

## 2013-2014 PRE-COMBINED PLAN CURRICULUM COURSE DESCRIPTIONS

### CHEMISTRY

**CHEM C1403-C1404 General chemistry:** (*Corequisite: MATH V1101 or the equivalent.*) Topics include stoichiometry, states of matter, chemical equilibria, acids and bases, chemical thermodynamics, nuclear properties, electronic structures of atoms, periodic properties, chemical bonding, molecular geometry, introduction to organic and biological chemistry, solid-state and materials science, polymer science and macromolecular structures, chemical kinetics, coordination chemistry, and electrochemistry.

**CHEM C1500 General chemistry laboratory:** (*Prerequisite or corequisite: CHEM C1403.*) An introduction to basic techniques and practices of modern experimental chemistry, including quantitative procedures and chemical analysis.

**CHEM C3443-C3444 Organic chemistry (lecture):** (*Prerequisite: CHEM C1404 or C1500 or their equivalents.*) The principles of organic chemistry. The structure and reactivity of organic molecules are examined from the standpoint of modern theories of chemistry. Topics include stereochemistry, reactions of organic molecules, mechanisms of organic reactions, syntheses and degradations of organic molecules, and spectroscopic techniques of structure determination.

**CHEM C3543 Organic chemistry (laboratory):** (*Prerequisite or corequisite: CHEM C3443-C3444.*) Techniques of experimental organic chemistry, with emphasis on understanding fundamental principles underlying the experiments and methodology of solving laboratory problems involving organic molecules.

### COMPUTER SCIENCE

**COMS W1003 Introduction To Computer Science and Programming In C:** A general introduction to computer science concepts, algorithmic problem-solving capabilities, and programming skills in C.

**COMS W1004 Introduction To Computer Science and Programming In Java:** A general introduction to computer science for science and engineering students interested in majoring in computer science or engineering. Covers fundamental concepts of computer science, algorithmic problem-solving capabilities, and introductory Java programming skills. Assumes no prior programming background.

**COMS W1005 Introduction to Computer Science and Programming in MATLAB:** A general introduction to computer science concepts, algorithmic problem-solving capabilities, and programming skills in MATLAB. Assumes no prior programming background.

**COMS W1007 Object-oriented programming and design in Java:** (*Prerequisites: COMS W1004 or AP Computer Science with a grade of 4 or 5.*) A rigorous treatment of object-oriented concepts using Java as an example language. Development of sound programming and design skills, problem solving and modeling of real world problems from science, engineering, and economics using the object-oriented paradigm.

**COMS W1009x Honors Introduction to Computer Science:** (*Prerequisites: COMS W1004 or Computer Science with a grade of 4 or 5.*) An honors-level introduction to computer science, intended primarily for students considering a major in computer science. Computer science as a science of abstraction. Creating models for reasoning about and solving problems. The basic elements of computers and computer programs. Implementing abstractions using data structures and algorithms. Taught in Java.

**COMS W3203 Discrete Mathematics: Introduction to Combinatorics and Graph Theory:** (*Prerequisites: Any introductory course in computer programming.*) Logic and formal proofs, sequences and summation, mathematical induction, binomial coefficients, elements of finite probability, recurrence relations, equivalence relations and partial orderings, and topics in graph theory (including isomorphism, traversability, planarity, and colorings).

**COMS W3210y Scientific Computation:** (*Prerequisites: Two terms of calculus.*) Introduction to computation on digital computers. Design and analysis of numerical algorithms. Numerical solution of equations, integration, recurrences, chaos, differential equations. Introduction to Monte Carlo methods. Properties of floating point arithmetic. Applications to weather prediction, computational finance, computational science, and computational engineering.

**COMS W3134 Data Structures In Java** (*Prerequisites: COMS W1004 or knowledge of Java*) Data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Rudiments of the analysis of algorithms. Taught in Java.

**COMS W3137 Data Structures and Algorithms:** (*Prerequisites: COMS W1007; Corequisites: COMS W3203*) Data types and structures: arrays, stacks, singly and doubly linked lists, queues, trees, sets, and graphs. Programming techniques for processing such structures: sorting and searching, hashing, garbage collection. Storage management. Design and analysis of algorithms. Taught in Java.

## [MATHEMATICS/APPLIED MATHEMATICS](#)

**MATH V1101 Calculus I:** Functions, limits, derivatives, introduction to integrals.

**MATH V1102 Calculus II:** (*Prerequisite: Calculus I or the equivalent.*) Methods of integration, applications of integrals, series, including Taylor's series.

**MATH V1201 Calculus III:** (*Prerequisite: Calculus II or the equivalent.*) Vector algebra, complex numbers and exponential, vector differential calculus.

**MATH V1202 Calculus IV:** (*Prerequisite: Calculus II and III.*) Multiple integrals, line and surface integrals, calculus of vector fields, Fourier series.

**MATH E1210 – Ordinary differential equations:** (*Prerequisite: MATH V1201 or the equivalent.*) Special differential equations of order one. Linear differential equations with constant and variable coefficients. Systems of such equations. Transform and series solution techniques. Emphasis on applications.

**MATH V2010 Linear Algebra:** (*Prerequisites: V1201, or the equivalent.*) Vector spaces, linear transformations, matrices, quadratic and hermitian forms, reduction to canonical forms.

**STAT W1211 – Introduction to Statistics (with calculus):** (*Prerequisites: one semester of calculus*) Random variables, probability distributions, pdf, cdf, mean, variance, correlation, conditional distribution, conditional mean and conditional variance, law of iterated expectations, normal, chi-square, F and t distributions, law of large numbers, central limit theorem, parameter estimation, unbiasedness, consistency, efficiency, hypothesis testing, p-value, confidence intervals. maximum likelihood estimation.

**APMA E2101 – Introduction To Applied Mathematics** (*Prerequisites: Calculus III.*) A unified, single-semester introduction to differential equations and linear algebra with emphases on (1) elementary analytical and numerical technique and (2) discovering the analogs on the continuous and discrete sides of the mathematics of linear operators: superposition, diagonalization, fundamental solutions. Concepts are illustrated with applications using the language of engineering, the natural sciences, and the social sciences. Students execute scripts in Mathematica and MATLAB (or the like) to illustrate and visualize course concepts (programming not required).

**APMA E3101 Linear Algebra:** Matrix algebra, elementary matrices, inverses, rank, determinants. Computational aspects of solving systems of linear equations: existence-uniqueness of solutions, Gaussian elimination, scaling, ill-conditioned systems, iterative techniques. Vector spaces, bases, dimension. Eigenvalue problems, diagonalization, inner products, unitary matrices.

## PHYSICS

**PHYS C1401 Introduction to mechanics and thermodynamics:** (*Corequisite: MATH V1101 or the equivalent.*) Fundamental laws of mechanics, kinematics and dynamics, work and energy, rotational dynamics, oscillations, gravitation, fluids, temperature and heat, gas laws, the first and second laws of thermodynamics.

**PHYS C1402y Introduction to electricity, magnetism, and optics:** (*Prerequisite: PHYS C1401. Corequisite: MATH V1102 or the equivalent.*) Electric fields, direct currents, magnetic fields, alternating currents, electromagnetic waves, polarization, geometrical optics, interference and diffraction.

**PHYS C1403 Introduction to classical and quantum waves:** (*Prerequisite: PHYS C1402. Corequisite: MATH V1201 or the equivalent.*) Classical waves and the wave equation, Fourier series and integrals, normal modes, wave-particle duality, the uncertainty principle, basic principles of quantum mechanics, energy levels, reflection and transmission coefficients, applications to atomic physics.

**PHYS C1493 Introduction to experimental physics:** (*Prerequisites: PHYS C1401 and C1402.*) Laboratory work associated with the two prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic and nuclear physics.

**PHYS C1494 Introduction to experimental physics:** (*Prerequisites: PHYS C1401, C1402*) Laboratory work associated with the two prerequisite lecture courses. Experiments in mechanics, thermodynamics, electricity, magnetism, optics, wave motion, atomic and nuclear physics.

## OTHER COURSES

**BIOL C2005 Introductory Biology I: Biochemistry, Genetics & Molecular Biology:** (*Prerequisites: One year of college chemistry, or a strong high school chemistry background.*) Lecture and recitation. Recommended as the introductory biology course for biology and related majors, and for premedical students. Fundamental principles of biochemistry, molecular biology, and genetics.

**EGON W1105 Principles of Economics:** How a market economy determines the relative prices of goods, factors of production, and the allocation of resources and the circumstances under which it does it efficiently. Why such an economy has fluctuations and how they may be controlled.

**EEEEB W2001 Environmental Biology, I: Molecules To Cells:** Introductory biology course for majors in biology or environmental biology, emphasizing the ecological and evolutionary context of modern biology.

**EESC V2100 Earth's Environmental Systems: the Climate System:** Origin and development of the atmosphere and oceans, formation of winds, storms and ocean currents, reasons for changes through geologic time. Recent influence of human activity: the ozone hole, global warming, water pollution. Laboratory exploration of topics through demonstrations, experimentation, computer data analysis, and modeling.

**EESC V2200 Earth's Environmental Systems: the Solid Earth System:** Plate tectonics: origin and development of continents, landslides, volcanoes, diamonds, oil. Land-use planning for resource development and conservation. Laboratory exploration of topics through demonstrations, experimentation, computer data analysis, and modeling.

**EESC W4001 Advanced General Geology:** (*Prerequisites: one term of college-level calculus, physics, and chemistry.*) A concentrated introduction to the solid Earth, its interior and near-surface geology. Intended for students with good backgrounds in the physical sciences but none in geology.

**ELEN E1201 Introduction to electrical engineering:** (*Prerequisites: MATH V1101.*) Basic concepts of electrical engineering. Exploration of selected topics and their application. Electrical variables, circuit laws, nonlinear and linear elements, ideal and real sources, transducers, operational amplifiers in simple circuits, external behavior of diodes and transistors, first order RC and RL circuits. Digital representation of a signal, digital logic gates, flipflops. A lab is an integral part of the course. Required of electrical engineering and computer engineering majors.

**ENGI E2261 Introduction to accounting and finance:** (*Prerequisite: ECON W1105.*) The concepts and methods underlying the financial statements of business corporations. Attention to problems of asset valuation, income determination, cash flows, and cost and profit behavior in response to changes in the level of business activity. Analysis of selected corporate financial statements, capital structure, and leverage. Strategies and analytical methods for the evaluation of capital projects.

**ENGL C1010 University Writing:** Teaches general techniques and strategies for academic reading and writing.

**ENME-MECE E3105 Mechanics:** (*Prerequisites: PHYS C1401, and MATH V1101-V1102 and V1201.*) Elements of statics, dynamics of a particle, systems of particles, and rigid bodies.

**IEOR E3658 Probability** (*Prerequisites: Calculus*) Fundamentals of probability theory. Distributions of one or more random variables. Moments, generating functions, law of large numbers and central limit theorem.

**SIEO W3600 Introduction to Probability and Statistics** (*Prerequisites: Calculus.*) Fundamentals of probability and statistics used in engineering and applied science. Probability: random variables, useful distributions, expectations, law of large numbers, central limit theorem. Statistics: point and confidence interval estimation, hypothesis tests, linear regression.

**STAT W3107 Statistical inference** (*Prerequisite: STAT W3000 or W4105, or the equivalent.*) Useful distributions, law of large numbers and central limit theorem, point estimation, hypothesis testing, confidence intervals, maximum likelihood, likelihood ratio tests, nonparametric procedures, theory of least squares, and analysis of variance.