3.016 Course Calendar 2009

Week of 7—11 September

Lectures		
	Topics	**Reading**
M 09/07	Labor Day, No Lectures	
W 09/09 Lect. 1	Course organization and introduction to Mathematica, Common Errors for Beginners	Course Notes and Mathematica Notebook *I*
F 09/11 Lect. 2	Introduction to Mathematica, assignment and evaluation, rules and replacement, basic calculus and plotting, lists and matrices, getting help	Course Notes and Mathematica Notebook *II*

Laboratory		
Date	**Topics**	**Reading**
Th 09/10 Lab 0	Discussion of Labotory and Expectations	*Start Reading for Laboratory 1 as Soon as Possible.*

Homework		
Homework Set	Out	Due
1	**9 Sept.**	18 Sept.

Week of 14—18 September

Lectures		
	Topics	**Reading**
M 09/14 Lect. 3	Mathematica programming: functions and patterns, localized variables, logical switches, recursion; Graphics: plotting lists of data, examples	Course Notes and Mathematica Notebook *III*
W 09/16 Lect. 4	Mathematica: symbolic and numerical operations, operations on expressions, solving equations, numerical solutions, file input and output, using packages	Course Notes and Mathematica Notebook *IV*
F 09/18 Lect. 5	Mathematica: overview of graphics, animation, interaction, graphics primitives, complete worked examples	Course Notes and Mathematica Notebook *V*

Laboratory		
Date	**Topics**	**Reading**
Th 09/17 Lab 1	Symbolic calculations, calculus and plotting	*Mathematica Help Browser* **"First Five Minutes with Mathematica,"** **"tutorial/YourFirstMathematicaCalculations,"** **"tutorial/AlgebraicCalculationsOverview."** **"tutorial/BasicEditingTechniquesOverview,"** **"tutorial/ListsOverview,"** **"tutorial/DefiningFunctions,"** **"tutorial/BasicPlotting,"** **"tutorial/Options"** `http://www.wolfram.com/broadcast/#Tutorials-GS` **Functions: Integrate, Table, Simplify, NIntegrate, Plot, Plot3D, ContourPlot**

Homework		
Homework Set	Out	Due
1	9 Sept.	**18 Sept.**
2	**18 Sept.**	27 Sept.

Week of 21—25 September

3.014 Laboratory Week: 3.016 does not meet.

Week 28 Sept.—2 October

Lectures		
	Topics	**Reading**
M 09/28 Lect. 6	Linear algebra: matrix operations, interpretations of matrix operations, multiplication, transposes, index notation	*Kreyszig* **7.1, 7.2, 7.3, 7.4** (pages: 272–276, 278–286, 287–294, 296–301)
W 09/30 Lect. 7	Linear algebra: solutions to linear systems of equations, determinants, matrix inverses, linear transformations and vector spaces	*Kreyszig* **7.5, 7.6, 7.7, 7.8, 7.9** (pages: 302–305, 306–307, 308–314, 315–323, 323–329)
F 10/02 Lect. 8	Complex numbers: complex plane, addition and multiplication, complex conjugates, polar form of complex numbers, powers and roots, exponentiation, hyperbolic and trigonometric forms	*Kreyszig* **13.1, 13.2, 13.5, 13.6** (pages: 602–606, 607–611, 623–626, 626–629)

Laboratory		
Date	**Topics**	**Reading**
Th 10/01 Lab 2	Solving linear systems of equations	*Mathematica Help Browser* **"tutorial/ConstructingMatrices," "tutorial/GettingAndSettingPiecesOfMatrices," "tutorial/OperationsOnScalarsVectorsAndMatrices," "tutorial/MultiplyingVectorsAndMatrices," "tutorial/VectorOperations," "tutorial/MatrixInversion," "tutorial/BasicMatrixOperations," "tutorial/SolvingLinearSystems," "tutorial/EigenvaluesAndEigenvectors";** **Functions: Solve, Inverse, Transpose, Eigensystem**

Homework		
Homework Set	Out	Due
3	**2 Oct.**	19 Oct.

Week of 5—9 October

Lectures		
	Topics	**Reading**
M 10/05 Lect. 9	Matrix eigenvalues: eigenvalue/eigenvector definitions, invariants, principal directions and values, symmetric, skew-symmetric, and orthogonal systems, orthogonal transformations	*Kreyszig* **8.1, 8.2, 8.3** (pages: 334–338, 340–343, 345–348)
W 10/07 Lect. 10	Hermitian forms, similar matrices, eigenvalue basis, diagonal forms	*Kreyszig* **8.4, 8.5** (pages: 349–354, 356–361)
F 10/09 Lect. 11	Vector calculus: vector algebra, inner products, cross products, determinants as triple products, derivatives of vectors	*Kreyszig* **9.1, 9.2, 9.3, 9.4** (pages: 364–369, 371–374, 377–383, 384–388)

Laboratory		
Date	**Topics**	**Reading**
Th 10/8 Lab 3	File input/output, plotting data	*Mathematica Help Browser* **"tutorial/ImportingAndExportingFiles," "tutorial/ImportingAndExportingData," "tutorial/lottingListsOfData," "tutorial/ManipulatingNumericalData," "tutorial/CurveFitting," "guide/Statistics";** **Functions: Dimensions, Append, AppendTo, Mean, StandardDeviation, ListPlot, Table, MultipleListPlot, Fit, FindFit**

Homework		
Homework Set	Out	Due
2	18 Sept.	**5 Oct.**

Week of 12—16 October

Lectures		
	Topics	**Reading**
T 10/13 Lect. 12	Multi-variable calculus: curves and arc length, differentials of scalar functions of vector arguments, chain rules for several variables, change of variable and thermodynamic notation, gradients and directional derivatives	*Kreyszig* **9.5, 9.6, 9.7** (pages: 389–398, 400–403, 403–409)
W 10/14 Lect. 13	Vector differential operations: divergence and its interpretation, curl and its interpretation	*Kreyszig* **9.8, 9.9** (pages: 410–413, 414–416)
F 10/16	3.014 Meets, No Lecture	

Laboratory		
Date	**Topics**	**Reading**
F 10/15 Lab 4	Graphical representations in three and higher dimensions	*Mathematica Help Browser* **"tutorial/BasicPlotting," "tutorial/RedrawingAndCombiningPlots," "tutorial/ThreeDimensionalSurfacePlots," "tutorial/ParametricPlots," "tutorial/SomeSpecialPlots,"**

Homework		
Homework Set	Out	Due
4	**15 Oct.**	26 Oct.

Week of 19—23 October

3.014 Laboratory Week: 3.016 does not meet.

Homework		
Homework Set	Out	Due
3	2 Oct.	**19 Oct.**

Week of 26—30 October

Lectures		
	Topics	**Reading**
M 10/26 Lect. 14	Path integration: integral over a curve, change of variables, multidimensional integrals	*Kreyszig* **10.1, 10.2, 10.3** (pages: 420–425, 426–432, 433–439)
W 10/28 Lect. 15	Multidimensional forms of the Fundamental theorem of calculus: Green's theorem in the plane, surface representations and integrals	*Kreyszig* **10.4, 10.5, 10.6, 10.7** (pages: 439–444, 445–448, 449–458, 459–462)
F 10/30 Lect 16	Multi-variable calculus: triple integrals and divergence theorem, applications and interpretation of the divergence theorem, Stokes' theorem.	*Kreyszig* **10.8, 10.9** (pages: 463–467, 468–473)

Laboratory		
Date	**Topics**	**Reading**
Th 10/29 Lab 5	Multivariable Calculus	*Mathematica Help Browser* **"tutorial/Differentiation,"** **"VectorAnalysis/tutorial/VectorAnalysis,"** **"VectorAnalysis/guide/VectorAnalysisPackage,"**

Homework		
Homework Set	Out	Due
4	15 Oct.	**26 Oct.**
5	**26 Oct.**	16 Nov.

Week of 2—6 November

Lectures		
	Topics	**Reading**
M 11/2 Lect. 17	Periodic functions: Fourier series, Interpretation of Fourier coefficients, convergence, odd and even expansions	*Kreyszig* **11.1, 11.2, 11.3** (pages: 478–485, 487–489, 490–495)
W 11/4 Lect. 18	Fourier theory: complex form of Fourier series, Fourier integrals, Fourier cosine and sine transforms, the Fourier transforms	*Kreyszig* **11.4, 11.7, 11.8, 11.9** (pages: 496–498, 506–512 513–517, 518–523)
F 11/6 Lect 19	Ordinary differential equations: physical interpretations, geometrical interpretations, separable equations	*Kreyszig* **1.1, 1.2, 1.3** (pages: 2–8, 9–11, 12–17)

Laboratory		
Date	**Topics**	**Reading**
Th 11/05 Lab 6	Optimization	*Mathematica Help Browser* **"tutorial/NumericalOptimization";** **Functions: Minimize, Maximize, FindMinimum**

Week of 9—13 November

3.014 Laboratory Week: 3.016 does not meet.

Week of 16—20 November

Lectures		
	Topics	**Reading**
M 11/16	3.014 Meets, No Lecture	
W 11/18 Lect. 20	ODEs: derivations for simple models, exact equations and integrating factors, the Bernoulli equation	*Kreyszig* **1.4, 1.5** (pages: 19–25, 26–32)
F 11/20 Lect. 21	Higher order differential equations: homogeneous second order, initial value problems, second order with constant coefficients, solution behavior	*Kreyszig* **2.1, 2.2** (pages: 45–52, 53–58)

Laboratory		
Date	**Topics**	**Reading**
Th 11/19 Lab 7	Solving Differential Equations	*Mathematica Help Browser* **"tutorial/DifferentialEquations," "tutorial/IntroductionToNumericalDifferentialEquations," "tutorial/NumericalSolutionOfDifferentialEquations"**

Homework		
Homework Set	Out	Due
5	26 Oct.	**16 Nov.**
6	**20 Nov.**	7 Dec.

Week of 10—14 November

3.014 Laboratory Week: 3.016 does not meet.

Week of 17—21 November

Lectures		
	Topics	**Reading**
M 11/23 Lect. 22	Differential operators, damped and forced harmonic oscillators, non-homogeneous equations	*Kreyszig* **2.3,2.4, 2.7** (pages: 59–60, 61–69, 78–83)
W 11/25 Lect. 23	Resonance phenomena, higher order equations, beam theory	*Kreyszig* **2.8, 2.9, 3.1, 3.2, 3.3** (pages: 84–90, 91–96, 105–111, 111–115, 116–121)
F 11/27	Holiday, No Lectures	

Week of 30 Nov—4 December

Lectures		
	Topics	**Reading**
M 11/30 Lect. 24	Systems of differential equations, linearization, stable points, classification of stable points	*Kreyszig* **4.1, 4.2** (pages: 131–135, 136–139)
W 12/02 Lect. 25	Linear differential equations: phase plane analysis and visualization	*Kreyszig* **4.3, 4.4** (pages: 139–146, 147–150)
F 12/02	3.014 Meets, No Lecture	

Week of 6—11 December

3.014 Laboratory Week: 3.016 does not meet.

Homework		
Homework Set	Out	Due
6	20 Nov.	**7 Dec.**