92.531 Applied Mathematics II Dr. Charles Byrne

Course Overview

Instructor: Charles Byrne, 428W Olney, x2447

Overview: We shall consider vector analysis, multiple, line and surface integrals with application to electromagnetism,, complex analysis, calculus of variations, special functions, and Sturm-Liouville differential equations and generalized orthogonality.

Intended audience: This is a beginning graduate course in the Applied Mathematics masters program, but is not intended only for students in that program. The course will assume a good knowledge of multi-variable calculus. It is not necessary to have taken 92.530 Applied Mathematics I.

Class format: There will be one three-hour lecture per week. Lecture material will be taken from the required text and the supplementary readings described below. Class attendance is probably helpful, but not required. Grades will be based on homework exercises and class participation. Homework will be collected and graded every two weeks during the semester. Homework problems and due dates are to be found on a separate pdf file.

PLEASE NOTE: Submitted homework must be in the form of pieces of paper, stapled together. I cannot accept notebooks or binders. I have to be able to carry the homework to my office and to my home.

Required text: The required text is:

M. Spiegel, *Advanced Mathematics for Engineers and Scientists*, Schaum's Outlines (ISBN: 978-0-07-163540-0).

Course Outline: The material for the course consists of six chapters from the required text, along with supplementary readings, the December 17, 2013 version of "Selected Topics in Applied Mathematics" , available under ALL COURSES on my website: http://faculty.uml.edu/cbyrne/cbyrne.html .

- **Lectures 1-3:** Chapter Five ("Vector Analysis"); supplementary notes "A Brief History of Electromagnetism" , "Div, Grad, Curl" , and "Kepler's Laws of Planetary Motion".
- **Lectures 4-5:** Chapter Six ("Multiple, Line and Surface Integrals and Integral Theorems"); supplementary notes "Green's Theorem and Related Topics", first five sections .

- **Lectures 6-7** Chapter Thirteen ("Complex Variables and Conformal Mapping"); supplementary notes "Green's Theorem and Related Topics", sixth section.

- **Lectures 8-9** Chapter Sixteen ("Calculus of Variations"); supplementary notes "Calculus of Variations".

- **Lectures 10-13** Chapters Nine ("Gamma, Beta, and Other Special Functions"), Ten ("Bessel Functions"), and Eleven ("Legendre Functions and Other Orthogonal Functions"); supplementary notes "Sturm-Liouville Problems" ; "Bessel's Equations "; "Legendre's Equations" ; and "Hermite's Equation and Quantum Mechanics" .

Recommended texts:

G. Simmons, *Differential Equations with Applications and Historical Notes*, McGraw-Hill, 1972. Probably the best of its kind; there is an expensive new addition with a second author, but no paperback.

H. Wilf, *Mathematics for the Physical Sciences*, Dover paperback, 1962. A nice treatment of matrices, orthogonal functions, roots of polynomials, asymptotic expansions and conformal mappings, it is out-of-print, unfortunately.

E. Zachmanoglou and D. Thoe, *Introduction to Partial Differential Equations with Applications*, Dover paperback, 1986. One of the best and most accessible treatments of pde's.

S. Twomey, *Introduction to the Mathematics of Inversion in Remote Sensing and Indirect Measurements*, Dover paperback, 1996. The original (1973) edition is one of the standard references in the field.

T. Körner, *Fourier Analysis*, Cambridge University Press, 1988 (paperback). This is not a text, but a beautiful compendium of 110 little chapters on practically everything remotely related to Fourier analysis.