

Learning Goals for CHEN 5740 – Mathematical Methods in Chemical Engineering

1. General Considerations

- Ability to employ microscopic and macroscopic balances to derive governing differential equations for physical processes
- Ability to specify initial and boundary conditions
- Ability to identify appropriate analytical and numerical approaches to solving algebraic and differential equations
- Familiarity with appropriate software tools for algebraic and differential equations

2. Algebraic Equations

- Ability to pose and solve systems of linear equations
- Working knowledge of matrices and eigenvalues
- Understanding of iterative methods for solving nonlinear algebraic systems
- Skills in numerical techniques for matrices and algebraic equations

3. Ordinary Differential Equations (ODEs)

- Ability to determine analytical solutions for linear ODEs, systems of linear ODEs, and special types of nonlinear ODEs
- Understanding of series solutions and special functions, including Bessel functions and Legendre polynomials
- Knowledge of integral transform techniques, including Laplace and Fourier transforms
- Skills in numerical methods for linear and non-linear ODEs, including initial value problems and boundary value problems

4. Partial Differential Equations (PDEs)

- Knowledge and use of the method of characteristics for solving 1st-order PDEs
- Ability to apply separation of variables to solve 2nd-order PDEs in finite domains
- Understanding and use of similarity solutions to solve 2nd-order PDEs in semi-infinite domains
- Skills in use of numerical methods for solving PDEs

Catalog Description

Presents applied analytical and numerical mathematical methods in the context of chemical engineering problems. Topics include modeling techniques, algebraic equations, and ordinary and partial differential equations. Prereq., senior or graduate standing; working knowledge of computing, calculus, differential equations, linear algebra, vector operations, undergraduate physics, undergraduate fluid mechanics, undergraduate heat transfer and undergraduate reaction engineering.