to implement the assignments
- Assignments must be submitted when due
- Late coming to the class will not be tolerated

**TOPICS FOR ASSIGNMENTS**
The students will be expected to write, run and defend programs to solve problems on the following topics:
- Newton-Raphson method
- Gauss-Seidel Method
- Euler Method

**Note:** Plagiarism is a serious offence. If in doubt, consult your lecturer.

**RECOMMENDED READING:**

- Stephen C. Chapra & Raymod P. Canacle(1991), Numerical Methods for Engineers With Software and Programming Applications, Mc-Graw-Hill.
- Solomon Adebola Okunuga & Moses A. Akanbi (2003), Computational Mathematics (A First Course), WIM Publications.
- John H. Mathews & Kurtis D. Fink (2004), Numerical Methods Using MatLab, Pearson Prentice Hall