

University of Arkansas – Fort Smith
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General Syllabus

PHYS 32063 Math Methods in Science I

Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Prerequisite: PHYS 20403 University Physics II

Effective: 2018~2019

I. Course Information

A. Catalog Description

Infinite series and complex numbers, vector analysis, coordinate systems, matrices and determinants, and complex analysis will be used as problem solving tools.

B. Additional Information

This course is designed to introduce a broad range of mathematical techniques that are used to solve scientific problems. This course cannot achieve the depth of individual math courses on each subject and will not spend time on detailed proofs. The purpose is to give the student some experience with a variety of important mathematical techniques. We will emphasize on how the techniques can be used to solve various problems in the sciences.

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Apply infinite series and power series to model and solve actual physical problems.
2. Apply complex numbers to simplify problems in mechanics, optics, fluid flow and electrical circuits.
3. Model and solve various physical problems using linear equations, vectors, matrices and determinants.
4. Apply the gradient of scalar fields, the Laplacian of scalar and vector fields, and the divergence and curl of vector fields in rectangular, cylindrical, and spherical coordinates.
5. Apply time derivatives of position in rectangular, cylindrical, and spherical coordinates
6. Assess and apply Gauss's Theorem, Stoke's Theorem, and Green's Theorem

7. Represent rotations and reflections as the operation of matrices (tensors) on vectors
8. Solve simple ordinary differential equations, especially first and second order inhomogeneous linear differential equations
9. Determine the eigenvalues and eigenvectors of matrices
10. Solve systems of first-order differential equations, including non-homogenous systems
11. Apply orthogonal functions and calculate Fourier series and integrals
12. Analyze the use of series of orthogonal functions to solve boundary value problems in three dimensions

B. University Learning Outcomes

Completion of this course will enhance the students ability in the following areas:

Analytical Skills

Critical Thinking Skills: Students will identify a problem or issue and will research, evaluate, and compare information from varying sources in order to evaluate authority, accuracy, recency, and bias relevant to the problems/issues. The student will generate solutions/analysis of problems/issues evaluated and will assess and justify the solutions and/or analysis.

Communication Skills (written and oral)

Students will communicate proficiently. The student will compose coherent documents appropriate to the intended audience and effectively communicate orally in a public setting.

Ethical Decision Making

Students will model ethical decision-making processes. The students will identify ethical dilemmas and affected parties and will apply ethical frameworks to resolve a variety of ethical dilemmas.

Global & Cultural Perspectives

Students will reflect upon cultural differences and their implications for interacting with people from cultures other than their own. The students will demonstrate understanding or application of their discipline in a global environment and will demonstrate how their discipline impacts or is impacted by different cultures.

III. Major Course Topics

- A. Infinite Series, Power Series
- B. Complex Numbers
- C. Linear Algebra
- D. Partial Differentiation
- E. Multiple Integrals
- F. Vector Analysis
- G. Fourier Series and Transforms
- H. Ordinary Differential Equations