Numerical Analysis

- **Course number and name:**
  CC 413 – Numerical Analysis

- **Credits and contact hours**
  Credits Hours: 3Hrs
  Contact Hours: In Lecture 2Hrs, In Tutorial 2Hrs.

- **Instructor's or course coordinator's name**
  Coordinator Name: Prof. Dr. Abdel Monem Wahdan

- **Text book, title, author, and year**
  - Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers with Software and Programming Applications", 4th Edition, McGraw Hill, 2002.

- **Specific course information**
  - **a. Catalog description**
    Introduction to numerical methods - Applications of numerical methods - Convergence - Error analysis of numerical methods - Bisection method - False Position method – secant method - Successive Approximation method - Newton Raphson method - Berge Vieta method - Ill-conditioning – Instability - Gauss elimination - Gauss Jordan methods – Jacobi - Gauss Siedel – Integration – Trapezoidal – Simpson.
  - **b. prerequisites or co-requisites**
    Prerequisites: CC112- BA224
  - **c. Type of the course (required, elective, or selected elective course) in the program**
    Required Course

- **Specific goals for the course**
  - **a. Specific outcomes of instruction**
    After the completion of this course the students will be able to:

	Course Learning Outcomes	SO
1	Master approximation techniques used in numerical solutions that arise in science and engineering problems	A,J
2	Understand numerical methods and errors of computers, error propagation.	A,D
3	Use numerical methods to find roots of equations of one variable linear equations, Eigen values and Eigen vectors, numerical differentiation, integration, interpolation, least square error, and regression.	A,D

Topics to be covered

- Bisection method, False Position method, and secant method
- Successive Approximation method, and modified Successive Approximation method
- Newton Raphson method and nearly equal roots
- Berge Vieta method
- Error Analysis and Propagation: Types and sources of errors and ill-conditioning and instability
- Error Analysis and Propagation: Process graphs, error propagation with examples
- Gauss elimination and Gauss Jordan methods
- Gauss Jordan method for Integral matrices
- Jacobi, Gauss Siedel, and conditions of convergence
- Matrix Inversion using Direct methods for solution of linear equations. Eigen values
- Numerical Interpolation (Linear, Quadratic, and Lagrange polynomials)
- Numerical Differentiation and Integration (Mid-point integration)
- Numerical Integration (Trapezoidal, Simpson, and Gaussian integration)
- Linear and Quadratic regression
- Lagrange regression