

**Title of the course:**

Mathematical Physics, PHYS 5325 001

**Course Duration:**

Aug 26, 2024 - Dec 05, 2024

**CRN: 18054**

**Schedule:** 12.30pm-1.50pm TR Classroom Building C203

**Text material:**

Class notes

The "official" text book for this course is *Mathematical Methods for Physicists, Seventh Edition: A Comprehensive Guide* by Arfken, Weber, and Harris. This book is a standard textbook used at several universities for the graduate mathematical methods for physical sciences courses.

**Recommended reference books:**

- *Mathematics of Classical and Quantum Physics*, Byron and Fuller, (Dover 1990).
- *R. V. Churchill, Fourier Series and Boundary value problems*, McGraw Hill
- *Mathematical Methods in the Physical Sciences* by Mary L. Boas.

**Prerequisites:**

Basic knowledge of linear algebra, vector calculus, complex numbers (not analysis), etc. that you must have come across during undergraduate studies. These topics will be reviewed at the start of the course. Pl. talk to me if you have concerns.

**Material:**

Chapters: 1, 2, 3, 5, 6, 8, 11, 19, and 20. Given the limited time and the broad range of topics available, we will be selective in details and topics. The syllabus is as follows:

## 1. Mathematical Preliminaries:

Series, Binomial theorem, Taylor expansion, Vectors, Complex numbers and functions, Derivatives and Extrema, Evaluation of Integrals, Dirac Delta functions

## 2. Determinant and Matrices: Matrix Algebra

## 3. Vector analysis:

Review of Basic properties, Vectors in 3D space, Coordinate transformations, Differential Vector Operators, Vector Integration, Potential Theory, Integral transform

## 4. Vector spaces:

Vectors in Function Spaces, Gram-Schmidt Orthogonalization, Operators, Self-Adjoint Operators, Unitary Operators

## 5. Eigenvalue Problems:

Eigenvalue equation, Matrix Eigenvalue Problems, Hermitian Matrix Diagonalization, Normal Matrices

## 6. Sturm-Liouville Theory:

Introduction, Hermitian Operators, ODE Eigenvalue problems

## 7. Complex Variable Theory:

Complex Variables, Complex functions, Cauchy-Rieman theorem, Cauchy's integral formula

## 8. Fourier Series:

General Properties, Application of Fourier Series

## 9. Integral Transforms:

Fourier Transform, Laplace Transform, Properties of Fourier and

Laplace transforms  
10. Special functions: Legendre or Bessel, or Calculus of Variation

No food in the class. Also, cell phones **must be turned off** or kept in the bag when in the classroom.

**Instructor:**

Dr. Rajendra Zope  
office: 116  
email: rzope@utep.edu  
phone: 915-747-8742

**Office Hours:**

By appointment (send email or ask in class) (open door policy).

**Grading:**

Quizzes/assigned problems [30%]  
Two midterm exams [30%]  
Final exam [40%]

The percentage (weight) for midterm and final is within 10%.

Midterms schedule (tentative): Last Tuesday of Sept, Oct, and November.

**Additional guidelines for Fall 2022**

**TECHNOLOGY REQUIREMENTS**

Course content is delivered via the Internet through the Blackboard learning management system.

Ensure your UTEP e-mail account is working and that you have access to the Web and a stable web browser. Google Chrome and Mozilla Firefox are the best browsers for Blackboard; other browsers may cause complications. When having technical difficulties, update your browser, clear your cache, or try switching to another browser.

**IMPORTANT:** If you encounter technical difficulties beyond your scope of troubleshooting, please contact the UTEP Help Desk as they are trained specifically in assisting with the technological needs of students. Please do not contact me for this type of assistance. The Help Desk is much better equipped than I am to assist you!

Course Communication: How we will stay in contact with each other

- Office Hours: • Email: UTEP e-mail is the best way to contact me. I will make every attempt to respond to your email within 24-48 hours of receipt. When e-mailing me, be sure to email from your UTEP student account, and please put the course number in the subject line. In the body of your email, clearly state your question. At the end of your email, be sure to put your first and last name and your university identification number.
- Discussion Board: If you have a question that you believe other students may also have, please post it in the Help Board of the discussion boards inside of Blackboard. Please respond to other students' questions if you have a helpful response.

- Announcements: Check the Blackboard announcements frequently for any updates, deadlines, or other important messages.

#### ATTENDANCE AND PARTICIPATION:

Attendance is strongly encouraged but not mandatory. Your participation in the course is important not only for your learning and success but also to create a community of learners. Participation is determined by the completion of the following activities:

- o Reading/viewing all course materials to ensure understanding of assignment requirements
- o Participation in classroom discussion
- o Other activities as indicated in the weekly modules

Because these activities are designed to contribute to your learning each week, they cannot be made up after their due date has passed.

Deadlines, Late Work: You are required to submit homework and other assignments in a timely manner, but if you need more time, you can ask me.

#### MAKE-UP Work

Make-up work will be given only in the case of a documented emergency. Note that make-up work may be in a different format than the original work, may require more intensive