AMSI Summer School 2025 - Numerical Solutions of Partial Differential Equations with Applications in Industry

Pre-enrolment Quiz

1. What is the primary purpose of numerical methods in solving partial differential equations (PDEs)?
    a. To obtain exact analytical solutions.
    b. To approximate numerical solutions and to visualize the dynamics governed by the mathematical model.
    c. To visualize PDEs graphically.
2. Which type of PDE describes steady-state phenomena (e.g., uniform temperature distribution in a metal plate)?
    a. Elliptic
    b. Parabolic
    c. Hyperbolic
3. What is the primary advantage of the Finite Element Method (FEM) over the Finite Difference Method (FDM) for solving partial differential equations (PDEs)?
    a. FEM provides exact solutions for all types of PDEs, unlike FDM.
    b. FEM handles irregular geometries less effectively than FDM.
    c. FEM allows for adaptive mesh refinement, leading to more efficient and accurate solutions.
4. Which of the following best describes stability in numerical solvers for differential equations?
    a. The ability of the solver to find the exact solution to the differential equation.
    b. The ability of the solver to find a solution that remains bounded over time.
    c. The ability of the solver to find a solution that oscillates between positive and negative values.
    d. The ability of the solver to find a solution that grows unbounded over time.
5. Why linear algebra knowledge is required for the numerical methods of PDEs?
    a. To make approximations.
    b. To find rank.
    c. To solve systems of equations resulting from discretization.
6. How do smart algorithms improve the accuracy of solutions for PDEs with mixed boundary conditions?
    a. By adapting the mesh or time step size to resolve complex regions accurately.
    b. By providing exact solutions for all types of PDEs.
    c. By increasing the number of iterations in the solver.
    d. By reducing the complexity of the PDE.

Correct answers

1. B
2. A
3. C
4. B
5. C
6. A