Title of the course:

Mathematical Physics - PHYS 5325 001

Course Duration:

Fall 2023

CRN: 10424

Schedule: 12.30pm-1.50pm TR Classroom Building C302

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 method for physical sciences courses.

Objective: This course will introduce students to mathematical methods and techniques necessary to to solve problems in physics problems in physics to build a strong understanding of classical mechanics, quantum mechanics, statistical physics, and electrodynamics.

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: (Review)
   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
09. 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:
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Office Hours:
By appointment (send email or ask in class) (open door policy).
Grading: (tentative)
Quizzes/assigned problems/Classwork [30%]
Two midterm exams [30%]
Final exam [40%]

EXCUSED ABSENCES AND/OR COURSE DROP POLICY
According to UTEP Curriculum and Classroom Policies, "When, in the judgment of the instructor, a student has been absent to such a degree as to impair his or her status relative to credit for the course, the instructor may drop the student from the class with a grade of "W" before the course drop deadline and with a grade of "F" after the course drop deadline." See academic regulations in the UTEP Undergraduate Catalog for a list of excuse absences. Therefore, if I find that, due to non-performance in the course, you are at risk of failing, I will drop you from the course. I will provide 24-hour advance notice via email.
OR
I will not drop you from the course. However, if you feel that you are unable to complete the course successfully, please let me know and then contact the Registrar's Office to initiate the drop process. If you do not, you are at risk of receiving an "F" for the course.

DEADLINES, LATE WORK, AND ABSENCE POLICY
All assigned work needs to be turned in even if it is past the deadline. If you need more time, contact me. Attendance and classroom participation is highly encouraged but not required. However, you are responsible for the classes you miss.