EMA/NEEP 547 ENGINEERING ANALYSIS I

DLH
Fall 2013

Catalogue Description: Methods of higher mathematics: stress on problem solving rather than rigorous proofs; linear algebra, differential equations, Laplace transforms, Fourier series and transforms, complex variables, Green's functions, Integral equations

Prerequisites: One year of advanced calculus, such as Math 319 and Math 321

Books:

Textbook: Peter V. O'Neil, Advanced Engineering Mathematics, 6th Edition, 2007

References: M.D. Greenberg, Advanced Engineering Mathematics, 2nd Edition, 1998
E. Kreyszig, Advanced Engineering Mathematics, 9th Edition, 2006
D.G. Zill and M.R. Cullen, Advanced Engineering Mathematics, 2nd Edition, 2000
C.R. Wylie and L.C. Barrett, Advanced Engineering Mathematics, 6th Edition, 1995
A. Jeffery, Advanced Engineering Mathematics, 2001

Handbooks: "Handbook of Mathematical Functions," M.A. Abramowitz and I.A. Stegun
"Table of Integrals, Series and Products," I.S. Gradshteyn and I.M. Ryzhik
"Table of Laplace Transforms," G.E. Roberts and H. Kaufman

Course Goals: To provide seniors and first year graduate students with the mathematical tools necessary for advanced analysis of engineering problems. The emphasis is on analytical methods and applications, not on proofs or numerical methods.

Topics:	**Chapter in Text**
Review of ordinary differential equations	1, 2, 4
Linear Algebra	7, 8, 9
Simultaneous linear differential equations	10
Fourier series	14
Analytical functions of a complex variable	20, 21
Expansions in the complex plane, series	22, 23
Residue theorem and evaluation of integrals and series	24
Fourier transforms	15
Laplace transforms	3
If time permits:	
Series Solutions	—
Green's Functions	Handout
Integral Equations	Handout

Contact Information:
Offices: 411 ERB
Tel.: 263-0808
Email: henderson@engr.wisc.edu

LECTURE SCHEDULE

Week	Lecture	Subject
9/2		
	1	Introduction, Terminology, separation of variables
	2	Exact first order, General integrating factor
9/9	3	Homogeneous first order Eq., Bernoulli Eq,
	4	2^{nd} order non-linear eqs., Linear Operators
	5	Linear operators (factoring), higher order D.E.
9/16	6	Non-homogeneous, linear eq.
	7	Variation of parameters, Cramer's rule
	8	Reduction of order, Euler, eq.
9/23	9	Laplace transforms, intro and basic operations
	10	Basic theorems, useful limits
	11	Transforms of special functions
9/30	12	Laplace transform inversion, inversion Theorems
	13	Periodic Functions
	14	Convolution integral
10/7	15	Integral eqs., convert 2^{nd} order ODE to integral eq.
	16	Volterra Eq., Fredholm eq., Neumann series solution
	17	Solution by differentiation
10/14	18	Numerical solution, Linear Algebra
	19	Intro., basic operations and definitions
	20	First Exam
10/21	21	Special Matrices, System of Linear Eqs.
	22	Matrix algebra, Augmented matrix
	23	Eigenvalue problems, Homogenous problems
10/28	24	Inhomogeneous problems, Fundamental matrix
	25	Solution by Diagonalization
	26	Matrix Exponential
11/4	27	
	28	Fourier series and alternative forms
	29	Application to D.E. , Fourier transforms
11/11	30	Fourier Sine and Cosine transforms, properties of
	31	Fourier transforms, convolution theorem, singular
	32	Functions, Fourier inversion
11/18	33	Complex variables, basic definitions
	34	Define derivative, Cauchy Rieman Eqs.
	35	Elementary functions, complex plane integration
11/25	36	Cauchy integral formula, series convergence tests
	37	Second exam
		Thanksgiving Recess

12/2	38	Taylor series, Laurent series
	39	Residue theorem, higher order poles
	40	Evaluation of real definite integrals
12/9	41	Real improper integrals, different integrals forms
	42	Indented contours
	43	

HOMEWORK: Weekly assignments, assigned typically on Fridays and due in a week. Five points will be deducted if homework is turned in a day late.

GRADING:

2 Midterms	45%
Homework	25%
Final Exam	30%

OFFICE HOURS:
Tuesday and Thursday from 9:30am – 11:00am and by appointment

FINAL EXAM:
Friday, December 20, 2013, 10:05am – 12:05pm.