Title of the course:

Mathematical Physics - PHYS 5325 001

Course Duration:

Aug 27, 2018 - Dec 06, 2018

CRN: 11181

Schedule: 12.00 -1.20pm TR Worrell Hall 205

Text material:

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.

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.

Course drop date deadline is November 2

Instructor:
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Office Hours:
W 11.00PM-.12.15 PM or by appointment (send email or ask in class).
Grading: (tentative)
Quizzes/assigned problems [30%]
Two midterm exams [30%]
Final exam [40%]