Undergraduate Syllabus*

Colton Grainger

January 20, 2017

2015–2016

MAT-441 Topology

3 credit(s). Taught by Dave Rosoff, with final grade **A**.

- Dave Rosoff. *Course Notes on Elementary Topology*. Personally distributed, 2016. adapted from notes by Michael Starbird
- An introduction to the techniques and theorems of point-set topology. Approached in a modified Moore method, with emphasis on writing, revising and presenting proofs. Topics included cardinality, separation axioms, compactness, connectedness, continuity, as well as novel proofs for the Heine-Borel theorem and the fundamental theorem of algebra.

MAT-494 Galois Theory for Diff Eqs

2 credit(s). Advised by Jonny Comes, with final grade **A**.

- Michio Kuga. *Galois' Dream: Group Theory and Differential Equations: Group Theory and Differential Equations*. Birkhäuser Boston, 1993
- An independent study. Explored the correspondence between the fundamental group of the plane with n points removed and its covering surface. Used Galois theory to prune the ring of continuous functions (defined out of the covering surface) down to exactly those functions that were solutions to Fuchsian type differential equations.

PHY-330 Electricity & Magnetism

3 credit(s). Taught by James Dull, with final grade **A**.

- David Jeffery Griffiths. *Introduction to Electrodynamics*. Prentice Hall, third edition, 1999
- An intermediate level survey of classical electro-magnetic theory including electrostatic and magnetostatic fields and potentials, Gauss's law, Laplace's equation, dielectrics, vector potentials, magnetization and Maxwell's equations.

MAT-370 Geometry

3 credit(s). Taught by Jonny Comes, with final grade **A**.

- Michael P. Hitchman. *Geometry with an Introduction to Cosmic Topology*. Jones and Bartlett Publishers, 2009
- A preparation for Felix Klein's *Erlangen* program. Developed geometry in terms of a space and a group of transformations of that space. Emphasis on congruence relations. Topics included Möbius transformations, hyperbolic geometry and elliptical geometry and quotient spaces.

*Courses are listed in reverse chronological order and grouped by academic year.

MAT-451 Real Analysis

3 credit(s). Taught by Jonny Comes, with final grade **A-**.

- Stephen Abbott. *Understanding Analysis*. Undergraduate Texts in Mathematics. Springer New York, 2015
- Proceeded from the Axiom of Completeness to rigorously prove results about the convergence of sequences and series. Defined continuity (Lipschitz and uniform), the derivative and nowhere differentiable functions. Used suprema and infima to define the Riemann integral.

MAT-498 Upper Division Seminar

1 credit(s). Taught by Dave Rosoff, with final grade **A**.

- Douglas R. Shier and K.T. Wallenius. *Applied Mathematical Modeling: A Multidisciplinary Approach*. Discrete Mathematics and Its Applications. CRC Press, 1999
- A student-led recitation concerned with computational methods for mathematical modeling. Considering the early outbreak of HIV in Houston as a case study, I presented a introduction to epidemiological modeling.

PHY-313 Thermal Physics

3 credit(s). Taught by James Dull, with final grade **A**.

- Daniel V. Schroeder. *An Introduction to Thermal Physics*. Addison Wesley, 2000
- Physical basis and applications of thermodynamics and statistical mechanics including temperature, heat heat engines, entropy and free energy. Included an introduction to Maxwell-Boltzmann, Bose-Einstein, and Fermi-Direct statistics and their application to the solution of thermal, mechanical and electrical problems in fluids and solids.

2014–2015

MAT-431 Complex Variables

0 credit(s). Taught by Dave Rosoff.

- Matthias Beck, Gerald Marchesi, Dennis Pixton, and Lucas Sabalka. *A First Course in Complex Analysis*. Orthogonal Publishing L3c, 2014
- 5 weeks into Spring 2015, I administratively withdrew from all courses due to a health concern.

PHY-400 Quantum Physics

0 credit(s). Taught by Kathrine Devine.

- David Jeffery Griffiths. *Introduction to Quantum Mechanics*. Pearson international edition. Pearson Prentice Hall, 2005
- 5 weeks into Spring 2015, I administratively withdrew from all courses due to a health concern.

MAT-372 History of Mathematics

3 credit(s). Taught by Dave Rosoff, with final grade **B**.

- Carl B. Boyer and Uta C. Merzbach. *A History of Mathematics*. Wiley, 2011
- A historical survey of the ideas, tools, and symbols of mathematics and the people who developed them. Addressed sexigesimal computations, Diophantine equations, as well as medieval Indian analytic geometry. Emphasis on notation and legible proofs.

MAT-461 Algebraic Structures

3 credit(s). Taught by Robin Cruz, with final grade **B+**.

- David M. Clark. Theory of groups. *Journal of Inquiry Based Learning in Mathematics*, (No. 3), April 2007
- An inquiry based course in abstract algebra focused primarily on groups. Addressed basic properties, cyclic groups, LaGrange's Theorem, homomorphisms, isomorphisms, representation theorems, normal subgroups and quotient groups. Many examples.

MAT-498 Upper Division Seminar

1 credit(s). Taught by Dave Rosoff, with final grade **A**.

- Stanley J. Farlow. *Partial Differential Equations for Scientists and Engineers*. Dover books on advanced mathematics. Dover Publications, 1993
- A student-led recitation addressing partial differential equations in mathematical modeling. I presented an application of Fourier analysis to analytically solve the heat equation.

PHY-301 Theoretical Mechanics

3 credit(s). Taught by Kathrine Devine, with final grade **B+**.

- John Robert Taylor. *Classical Mechanics*. University Science Books, 2005
- A survey of classical and modern topics in dynamics. Topics included orbital mechanics, noninertial reference frames, rigid-body motion, Lagrangian and Hamiltonian methods, and elements of nonlinear mechanics and chaos.

2013–2014

MAT-352 Differential Equations

3 credit(s). Taught by Dave Rosoff, with final grade **C+**.

- William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations and Boundary Value Problems*. Wiley, ninth edition, 2008
- A study of the solution and applications of ordinary differential equations including systems of equations using matrix algebra.

MAT-361 Linear Algebra

3 credit(s). Taught by Robin Cruz, with final grade **C**.

- Robert A. Beezer. *A First Course in Linear Algebra*. Published Online, 2012
- A study of general vector spaces, linear transformations, eigenvalues and eigenvectors.

References

[1] Dave Rosoff. *Course Notes on Elementary Topology*. Personally distributed, 2016. adapted from notes by Michael Starbird.

[2] Michio Kuga. *Galois' Dream: Group Theory and Differential Equations: Group Theory and Differential Equations*. Birkhäuser Boston, 1993.

[3] David Jeffery Griffiths. *Introduction to Electrodynamics*. Prentice Hall, third edition, 1999.

[4] Michael P. Hitchman. *Geometry with an Introduction to Cosmic Topology*. Jones and Bartlett Publishers, 2009.

[5] Stephen Abbott. *Understanding Analysis*. Undergraduate Texts in Mathematics. Springer New York, 2015.

[6] Douglas R. Shier and K.T. Wallenius. *Applied Mathematical Modeling: A Multidisciplinary Approach*. Discrete Mathematics and Its Applications. CRC Press, 1999.

[7] Daniel V. Schroeder. *An Introduction to Thermal Physics*. Addison Wesley, 2000.

[8] Matthias Beck, Gerald Marchesi, Dennis Pixton, and Lucas Sabalka. *A First Course in Complex Analysis*. Orthogonal Publishing L3c, 2014.

[9] David Jeffery Griffiths. *Introduction to Quantum Mechanics*. Pearson international edition. Pearson Prentice Hall, 2005.

[10] Carl B. Boyer and Uta C. Merzbach. *A History of Mathematics*. Wiley, 2011.

[11] David M. Clark. Theory of groups. *Journal of Inquiry Based Learning in Mathematics*, (No. 3), April 2007.

[12] Stanley J. Farlow. *Partial Differential Equations for Scientists and Engineers*. Dover books on advanced mathematics. Dover Publications, 1993.

[13] John Robert Taylor. *Classical Mechanics*. University Science Books, 2005.

[14] William E. Boyce and Richard C. DiPrima. *Elementary Differential Equations and Boundary Value Problems*. Wiley, ninth edition, 2008.

[15] Robert A. Beezer. *A First Course in Linear Algebra*. Published Online, 2012.