

Week	Date	Material	Reference
1	16-Jul-12	Ordinary Differential Equations. Examples. Linear, nonlinear.	Kreyszig 1.1
		First order ODEs. Separable. Modelling growth and decay.	1.2, 1.3
		Linear inhomogeneous. Particular integrals. Integrating factors.	1.5
2	23-Jul-12	Separable nonlinear. Spread of infection.	1.3
		Equations reducible to separable form. Bernoulli's equation.	1.5
		Systems of first-order ODEs. The linear algebra connection.	4.0, 4.1
3	30-Jul-12	Matrices. Some definitions. Elementary operations, Examples.	4.0, 7.1, 7.2
		Systems of Linear Equations. Elementary row operations.	7.3
		Gaussian elimination. Examples. More on row operations.	
4	6-Aug-12	Under-determined and inconsistent equations. Rank, nullity.	7.5
		Determinants. Co-factors, Gaussian elim. Properties.	7.6, 7.7
		Determinants by Gaussian elimination. Inverse matrices.	7.8
5	13-Aug-12	Inverse matrices, singular matrices. Vector spaces , subspaces.	7.4, 7.9
		Linear combinations. Linear independence. Basis vectors, span.	7.9
		Linear Transformations. Orthogonal matrices, Similarity.	8.3
6	20-Aug-12	The Matrix Eigenvalue Problem. The ODE connection.	8.1, 8.2
		Eigenvalues, eigenvectors. The Cayley-Hamilton theorem.	
		Diagonalization. Symmetric matrices, eigenvalue/vector properties.	8.4
7	27-Aug-12	Second order ODEs. Constant coefficient. Character. Equation	2.2
		Complex roots of character. Equation. Simple harmonic motion.	2.2, 2.4
		Damped SHM - overdamping, critical damping, underdamping.	2.4
	3-Sep-12	<i>Mid-Semester Break</i>	
8	10-Sep-12	Existence of solutions. Linear independence. Wronskians.	2.6
		Reduction of order. Examples.	2.1
		Inhomogeneous ODEs. Guessing a particular integral.	2.7
9	17-Sep-12	Forced Oscillations. Resonance.	2.8, 2.9
		Variation of parameters for inhomogeneous ODEs.	2.10
		Systems of First order ODEs. The phase plane.	4.1, 4.3
10	24-Sep-12	Linear systems. Critical point. Eigenvalues.	4.3
		Critical point is node, or focus, or centre, or saddle.	4.4
		Nonlinear systems. Approximating by linear systems.	4.5
11	1-Oct-12	Nonlinear behaviour. Limit cycles. Example: Lotka-Volterra model.	4.5
		Laplace Transforms. Definition. Transforms of derivatives.	6.1
		Applications to ODEs.	6.2
12	8-Oct-12	Laplace Transforms of integrals. When Laplace transforms exist.	6.1, 6.2
		First and second shifting theorems. Discontinuous functions.	6.1, 6.3
		ODEs with discontinuous forcing terms. Switches and circuits.	6.3
13	15-Oct-12	The Dirac delta function.	6.4
		Differentiation and Integration of Laplace Transforms	6.6
		Inverting Transforms - Partial Fractions.	6.7