ENGS/PHYS 100 METHODS IN APPLIED MATHEMATICS I Fall, 2009

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Class time: MWF 11:15-12:20, X-hour Tuesday 12-12:50 **Classroom:** MacLean 132

Evaluation criteria: Weekly Exercises (50%); Midterm Exam (25%); Final Exam (25%)

Textbook: *Mathematical Methods for Physics and Engineering, Third Edition Set*
by K.F. Riley, M.P. Hobson and S.J. Bence, Cambridge University Press, 2006
Includes 2 paperbound books (Textbook + Student Solutions Manual)

Week 1	Function of a Complex Variable	
Wednesday Sep 23	Algebra, complex plane, Argand diagram, de Moivre's theorem, trigonometric series	3
Friday Sep 25	Analytic functions, Cauchy-Riemann conditions, Riemann sheets, branch cuts	24.1 - 24.6

Week 2	Function of a Complex Variable	
Monday Sep 28	Contour integrals, Cauchy's Theorem and integral formula, Taylor expansion	24.8-24.11
Wednesday Sep 30	Analytic continuation, Laurent series, poles, calculus of residues	24.12
Friday Oct 2	Contour integration: Examples	24.13

Week 3	Finite Dimensional Vector Spaces	
Monday Oct 5	Contour integration with branch cuts	24.13
Tuesday Oct 6 X-Hr 12-12:50p	Linear vector spaces, algebra, linear independence, basis set, transpose. Inner product	8.1
Wednesday Oct 7	Matrix operations, linear operators, classes of operators, examples	8.2-8.12
Friday Oct 9	Eigenvectors/values, inequalities, Gram-Schmidt orthogonalization	8.13

Week 4	Finite Dimensional Vector Spaces	
Monday Oct 12	Unitary operators, eigenvalues/vectors, diagonalization, characteristic equation	8.13 - 8.14
Wednesday Oct 14	Change of basis, orthogonal transformation, eigenproblems	8.15 - 8.17
Friday Oct 16	Systems of linear differential equations	8.18, 9.1

Week 5	Linear Differential Equations	
Monday Oct 19	Second order DEs, ordinary and singular points, series solution	16.1-16.2
Wednesday Oct 21	Series solution and Method of Frobenius	16.2
Friday Oct 23	Series expansion around a singular point, Bessel's equation and functions	16.3

Week 6	Linear Differential Equations	
Monday Oct 26	Missing solutions, logarithmic solution	16.4
Wednesday Oct 28	Legendre's equation and polynomial solutions	16.6
Friday Oct 30	Families of ODES	Notes

Week 7	Infinite Dimensional Vector Space	
Monday Nov 2	Hilbert space, self-adjoint operator, complete and orthonormal sets	17.1 - 17.2
Wednesday Nov 4	Eigenfunction expansions	17.3
Friday Nov 6	Boundary value problems, Sturm-Liouville problem	17.4

Week 8	Infinite Dimensional Vector Spaces	
Monday Nov 9	Green's functions	17.5 - 17.6
Wednesday Nov 11	Gamma function	18, Notes
Friday Nov 13	Hypergeometric and special functions	18, Notes

Week 9	Integral Transforms	
Monday Nov 16	Orthogonal polynomials	18, Notes
Wednesday Nov 18	Fourier transform, convolution, Parseval relation, uncertainty principle	13.1
Friday Nov 20	Laplace transform, an application leading to Abel's integral equation	13.2

Week 10/11	Integral Transforms	
Monday Nov 23	General approach to the derivation of transform pairs	Notes
Monday Nov 30	Other transform pairs	Notes
Wednesday Dec 2	Applications	