ENGI 3424 List of Topics

Summary:

1. **Ordinary Differential Equations**
2. **Second Order Linear Ordinary Differential Equations**
3. **Laplace Transforms**
4. **Partial Differentiation**
5. **Series**

Detailed List:

1.	**Ordinary Differential Equations**	Week 1
1.1	First Order Separable ODEs	Week 2
1.2	Examples for First Order Separable ODEs	
1.3	First Order Linear ODEs	
1.4	Reduction of Order	Week 3
1.5	Numerical Methods for First Order First Degree ODEs	
1.6	Exact First Order ODEs [not examinable]	
1.7	Integrating Factor [not examinable]	
1.8	Derivation of the General Solution of First Order Linear ODEs [not examinable]	
1.9	Integration by Parts [Lecture in Week 1]	

2.	**Second Order Linear Ordinary Differential Equations**	Week 3
2.1	Complementary Function	
2.2	Particular Solution (Variation of Parameters)	Week 4
2.3	Particular Solution (Undetermined Coefficients)	
2.4	Higher Order Linear Ordinary Differential Equations	
2.5	Numerical Methods [not examinable]	

3.	**Laplace Transforms**	Week 5
3.01	Definition, Linearity, Laplace Transforms of Polynomial Functions	
3.02	Laplace Transforms of Derivatives	
3.03	Review of Complex Numbers	
3.04	First Shift Theorem, Transform of Exponential, Cosine and Sine Functions	
3.05	Applications to Initial Value Problems	Week 6
3.06	Laplace Transform of an Integral	Week 7
3.07	Heaviside Function, Second Shift Theorem; Example for RC Circuit	
3.08	Dirac Delta Function, Example for Mass-Spring System	
3.09	Laplace Transform of Periodic Functions; Square and Sawtooth Waves [not examinable]	
3.10	Derivative of a Laplace Transform	
3.11	Convolution; Integro-Differential Equations; Circuit Example	

4.	**Partial Differentiation**	Week 8
4.1	Partial Derivatives - introduction, chain rule, practice	
4.2	Higher Partial Derivatives, Clairaut's theorem, Laplace's PDE	
4.3	Differentials; error estimation; chain rule [again]; implicit functions; partial derivatives on curves of intersection	
4.4	The Jacobian - implicit and explicit forms; plane polar; spherical polar	
4.5	Gradient Vector, directional derivative, potential function, central force law	Week 9
4.6	Extrema; Second Derivative Test for $z = f(x, y)$	
4.7	Lagrange Multipliers; nearest point on curve of intersection to given point	
4.8	Miscellaneous Additional Examples	Week 10

5.	**Series**	Week 10
5.01	Sequences; general term, limits, convergence	
5.02	Series; summation notation, convergence, divergence test	
5.03	Series; telescoping series, geometric series, *p*-series	
5.04	Tests for Convergence: comparison and limit comparison tests	
5.05	Tests for Convergence: alternating series; absolute and conditional convergence	Week 11
5.06	Tests for Convergence: ratio and root tests	
5.07	Power Series, radius and interval of convergence	
5.08	Taylor and Maclaurin Series, remainder term	Week 12
5.09	Binomial Series	
5.10	Introduction to Fourier Series	
5.11	Introduction to Series Solutions of ODEs	
5.A	Integral Test [not examinable; for reference only]	Week 13

Appendix:

Suggestions for Formula Sheets