BAS 212 – Partial Differential Equations and Numerical analysis

(Fall 2025)

Course overview

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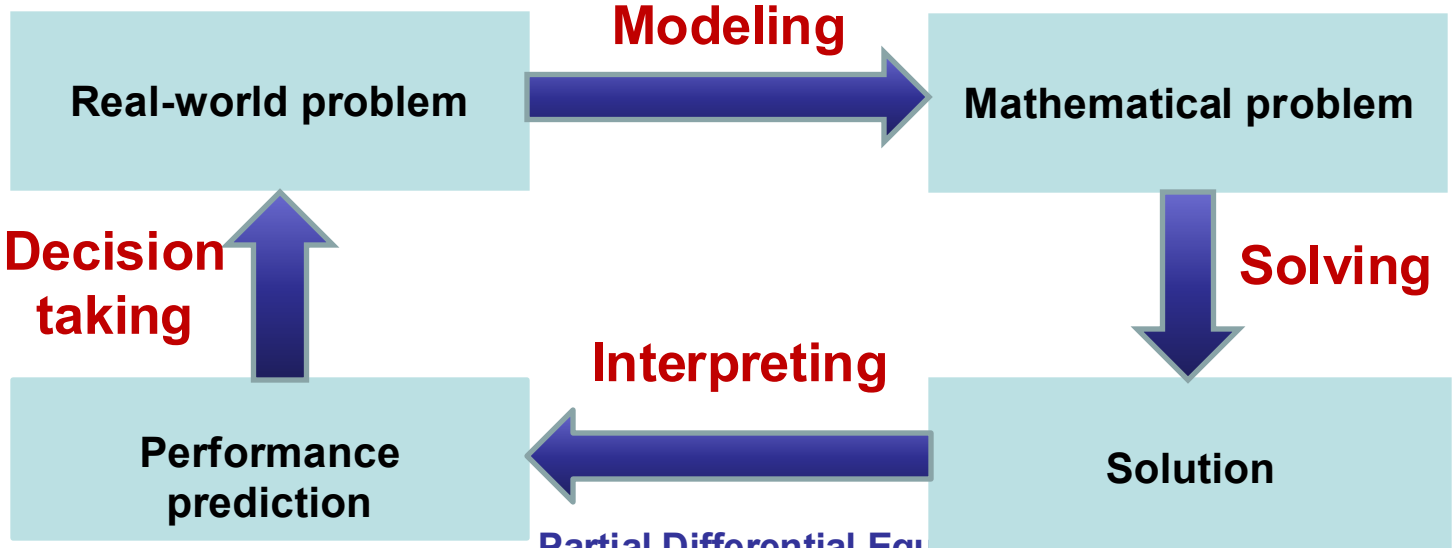
What are we going to study?

Numerical Analysis

- An approach of mathematics that designs and analyzes **algorithms** for obtaining approximate numerical solutions to mathematical problems.
- It focuses on **approximation** rather than exact answers.
- Examples: solving equations, integrals, differential equations, optimization problems, and simulations.



What are we going to study? (cont'd)

MATLAB

- A high-level mathematical package that have **computational**, **visualization** and **programming** capabilities
- A MATLAB **toolbox** provides collection of functions devoted to a specific mathematical area or a specific application
  - **PDE** toolbox
  - **Optimization** toolbox
  - **Communications** toolbox
  - **Statistics** and **machine learning** toolbox
  - ...

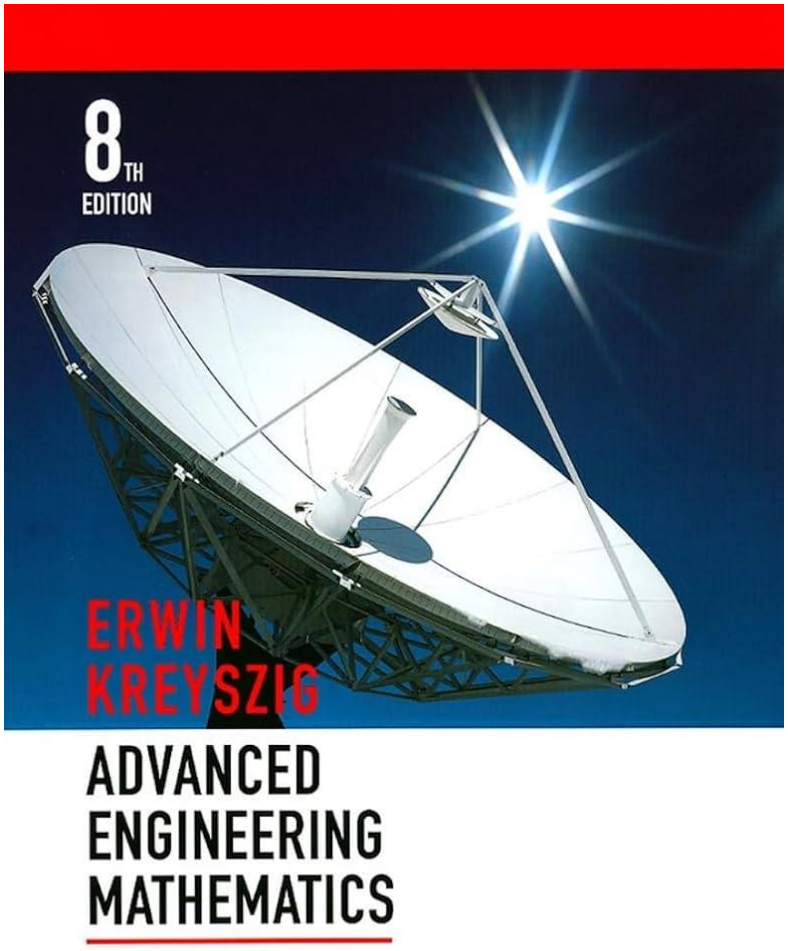
Text Books

- **Main text book**

  Erwin Kreyszig, **Advanced Engineering Mathematics**, 8th edition.

- **Additional reference**

  – J. D. Faires and R. L. Burden, **Numerical Analysis**, 9th edition, Brooks / Cole, Cengage Learning, 2011.



Course content – Numerical methods

- Method of solving Equations on one variable.
- System of Linear Equations
- Interpolation
- Curve Fitting
- Numerical Differentiation/Integration
- Ordinary Differential Equations

Course content – Numerical methods

Weak	Description
1	**Method of solving Equations on one variable.** 1.Bisection method, 2.Fixed point iteration method, 3.Newton's method.
2	**Solution of linear system of equations** 1.Jacobi Method 2.Gauss-Seidel, 3.Successive over relaxation method (SOR),
3	**Polynomial Interpolation methods** 1.Lagrange Interpolation, 2.Newton Interpolation, 3.Divided differences, 4.Cubic spline interpolations, 5.error analysis.

Course content – Numerical methods

Weak	Description
4	**Curve Fitting**
5	**Numerical Differentiation and Integration**
6	**Ordineray Differential Equation** 1.Taylor's Methods 2.Euler's Method, 3.Runge-Kutta Method.

Grading (2-credit hour course)

- Mid-term exam 25%
- Semester work 25%
- Final exam 50%

Office hours

- **Time**
  - Tuesday 09:00 AM -10:30 AM &

    12:30 PM - 02:00 PM
  - **Office**
    - New Building – F6 – Math Staff Room
- **Contact me**
  - Send an email to : Ayman.fayez@feng.bu.edu.eg

Any questions?

(before we start)