

Syllabus for Intro to Applied Mathematics/Mathematical Methods

Topics 1 to 7 in first semester and 8 to 13 in second semester

1. Infinite series and power series
2. Complex Numbers
 - a. basics, infinite and power series
 - b. trig functions
 - c. Euler formula
3. Rudiments of linear algebra
 - a. linear equations
 - b. row reduction
 - c. matrix operations
 - d. eigenvalues, eigenvectors, and diagonalization
4. Partial Derivatives
 - a. total differential
 - b. Taylor and Power Series in several variables
 - c. Chain Rule
 - d. Lagrange Multipliers
5. Multiple Integration and Vector Analysis
 - a. multiple integrals
 - b. the Jacobian and change of variables
 - c. inner, cross, and triple products
 - d. gradient and line integrals
 - e. Green's theorem, the divergence theorem, and Stokes theorem
6. Fourier Series and Transforms
7. Ordinary Differential Equations I (Constant coefficient differential equations and the Laplace transform)
8. Variational Calculus (Euler equation, Lagrange's Equation, and some example problems)
9. Assorted Special Functions
 - a. Gamma, Beta, and Error Functions
 - b. Asymptotic Series and Stirling's Formula
10. Ordinary Differential Equations II
 - a. Series solution of differential equations
 - b. Orthogonal functions, Legendre polynomials, Bessel functions
 - c. Other classes of orthogonal functions and their ODEs
11. Partial Differential Equations
 - a. Basic types of PDEs
 - b. model problems (heat flow, vibrating string, steady state temperature)
12. Complex Function Theory
 - a. contour integrals and Cauchy's theorem
 - b. Laurent series and the residue calculus
 - c. conformal maps
13. Probability and Statistics
 - a. sample spaces and random variables
 - b. discrete and continuous distributions
 - c. the binomial, the Gaussian, and the Poisson distribution
 - d. sampling and confidence intervals