Numerical Analysis

This course aims at introducing students to the fundamental concepts of Numerical Analysis that Mathematics that is essential to an electrician and electronic engineer. The course provides the knowledge to solve numerically basic mathematical problems that emerge in engineering applications.

On successful completion of this course students will be able to:

- understand the concept of calculation errors and its accumulation in approximate solutions.
- apply iterative methods to solve non-linear equations, having understood the concept of convergence of these methods.
- learn to apply direct or iterative methods for the solution of linear systems of equations and perceive the importance of these methods in engineering science applications.
- understand how derivatives are approximated and he/she will know how to calculate numerically integrals.
- comprehend the concept of numerical solution of differential equations.

Having acquired this knowledge base, the student will be able to use effectively and modify numerical problem-solving algorithms implemented in a popular programming environment such as Matlab).

Part 1 "Introduction to Numerical Analysis, Errors and Approximation"

The definition and significance of numerical analysis. Problems with errors in approximations. Implementation of numerical methods on the computer.
Approximations and Errors.

Part 2 "Approximate Roots of Non Linear Equations"

Bisection Method, Regula Falsi.
General iterative method, Newton's method and is variants.

Part 3 "Numerical Linear Algebra"
Direct methods for solving linear systems. Methods Gauss, LU.
Iterative methods of solving linear systems. Methods Jacobi, Gauss-Seidel.

Part 4 "Approximation of functions"

Interpolating and approximating functions and data. Lagrange and Newton Interpolation.
Least squares methods.

Part 5 "Numerical Differentiation and Integration"

Approximate derivatives.
Integral approximation. Trapezoidal method
Simpson's and 3/8 rule. Composite integrations.

Part 6 "Numerical solution of differential equations"

Numerical solution of differential equations, Euler's method.
Improved Euler method, Runge Kutta methods