Master Syllabus Department of Physics and Astronomy



PHYC 572 Introductory Mathematical Physics 2

Course Description

Techniques in the formulation and solution of physical problems. Computer algebra system (e.g. Mathematica) may be introduced for the study of topics such as boundary value problems, transforms, integral equations, and special functions of mathematical physics. (3 credit hours)

Prerequisite: PHYC 370, or permission of department chairperson.

Course Objective

To impart to the physics student:

An appreciation of the overall unity of the underlying mathematical methods in classical and modern physics.

Familiarity with frequently encountered mathematical methods, equations, functions, and solutions occurring in advanced physics courses.

Skill in the techniques of problem formulation and solution in mathematical physics.

Course Rationale

To familiarize the student with mathematical physics as a method for solving a great variety of problems in the physical sciences.

To illustrate the mathematical techniques with examples from theory and experiments in physics.

By providing an emphasis on practice in problem solving, the students will develop the experience and confidence to be able to apply the mathematical problem-solving techniques in a variety of applications.

Course Content, Format, and Bibliography

Content

Differential Equations

Partial differential equations

First-order differential equations

Nonhomogeneous equations – Green's function

Boundary Value Problems, Sturm-Liouville Theory

Self-adjoint differential equations

Hermitian (self-adjoint) operators

Master Syllabus: PHYC 572

Gram-Schmidt orthogonalizations

Completeness of eigenfunctions

Special Functions in Mathematical Physics

Gamma function (factorial function)

Bessel functions

Legendre functions

Fourier series

Transforms

Integral transforms--introduction

Fourier transforms

Convolution theorem

Laplace transforms

Inverse Laplace transforms

Other transforms sometimes confronted

Integral Equations

Integral transforms, generating functions

Neumann series, separable (degenerate kernels)

Green's functions

Format

Lectures and problem solving.

This course is taught as a dual undergraduate/graduate course. Students will be required to complete activities appropriate for the level of the course in which they are enrolled. Student performance on homework, quiz, and exams will be evaluated using different standards for undergraduate and graduate students.

Extra assignments for graduate level counterpart of taught/with course:

Graduate students in taught/with course will be assigned one or more of the following, at the instructor's discretion, commensurate with the higher requirements of the graduate component as compared with the undergraduate component:

Extra problem assignments

Course term paper

Individual experimental project

Extra or different examination requirements

Oral examination

Class lecture on assigned topic

Assigned readings/report on the literature

Bibliography

Arfken, Mathematical Methods for Physicists, 6th Ed., Academic Press, ISBN 0-12-059876-0