MAT 5435
Introduction to Partial Differential Equations
3 credit hours

Prerequisites: MAT352

Catalog Description: This course covers the development of partial differential equations from special applications and concentrates on the derivation of methods. Parabolic, elliptic, hyperbolic linear equations, and separation of variables are discussed as well as further applications.

Text*: Partial Differential Equations for Scientists and Engineers, Farlow.

Rationale: This course is an introduction to the concepts leading to partial differential equations and describes several methods used to solve initial and boundary value problems for parabolic, elliptic, and hyperbolic linear partial differential equations. Major emphasis is placed on problem solving and mathematical modeling but rigorous mathematical proofs of some of the results are presented.

Partial differential equations have application to problems in all scientific areas and is especially important for those in engineering related fields. This course is designed to introduce not only the mathematical vocabulary of the subject but to also instruct the student in proper methods of solving partial differential equations and proper ways to apply these equations to standard problems. The goal is for the student to consistently solve problems using correct technique and to additionally know how to approach similar problems in applications.

Learning Objectives: Upon successful completion of this course, students will be able to:
- Formulate physical problems as PDEs using conservation laws
- Solve boundary value problems
- Solve partial differential equations using the method of separation of variables
- Solve the heat equation, wave equation, and the Laplace equation
- Find the Fourier series of a function
- Solve nonhomogeneous boundary value problems with the method of eigenfunction expansion

Outline of Topics:
- Diffusion-type Problems
    - Parabolic equations
    - Heat equation
    - Separation of Variables
    - Eigenfunction Expansions
    - Fourier Transform
- Hyperbolic-type Problems
    - Wave equation
    - D'Alembert Solution

- Method of Characteristics
- Dirichlet boundary condition
- Neumann boundary condition
- Robin boundary condition
- Elliptic-type Problems
  - Maximum Principle
  - Poisson equation
  - Laplace equation
  - Green's Functions

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 10%, homework at 10%, graduate research project 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.

Graduate students will be assigned more challenging problems in addition to the homework assigned to the class. Additionally, graduate students will complete a project based on material from the textbook that is not typically covered in class.

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/

Tutoring Hours:
Hours and location for the departmental tutoring center are posted at
http://www.mc.edu/academics/academic-tutoring/ .