Mathematical Physics
Syllabus, Spring 2019
Frank A. Moscatelli
Physics NYU

General Description

The course introduces important topics and methods in mathematics that are relevant to physics and engineering. Emphasis is on the use of the methods rather than on proofs and derivations. The assumed prior knowledge is three semesters of calculus or intensive calculus and at least one year of physics.

Instructor

Prof. Frank Moscatelli
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Office Hours: Monday, Tuesday 2:00 onward. Appointments please.
Office: 726 Broadway room 838

Teaching Assistant

Nanoom Lee
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Office Hours: TBA
Office 726 B'way, RM 1043

Meeting Times & Places

Lectures:	Tuesday Thursday 12:30 – 1:45	726 B'way, 1067
Recitation:	Tuesday 2:00 – 3:15	726 B'way, 802
Recitation:	Thursday 5:00 – 6:15	726 B'way, 802

Texts

The required text is:
B. Kusse and E. Westwig, *Mathematical Physics*, 2006 (2nd ed), John Wiley & Sons

Other useful texts include:
George Arfken, *Mathematical Methods for Physics*
Mary Boas, *Mathematical Methods in the Physical Sciences*, 3rd Edition

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Weekly Problem Sets

Problem sets will be assigned about once a week and posted on NYU Classes. They are due Friday at 5:00PM in the Physics office, Rm 1005. There will be a box marked Math Phys.

Exams

There will be two midterm exams and a final exam. The midterms will be announced well in advance. The final is scheduled by the Registrar.

Grading

Mid-term exam 1: 20%
Mid-term exam 2: 20%
Final exam: 30%
Homework: 30%

Topics

Vector Calculus, Tensors [Chapters 1 - 4]
- Summation Convention: Scalar, Vector Products, Determinants
- Gradient, Divergence, Curl, Gauss and Stokes Theorems
- Laplacian, Potential and Rotational Fields, Helmholtz Theorem
- Non-Cartesian Coordinate Systems, Introduction to Tensors, Eigenvalues, Eigenvectors

Dirac Delta and Complex Analysis [Chapters 5 - 6]
- Dirac Delta Function: singular distributions
- Complex Analysis: Analytic Functions, Derivatives, Cauchy Theorem
- Complex Analysis: Laurent Series, Residues, Residue Theorem, Contour Integrals

Differential Equations [Chapters 10 - 11]
- Ordinary Differential Equations: First Order, Second Order
- Frobenius Method, Legendre Polynomials, Fuch's Theorem, Bessel Functions
- Partial Differential Equations: Laplace, Diffusion and Wave Equations
- Special functions
- Separation of Variables in Cartesian, Cylindrical and Spherical Coordinates.