Core Curriculum Requirements

Freshman Mathematics (Ma 1 abc) 27 units

Ma 1 abc. Calculus of One and Several Variables and Linear Algebra. Review of calculus. Complex numbers, Taylor polynomials, infinite series. Comprehensive presentation of linear algebra. Derivatives of vector functions, multiple integrals, line and path integrals, theorems of Green and Stokes. Ma 1 b, c is divided into two tracks: analytic and practical.

Freshman Physics (Ph 1 abc) 27 units

Ph 1 abc. Classical Mechanics and Electromagnetism. The first year of a two-year course in introductory classical and modern physics. Topics: Newtonian mechanics in Ph 1 a; electricity and magnetism, and special relativity, in Ph 1 b, c. Emphasis on physical insight and problem solving. Ph 1 b, c is divided into two tracks: the Practical Track emphasizing practical electricity, and the Analytic Track, which teaches and uses methods of multivariable calculus.

Freshman Chemistry (Ch 1 ab) 15 units

Ch 1 ab. General Chemistry. Lectures and recitations dealing with the principles of chemistry. First term: electronic structure of atoms, periodic properties, ionic substances, covalent bonding, Lewis representations of molecules and ions, shapes of molecules, Lewis acids and bases, Bronsted acids and bases, hybridization and resonance, bonding in solids. Second term: chemical equilibria, oxidation and reduction, thermodynamics, kinetics, introduction to organic chemistry and the chemistry of life.

Freshman Biology (Bi 1 or 1x) 9 units

Bi 1. The Biology and Biophysics of Viruses. This course introduces non-biologists to recent advances in our understanding of how HIV and other viruses infect and cause damage to their hosts. Because understanding and treating HIV infection involves a basic knowledge of cell and molecular biology, virology, and immunology, the course will cover fundamental concepts in these areas from a quantitative, molecular, chemical, and biophysical perspective.

Bi 1 x. The Great Ideas of Biology: An Introduction through Experimentation. Introduction to concepts and laboratory methods in biology. Molecular biology techniques and advanced microscopy will be combined to explore the great ideas of biology. This course is intended for non-biology majors and will satisfy the freshman biology course requirement. Limited enrollment.

Menu Class (currently Ay 1, Ch/APh 2, ESE 1, EST 2, Ge 1, IST 1, or IST 4): 9 units

Ay 1. The Evolving Universe. Introduction to modern astronomy that will illustrate the accomplishments, techniques, and scientific methodology of contemporary astronomy. The course will be organized around a set of basic questions, showing how our answers have changed in response to fresh observational discoveries. Topics to be discussed will include telescopes, stars, planets, the search for life elsewhere in the universe, supernovae, pulsars, black holes, galaxies and their active nuclei, and the Big Bang. There will be a series of laboratory exercises intended to highlight the path from data acquisition to scientific interpretation. Students will also be required to produce a term paper on an astronomical topic of their choice and make a short oral presentation. In addition, a field trip to Palomar Observatory will be organized.

**ESE 1. Introduction to Environmental Science and Engineering.**
An introduction to the array of major scientific and engineering issues related to environmental quality on a local, regional, and global scale. Fundamental aspects of major environmental problems will be addressed with an overall focus on the dynamic interplay among the atmosphere, biosphere, geosphere, and hydrosphere. Underlying scientific principles based on biology, chemistry, and physics will be presented. Engineering solutions to major environmental problems will be explored.

**EST 2. Energy and Society.** Prerequisites: Ph 1ab, Ma 1ab, Ch 1ab. A discussion of where our energy comes from and how we use it. Resources of oil, coal, natural gas, oil sands, and shale gas. Alternative energy sources: hydroelectric, nuclear, wind, geothermal, solar photovoltaic, and solar thermal. Combustion, steam engines, gas turbines, internal-combustion engines, fuel cells and batteries. The electricity grid and transmission lines, agriculture and biofuels, freight and passenger transportation, and heating and lighting of buildings. Not offered on a pass/fail basis.

**Ge 1. Earth and Environment.** An introduction to the ideas and approaches of earth and environmental sciences, including both the special challenges and viewpoints of these kinds of science as well as the ways in which basic physics, chemistry, and biology relate to them. In addition to a wide-ranging lecture oriented component, there will be a required field trip component (two weekend days). The lectures and topics cover such issues as solid earth structure and evolution, plate tectonics, oceans and atmospheres, climate change, and the relationship between geological and biological evolution.

**IST 1. Introduction to Information.** This course offers an introduction to the modern study of information, addressing fundamental questions about information representation, transmission, and learning. Questions considered include: What is information, and how should we represent it for storage and transmission? What does it mean to represent information efficiently? Is there a “shortest possible” description? Can we hope to communicate reliably in a noisy world? How much information can be transmitted, and what are the strategies by which we can improve reliability? What does it mean for a machine to learn? How much data must be observed to achieve reliable learning?

**IST 4. Information and Logic.** The course explains the key concepts at the foundations of computing with physical substrates, including representations of numbers, Boolean algebra as an axiomatic system, Boolean functions and their representations, composition of functions and relations, implementing functions with circuits, circuit complexity, representation of computational processes with state diagrams, state diagrams as a composition of Boolean functions and memory, and the implementation of computational processes with finite state machines. The basic concepts covered in the course are connected to advanced topics like programming, computability, logic, complexity theory, information theory, and biochemical systems.

**Freshman Chemistry Laboratory (Ch 3 a):**

**Ch 3 a. Fundamental Techniques of Experimental Chemistry.**
Introduces the basic principles and techniques of synthesis and analysis and develops the laboratory skills and precision that are fundamental to experimental chemistry.

**Chemistry Lab (Ch 3a) 6 units**

**Ch 3a. Fundamental Techniques of Experimental Chemistry.** Introduces the basic principles and techniques of synthesis and analysis and develops the laboratory skills and precision that are fundamental to experimental chemistry. Freshmen who have gained advanced placement into Ch 41 or Ch 21, or who are enrolled in Ch 10, are encouraged to take Ch 3 a in the fall term.
**Additional Introductory Laboratory:** 6 units
The additional 6 units must be chosen from one of the following: APh/EE 9 ab (6 units), APh 24 (6 units), Bi 10 (6 units), Ch 4 ab (9 units), Ch 8 (9 units), Ch/ChE 9 (9 units), EE/ME 7 (6 units), Ge 116 (6 units), Ph 3 (6 units), Ph 5 (9 units), Ph 8 bc (6 units), or a more advanced laboratory. Computational laboratory courses may not be used to satisfy this requirement.

**Scientific Writing:** 3 units
*En 84. Writing Science.* Instruction and practice in writing about science and technology for general audiences. The course considers how to convey complex technical information in clear, engaging prose that non-specialists can understand and appreciate. Readings in different genres (e.g., magazine and newspaper journalism, reflective essays, case studies, popularizations) raise issues for discussion and serve as models for preliminary writing assignments and for a more substantial final project on a topic of each student’s choice. Includes oral presentation.

**Humanities Courses:** 36 units
**Social Sciences Courses:** 36 units
**Additional Humanities and Social Sciences Courses:** 36 units
**Humanities and Social Sciences Requirements**
All students must complete satisfactorily 108 units in the Division of the Humanities and Social Sciences. Of these, 36 must be in the humanities (art, English, film, history, history and philosophy of science, humanities, music, philosophy, and, with certain restrictions, languages) and 36 in the social sciences (anthropology, business economics and management, economics, law, political science, psychology, social science), in each case divided equally between introductory and advanced courses. The remaining 36 may be drawn from humanities and social sciences, including HSS tutorial courses.

**Physical Education:** 9 units
**Physical Education Requirement**
Before graduation each undergraduate is required to successfully complete 9 units of physical education. This requirement may be satisfied entirely or in part by participation in intercollegiate athletics, or successful completion of physical-education class coursework.

**Typical First-Year Course Schedule, All Options**
Differentiation into the various options begins in the second year.

| Ma 1 abc | Freshman Mathematics |
| Ph 1 abc | Freshman Physics |
| Ch 1 ab  | General Chemistry |
| Bi 1     | Principles of Biology |
| Ch 3 a   | Fundamental Techniques of Experimental Chemistry |

Introductory courses in the humanities and social sciences. A wide choice of alternatives will be available to students; the registrar will announce the offerings for each term.

Introductory laboratory courses

Menu course or additional electives

PE Physical education