Department: Civil Engineering  
Number: CE 6303  
Title: Engineering Analysis I

Catalog Description: Series solutions of differential equations, Fourier series and Fourier Integrals, Bessel’s equations and Bessel functions, Lagrange’s equations and Lagrange’s polynomial, Sturm-Liouville problem and eigenfunction expansions, Formulation and solution of initial and boundary value problems arising in civil engineering.

Prerequisites: Permission of instructor

Textbook:  
- *Numerical Methods for Engineers, 1996*  
  by B. M. Ayyub and R. H. McCuen, Prentice-Hall (AM)

- *Advanced Engineering Mathematics, 2002*  
  by A. Jeffrey, Harcourt/Academic Press (AJ)

Course Objectives: This course is designed to prepare students with basic mathematical and numerical skills that are critical in their future research. After completing the course, the student should be familiar with analytical and numerical methods in matrix algebra, system of equations, differentiation and integration, differential equations, data description and treatment. Students will develop basic knowledge in vector and matrix algebra, eigenvalues and eigenvectors, Bessel's Equations and Bessel Functions, Lagrange's equations and Lagrange's polynomials, Sturm-Liouville problems, Fourier Series and Fourier Integrals, and Green's theorem problem. Formulation and solution of initial and boundary value problems arising in civil engineering will also be discussed.

Specifically student will develop the following skills (the CE program outcomes addressed by each objective are given in parentheses):

Student will be able to apply advanced concepts of mathematics, science & engineering to solve engineering problems. (1)  
Student will be able to apply the learned skills to design a system, component, or process to meet desired needs. (2)  
Students will learn the various aspects of numerical analysis and be able to conduct independent work/research (4)
Topics covered:

1. Review of basic mathematics  (AJ: Chapter 1; AM: Chapter 1)
2. Vector and vector space    (AJ: Chapter 2; AM: Chapter 2)
3. Matrix operations       (AJ: Chapter 3; AM: Chapter 2)
4. Eigenvalues and eigenvectors (AJ: Chapter 4; AM: Chapter 2)
5. Numerical methods        (AJ: Chapter 19; AM: Chapter 3)
6. Roots of equations       (AJ: Chapter 5; AM: Chapter 4)
7. Systems of linear equations (AJ: Chapter 3; AM: Chapter 5)
8. Differentiation and integration (AM: Chapter 7)
9. Ordinary differential equations (AJ: Chapter 5, 6; AM: Chapter 8)
10. Laplace Transform      (AJ: Chapter 7)
11. Series solutions of differential equations (AJ: Chapter 8; AM: Chapter 8)
12. Fourier series, integrals and transform (AJ: Chapter 9,10; AM: Chapter 9)
13. Vector calculus        (AJ: Chapter 11,12; AM: Chapter 9)

Class/Laboratory Schedule

Class:  TR   4:30 to 5:50 PM

Contribution of course to meeting the professional component: The course contributes towards one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the civil engineering field.

Prepared by: Dr. Wen-whai Li
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