CC 413- Numerical Analysis

Hour: Lecture: 2 Hrs. Tutorial: 2 Hrs. Credit: 3.
Coordinator: Abdelmonem Wahdan

Text Book:

- Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers with Software and Programming Applications", McGraw Hill, latest edition.

Specific course information

a. Introduction to numerical methods and their applications - solve science and engineering problems – convergence - error analysis of numerical methods.
b. Prerequisite: CC 112 - BA224
c. Designation: Required

Specific goals for the course:

- An ability to apply knowledge of mathematics, science, and engineering.
- An ability to function on multi-disciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.

Course instruction outcomes:

- The students will be able to master the approximation techniques used in numerical solutions that arise in science and engineering problems.
- The students will be able to understand why numerical methods work, what type of errors to expect and when an application might lead to difficulties.

Student outcomes:

A, D, E, G, H

Topics Covered:

- Solution of equations of one variable: Bisection method, False Position method, and secant method.
- Solution of equations of one variable: Successive Approximation method, and modified Successive Approximation method.
- Solution of equations of one variable: Newton Raphson method and nearly equal roots.
- Solution of equations of one variable: Berge Vieta method (of roots of polynomials).

- Error Analysis and Propagation: Types and sources of errors and ill-conditioning and instability.
- Error Analysis and Propagation: Process graphs, error propagation with examples.
- Solutions of linear equations: (Direct Methods) Gauss elimination and Gauss Jordan methods.
- Solutions of linear equations: (Direct Methods) Gauss Jordan method for Integral matrices.
- Solutions of linear equations: (Indirect Methods) 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 and revision.

Course / credit hours	Math & Basic Sciences	Engineering Topics	General Education
Numerical Analysis /3		3	