

**MA255 2009-02**  
**Mathematical Modeling & Introduction to Differential Equations**  
**Syllabus (as of 03JAN09)**  
56 Lessons  
8 Problem Solving Labs

**Text:** <sup>(1)</sup> Differential Equations: An Introduction to Modern Methods & Applications, Brannan & Boyce, 2007.  
<sup>(2)</sup> Differential Equations with Mathematica; Hunt, Lipsman, Osborn, Outing, & Rosenberg; 2008.

**Block 1: First Order Differential Equations**

Lsn	Date	Sec	Title	Homework Problems	Notes
1	1/9	<sup>(1)</sup> 1.1	Course Intro; Some Basic Math Models; Direction Fields	<sup>(1)</sup> 1.1: 2,10,11,24	
2	1/12	<sup>(1)</sup> 1.2	Solns of Some Differential Eqns	<sup>(1)</sup> 1.2: 2,8,12,19	
3	1/13	<sup>(1)</sup> 1.3	Numerical Approximations: Euler's Method	<sup>(1)</sup> 1.3: 2a (by hand), 12 (w/Excel)	
4	1/14	<sup>(1)</sup> 1.4	Classifications of Differential Eqns	<sup>(1)</sup> 1.4: 1,2,3,4,5,6,7,10,16,21	
5	1/15	TBD	Tech Lab 1	Instructor Determined	
6	1/16	<sup>(1)</sup> 2.1	Linear Eqns; Meth of Integ Factors	<sup>(1)</sup> 2.1: 4,13,20,28	HW1 Due (1.1-1.4)
Drop	1/19		Course Drop		Tech Report 1 Due
7	1/20	<sup>(1)</sup> 2.2	Separable Equations	<sup>(1)</sup> 2.2: 2,3,10,24	
8	1/21	<sup>(1)</sup> 2.3	Modeling with First Order Eqns	<sup>(1)</sup> 2.3: 2,5,8,16	
9	1/22	<sup>(1)</sup> 2.4	Diff Between Linear/Nonlinear Eqns	<sup>(1)</sup> 2.4: 2,15,18,28	
10	1/23	<sup>(1)</sup> 2.5	Autonomous Eqns & Pop Dynamics	<sup>(1)</sup> 2.5: 2,3,7,20	
11	1/26	<sup>(1)</sup> 2.6	Exact Eqns & Integ Factors	<sup>(1)</sup> 2.6: 4,11,22,26	
12	1/27	<sup>(1)</sup> 2.7	Accuracy of Numerical Methods	<sup>(1)</sup> 2.7: 3&22c (w/Excel);15,17	
13	1/28	<sup>(1)</sup> 2.8	Improved Euler & Runge-Kutta	<sup>(1)</sup> 2.8: 3,19	
14	1/29	TBD	Tech Lab 2	Instructor Determined	
Drop	1/30		Course Drop		HW2 Due (2.1-2.8)
PSL1	2/2		Block 1 Review	None	Tech Report 2 Due
15	2/3		WPR1	None	Class Hour

**Block 2: Systems of Two First Order Equations & Second Order Linear Equations**

16	2/5	<sup>(1)</sup> A.1	Review of Matrices	TBD	
17	2/6	<sup>(1)</sup> 3.1	Systems of Two Linear Algebraic Eqns	TBD	
18	2/9	<sup>(1)</sup> 3.2	Syst of Two 1 <sup>st</sup> Order Linear Diff Eqns	TBD	
19	2/10	<sup>(1)</sup> 3.3	Homog Linear Syst w/ Const Coef	TBD	
20	2/11	<sup>(1)</sup> 3.4	Complex Eigenvalues	TBD	
21	2/12	TBD	Tech Lab 3	Instructor Determined	
22	2/13	<sup>(1)</sup> 3.5	Repeated Eigenvalues	TBD	
23	2/17	<sup>(1)</sup> 3.6	Brief Intro to Nonlinear Systems	TBD	Tech Report 3 Due
24	2/20	<sup>(1)</sup> 3.7	Numerical Methods for Systems of 1 <sup>st</sup> Order Equations	TBD	

25	2/23	<sup>(1)</sup> 4.1	Def & Ex of 2 <sup>nd</sup> Order Linear Homog Eqn	TBD	HW3 Due (A.1; 3.1-3.7)
26	2/24	<sup>(1)</sup> 4.2	Theory of 2 <sup>nd</sup> Order Linear Homog Eqn	TBD	
27	2/25	<sup>(1)</sup> 4.3	Linear Homog Eqns w/ Const Coef	TBD	
28	2/26	TBD	Tech Lab 4	Instructor Determined	
29	2/27	<sup>(1)</sup> 4.4	Characteristic Eqns w/ Complex Roots	TBD	
30	3/2	<sup>(1)</sup> 4.5	Mechanical & Electrical Vibrations	TBD	Tech Report 4 Due
31	3/3	<sup>(1)</sup> 4.6	Nonhomogeneous Eqns; Meth of Undetermined Coefficients	TBD	
32	3/6	<sup>(1)</sup> 4.7	Forced Vibrations, Frequency Response, & Resonance I	TBD	
33	3/9	<sup>(1)</sup> 4.7	Forced Vibrations, Frequency Response, & Resonance II	TBD	
PSL2	3/10		Block 2 Review	None	HW4 Due (4.1-4.7)
34	3/11		WPR 2	None	Dean's Hour
35	3/13		Guest Lecture – CME Bridge Design	Instructor Determined	Class Hour

**Block 3: Laplace Transform, Systems of First Order Linear Equations, & Nonlinear Differential Equations**

36	3/23	<sup>(1)</sup> 5.1	Def of the Laplace Transform	TBD	
37	3/24	<sup>(1)</sup> 5.2	Prop of the Laplace Transform	TBD	
38	3/25	<sup>(1)</sup> 5.3	The Inverse Laplace Transform	TBD	
39	3/26	TBD	Tech Lab 5	Instructor Determined	
40	3/30	<sup>(1)</sup> 5.4	Solving Diff Eqns w/ Laplace Transf	TBD	Tech Report 5 Due
41	3/31	<sup>(1)</sup> 5.5	Discont Fcns & Periodic Fcns	TBD	
42	4/1	<sup>(1)</sup> 5.6	Diff Eqns w/ Discont Forcing Fcns	TBD	
43	4/2	<sup>(1)</sup> 6.1	Definitions & Examples	TBD	
PSL3	4/3		Guest Lecture – TBD	None	Dean's Hour
44	4/6	<sup>(1)</sup> 6.2	Basic Theory of 1 <sup>st</sup> Order Linear Syst	TBD	HW5 Due (5.1-5.6)
45	4/7	<sup>(1)</sup> 6.3	Homog Linear Syst w/ Const Coef	TBD	
46	4/14	<sup>(1)</sup> 6.4	Complex Eigenvalues	TBD	
47	4/15	<sup>(1)</sup> 6.5	Fund Matrices & the Exp of a Matrix	TBD	
48	4/16	TBD	Tech Lab 6	Instructor Determined	
49	4/17	<sup>(1)</sup> 6.6	Nonhomogeneous Linear Systems	TBD	
50	4/20	<sup>(1)</sup> 7.1	Autonomous Systems & Stability	None	Tech Report 6 Due
51	4/21	<sup>(1)</sup> 7.2	Almost Linear Systems	TBD	
52	4/22	<sup>(1)</sup> 7.3	Competing Species	TBD	
PSL4	4/23		Guest Lecture – TBD	None	Dean's Hour
53	4/24		Project Drop	None	
54	4/27	<sup>(1)</sup> 7.4	Predator-Prey Equations	TBD	
55	5/1		Project Drop	TBD	Project Due

PSL5	5/4		Block 3 Review	None	HW6 Due (6.1-6.6, 7.1-7.4)
56	5/5		<b>WPR 3</b>	None	Class Hour
PSL6	5/6		Guest Lecture – TBD	None	Dean's Hour
PSL7	5/7		Course Admin/Review	None	
PSL8	5/8		Course Admin/Review	None	
TEE	TBD		<b>TEE</b>	None	