

MAT6566

Numerical Partial Differential Equations

3 credit hours

Prerequisites: MAT5465 or the equivalent

Catalog Description: This course covers numerical methods for partial differential equations. Various approaches are discussed including the finite difference, finite volume, finite element, and spectral methods. Important concepts such as stability, convergence, and error analysis for these methods will also be studied.

Text: Computational Partial Differential Equations Using MATLAB, Li & Chen.

Rationale: While partial differential equations have a wide range of applications in science and engineering, the majority of PDEs do not have analytical solutions. It is, therefore, important to be able to obtain an accurate solution numerically. This course is designed to introduce not only the numerical techniques of solving PDEs but to also to analyze these methods. The goal is for the student to use the correct numerical techniques and to be able to use technology to assist in determining the solution.

Learning Objectives: Upon successful completion of this course, students will be able to demonstrate an understanding of numerical approaches to solving various kinds of partial differential equations.

Outline of Topics:

- Finite Difference Methods
 - Parabolic equations
 - Hyperbolic equations
 - Elliptic equations
 - Stability, consistency, convergence
 - Error analysis

- Finite Element Methods
 - Mesh generation
 - Existence and Uniqueness
 - Assembly of Boundary Conditions
 - Time-Domain

- Meshless Methods
 - Radial Basis Functions
 - Method of Fundamental Solutions
 - Kansa's Method
 - Method of Particular Solutions

Meetings: The format of class meetings will consist of lectures by the instructor. Student participation will be encouraged via classroom discussions as well as problem sessions where the student will present their work.

This class meets as scheduled. You are expected to be in class on time. University policy states that a student cannot miss more than 25% of class meetings and receive credit for the course. Further, attendance will be necessary in order to understand the material and make a good grade. The student is responsible for work and material missed when absent. Cheating in any way will be properly rewarded per University policy (See the undergraduate Bulletin: [Academic Honesty \(Policy 2.19\)](#)).

Assessment: There will be approximately three regularly scheduled exams worth 15% of your grade, daily quizzes at 20%, homework at 10%, and the final exam at 25%.

Grading Scale: A 90% - 100%, B+ 87% - 89%, B 80% - 86%, C+ 77% - 79%, C 70% - 79%, D 60% - 69%, F 0% - 59%.

Class participation and attendance will be used as deciding factors for the course grade in borderline cases.

MISSISSIPPI COLLEGE ACADEMIC POLICIES:

Students should consult the Mississippi College policy manual located at <http://www.mc.edu/resources/publications/policies/> for official information regarding:

- Class attendance - Policy 2.10
- Grading - Policy 2.15
- Cheating - Policy 2.19
- Counseling and Career Services - Policy 2.25
- Research - Policy 2.27
- Counseling and Testing Center - Policy 2.34

Students who may require accommodation due to a documented handicap should follow the procedures located at <http://www.mc.edu/about/offices/counseling/disabilities/>