

## Salisbury University Department of Mathematical Sciences

MATH 422/522 : Advanced Differential Equations  
Syllabus (Tentative)

**Description:** An advanced course from differential equations to include series solutions, matrix methods for linear systems, Laplace transformations and partial differential equations. An expansion of the first differential equations course to expand beyond solutions to common ordinary differential equations. Includes a strong focus on applying strategies to problems describing real-life situations and solving common differential equations from physics, including the heat equation, wave equation and Laplace equation given different initial conditions. 4 Hours Credit: Meets four hours per week.

**Prerequisites:** C or better in MATH 311.

**Intended Audience:** Majors in Mathematical or Physical Sciences and students in the Dual-Degree Engineering Program.

**Objective:** Discuss additional topics in differential equations beyond the scope of differential equations I

**Textbooks:** *Fundamentals of Differential Equations*, by R. Kent Nagle, Edward B. Staff, Arthur David Snider; Addison-Wesley, 8th Edition, 2012.

| Topic  | Weeks     |
|--|-----------|
| <b>Review of Differential Equations (Chapter 1-6)</b>  | 1         |
| Review of prerequisite DE techniques including solving first order ODEs, linear ODEs with constant coefficients, and higher order linear DEs |           |
| <b>Series Solutions</b>  | 3         |
| Taylor Series Approximations, Power series solutions, Method of Frobenius, etc.  |           |
| <b>Systems of Equations</b>  | 3.5       |
| Matrices and vectors, Eigenvalues and eigenvectors, homogeneous linear systems   |           |
| <b>Laplace Transforms</b>  | 2.5       |
| Definitions and properties, inverse Laplace transforms, solving using Laplace transforms, convolution of Laplace transforms.                 |           |
| <b>Partial Differential Equations</b>  | 3         |
| Using Fourier sine and cosine series to solve standard boundary value problems for the heat equation, wave equation, and Laplace equation.   |           |
| <b>Testing and Review</b>  | 1         |
| <b>Total</b>   | <b>14</b> |

#### Evaluation

|                             |          |
|-----------------------------|----------|
| Homework, Lab work, quizzes | 20 – 40% |
| In-class examinations       | 40 – 60% |
| Comprehensive Final Exam    | 20 – 40% |

- Graduate students will be assigned special homework/test problems or projects.
- Clear descriptions of thought processes, evidence of critical thinking, and effective communication must be demonstrated in written work.
- **Writing Across the Curriculum:** Students will be expected to communicate mathematics and mathematical ideas effectively in speech and writing. At the University Writing Center, trained consultants are ready to help you at any stage of the writing process. In addition to the important writing instruction that occurs in the classroom and during professors' office hours, the Center offers another site for learning about writing. **All students are encouraged to make use of these important services.**

- **NOTE:** Once a student has received credit, including transfer credit, for a course, credit may not be received for any course with material that is equivalent to it or is a prerequisite for it.