Course Code	EM 203
Course Title	Numerical Methods in Chemical and Process Engineering
No. of Credits	3
Pre-requisites	None
Compulsory/Optional	Compulsory for Chemical and Process Engineering

Aim(s): To provide the students with theoretical knowledge and practical experience of numerical methods so that they will be able to apply them in chemical and process engineering.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

- Use modern computational and mathematical techniques in chemical and process engineering
- Acquire the knowledge understanding and skills required for the use of pertinent software and appropriate programming language
- Solve set of linear and nonlinear algebraic equations, ordinary differential equations, and differential-algebraic (DAE) systems in Chemical and Process Engineering
- Solve partial differential equations obtained from transport phenomena in Chemical and Process engineering

Time Allocation (Hours): Lectures 32 Tutorials Practical Assignments 26

Course content/Course description:

- **Introduction to computing software**
- **Introduction to numerical methods**: Error analysis
- **Numerical solutions to systems of linear equations**: Gaussian elimination,
  Iterative methods,
  Relaxation methods
- **Numerical solutions to non-linear equations**:
  Fixed point iteration,
  Newton-Raphson method,
  System of non-linear equations

- **Numerical calculus**:
  Differentiation,
  Interpolation method,
  Finite difference integration,
  Newton-Cotes methods,
  Gaussian integration methods

- **Numerical solutions to ordinary differential equations**:
  Initial value problems: Euler method, Runge-Kutta methods,
  Boundary value problems: Finite difference Method, Solving system of ordinary differential equations and higher order differential equations,
  Adaptive step size mechanisms

- **Numerical solutions to partial differential equations**:
  Explicit and implicit finite difference methods;
  Basics of finite element methods

Recommended Texts :

- C. Chapra and R.P.Canale, (2000). *Numerical Methods for Engineers*, 5th edition, McGraw-Hill.

Assessment	**Percentage Mark**
In-course	
Assignments/Projects	40
Mid Semester Examination	20
End-semester	40