Michael Heinz - List of Undergraduate Physics Courses

MECHANICS COURSES

PHYSICS 1250H: Honors Physics: Mechanics and Special Relativity Autumn 2015
Instructors: Samir Mathur and Richard Leonard *Grade: A*

- Main topics covered: kinematics, foundations of Newtonian mechanics, momentum, work, energy, collisions, conservative and nonconservative forces, angular momentum, circular motion, noninertial frames, special relativity, Lorentz transformations, basic laboratory methods.
- Textbooks: *Six Ideas that Shaped Physics: Unit C - Conservation Laws Constrain Interactions*, *Six Ideas that Shaped Physics: Unit N - The Laws of Physics are Universal*, and *Six Ideas that Shaped Physics: Unit R - The Laws of Physics are Frame-Independent* by Thomas A. Moore; various chapters.

PHYSICS 2300: Intermediate Mechanics I Autumn 2016
Instructor: Gregory Kilcup *Grade: A*

- Main topics covered: kinematics, foundations of Newtonian mechanics, momentum, work, energy, conservative and nonconservative forces, angular momentum, circular motion, orbital mechanics, mathematical methods, programming in Mathematica.
- Textbooks: *Introduction to Classical Mechanics* by David Morin; chapters 1-7. *Basic Training in Mathematics: A Fitness Program for Science Students* by Ramamurti Shankar; various chapters.

PHYSICS 2301: Intermediate Mechanics II Spring 2017
Instructor: Gregory Kilcup *Grade: A*

- Main topics covered: vector angular momentum, rigid body motion, accelerated frames of reference, relativity, oscillations (including damping, driving, and coupling), more mathematical methods and Mathematica programming.
- Textbooks: *Introduction to Classical Mechanics* by David Morin; chapters 8-14. *Basic Training in Mathematics: A Fitness Program for Science Students* by Ramamurti Shankar; various chapters.

PHYSICS 5300: Theoretical Mechanics Spring 2019
Instructor: Richard Furnstahl *Grade: A*

- Main topics covered: Newton's laws of motion, projectiles and charged particles, momentum and angular momentum, energy, oscillations, Fourier series, calculus of variations, Lagrangian mechanics, Hamiltonian mechanics, two-body central-force problems, coupled oscillators and normal modes, nonlinear mechanics and chaos, collision theory, continuum mechanics, programming in Python.
- Textbook: *Classical Mechanics* by John R. Taylor; chapters 1-8, 11-14, 16

ELECTRODYNAMICS & MAGNETISM COURSES

PHYSICS 1251H: Honors Physics: E&M, Thermo, and Quantum Physics Spring 2016
Instructors: Brian Winer and Richard Leonard *Grade: A*

- Main topics covered: electric fields and potential, Gauss's law, currents, magnetic fields, Ampere's law, Maxwell's equations, entropy, Boltzmann factor, the Ideal Gas law, gas processes, wave models, interference and diffraction, spin, Stern-Gerlach devices, wavefunctions, basic laboratory methods.
- Textbooks: *Six Ideas that Shaped Physics: Unit E - Electricity and Magnetism are Unified*, *Six Ideas that Shaped Physics: Unit Q - Particles Behave Like Waves*, *Six Ideas that Shaped Physics: Unit T - Some Processes are Irreversible* by Thomas A. Moore; various chapters.

PHYSICS 5400H: Honors Intermediate E&M I Autumn 2017
Instructor: Ciriyam Jayaprakash *Grade: A*

· Main topics covered: vector analysis, electrostatics, conductors, electric potentials, multipole expansion, polarization, electric displacement, dielectrics, magnetostatics, magnetic vector potential, magnetization, auxiliary field $\vec{H}$, electromotive force, Faraday's law, Maxwell's equations.
· Textbook: *Introduction to Electrodynamics* by David J. Griffiths; chapters 1-7.

PHYSICS 5401H: Honors Advanced E&M II Spring 2018
Instructor: Ciriyam Jayaprakash *Grade: A*

· Main topics covered: conservation laws, continuity equation, Maxwell's stress tensor, conservation of angular momentum, electromagnetic waves, the wave equation, reflection and transmission, wave guides, gauge transformations, retarded potentials, dipole radiation, power radiated by point charge.
· Textbook: *Introduction to Electrodynamics* by David J. Griffiths; chapters 8-11.

QUANTUM MECHANICS COURSES

PHYSICS 5500H: Honors Quantum Mechanics I Autumn 2017
Instructor: Robert Perry *Grade: A*

· Main topics covered: spin 1/2 systems, Stern-Gerlach experiments, Dirac notation, operators and measurement, Schrödinger time evolution, postulates of quantum mechanics, 1-D particle in a box, 1-D harmonic oscillator, scattering states in one dimension, angular momentum, the Hydrogen atom.
· Textbook: *Quantum Mechanics* by David H. McIntyre; chapters 1-9.

PHYSICS 5501H: Honors Quantum Mechanics II Spring 2018
Instructor: Robert Perry *Grade: A*

· Main topics covered: perturbation theory, hyperfine structure and addition of angular momenta, perturbation of Hydrogen, identical particles, time-dependent perturbation theory, quantum information processing, the Deutsch algorithm, Grover's algorithm, Berry's phase, Aharonov-Bohm effect.
· Textbook: *Quantum Mechanics* by David H. McIntyre; chapters 10-14, 16.

COURSES IN OTHER PHYSICS TOPICS

PHYSICS 5600: Statistical Mechanics Autumn 2018
Instructor: Annika Peter *Grade: A*

· Main topics covered: thermal equilibrium, the ideal gas, equipartition of energy, heat and work, heat capacities, the second law of thermodynamics, entropy, Einstein model of a solid, paramagnetism, mechanical equilibrium and pressure, heat engines and refrigerators, free energy, phase transformations, Boltzmann statistics, Fermi-Dirac distribution, Bose-Einstein distribution, blackbody radiation.
· Textbook: *An Introduction to Thermal Physics* by Daniel V. Schroeder; chapters 1-7.

PHYSICS 6810: Computational Physics Spring 2019
Instructor: Ralf Bundschuh *Grade: A*

· Main topics covered: Unix environment, rounding errors in floating point arithmetic, using scientific computing libraries, numerical differentiation and integration, numerical linear algebra and quantum mechanics, parallel processing, solving differential equations numerically, oscillations/pendulums, chaos, debugging, optimization, random numbers, Monte Carlo methods, Ising model.
· Textbook: Lecture notes on computational physics.

LABORATORY COURSES

PHYSICS 3700: Experimental Physics Instrum. and Data Analysis Lab Spring 2018
Instructor: Kock Kiam Gan *Grade: A*

- Main topics covered: probability and statistics, mean and variance, measurement and statistical errors, binomial and Poisson distributions, Gaussian distribution, central limit theorem, propagation of errors, chi-square distribution, least-squares fitting, hypothesis testing, basic laboratory methods.
- Lab topics: probabilities from rolling two six-sided dice, measurement of π, probability of a two from a dozen six sided dice, rate of cosmic ray particles through Geiger counter, Gaussian distribution of a basic "Pachinko machine", gamma ray energy spectroscopy, energy resolution of NaI detector, lifetime of radioactive ^{137}Ba isotope.
- Textbook: *An Introduction to Error Analysis* by John Taylor; various sections from chapters 1-12 excluding 9. Lecture and lab notes on topics not covered in the textbook: `https://www.asc.ohio-state.edu/gan.1/teaching/spring18/3700.html`.

PHYSICS 5700: Advanced Physics Laboratory Spring 2020
Instructor: James Beatty *Grade: PA*

- Main topics covered: experimental techniques of physics, statistical analysis of data

SOME RELEVANT NON-PHYSICS COURSES

CSE 1222: Introduction to C++ Spring 2016
Instructor: Tianqi Li *Grade: A*

- Main topics covered: basic syntax, variables, assignments, if-else branches, loops, arrays/vectors, user-defined functions, objects and classes, pointers, strings, algorithms.
- Textbook: *Programming in C++* by zyBooks; chapters 1-8.