

Courses .

Spring 2006.

ns205 **Neuroscience 205**: Systems Neuroscience.

4 units

D. Buonomano, J. Feldman, T. O'Dell, M. Iacoboni, and C. Colwell. Integration of molecular mechanisms, cellular processes, anatomical circuits, and behavioral analysis to understand function of neural systems. Auditory system, McGurk effect, hair cells, sound localization, cochlea implants, somatosensation, dermatomes, topographic organization, pain, visual system, top-down effects, ganglion cells, pupillary reflex, magnocellular and parvocellular streams, lateral geniculate, ocular dominance, dorsal and ventral streams, plasticity, BCM model, self-organizing networks, motor neuron size principle, spinal cord, rhythmic movements, lamprey locomotion, central pattern generators, breathing, basal ganglia, Parkinson's, subthalamic indirect path, cerebellum, Purkinje cells, inferior olive, red nucleus, ataxia, vestibular-ocular and optokinetic reflexes, saccades, vergence, autonomic control, context and cue fear conditioning, Lashley's law, RB and HM, Morris maze, classical conditioning, Aplysia, LTP LTD, CREB, Hebb's postulate, NMDAR coincidence detection, associative learning and LTP, association cortices, language and speech, emotion.

Winter 2006.

ns203 **Neuroscience 203**: Functional Neuroanatomy.

4 units

A. Scheibel.

Anatomy of central and peripheral nervous system at cellular histological and regional systems level, with emphasis on contemporary experimental approaches to morphological study of nervous system in discussions of circuitry and neurochemical anatomy of major brain regions. Consideration of representative vertebrate and invertebrate nervous systems. Origins of the brain, embryology, neural crest, brain coverings, cerebrovasculature, ventricular system, cerebrospinal fluid, neurons and neuroglia, sensory receptors, spinal cord and spinal reflex, long ascending tracts, posterior columns, descending tracts, medial longitudinal tracts, brain stem, medulla oblongata, pons, midbrain, thalamus, epithalamus, cortex, fissures and sulci, cerebellum, cerebellar

peduncles, basal ganglia, olfaction and taste, hypothalamus, pineal gland, mammillary bodies, visceral nervous system, limbic system, visual system, cranial nerves, spinal nerves, reticular formation, forebrain.

Fall 2005.

ns201 **Neuroscience 201**: Cell, Developmental, and Molecular Neurobiology.
6 units

D. Bok, K. Martin, D. Krantz, E. Carpenter, J. de Vellis, Y. Sun, M. Barad, J. Boulter, D. Smith, and W. Yang.
Intracellular signaling, cell-cell communication, neurogenesis and migration, synapse formation and elimination, programmed neuronal death, and neurotrophic factors. Membrane structure, RNA processing, nuclear import, translation and transcription regulation, protein synthesis, Golgi apparatus, sorting and vesicle targeting, endocytosis, polarity, intermediate filaments, microtubules, dyneins and kinesins, gap and tight junctions, neural induction, neural patterning, axonal path finding, development of Schwann cells and oligodendrocytes, myelination, astrocytes and microglia, cytokines, neural fate selection, stem cells, classical genetics, bioinformatics, neurogenetic model systems, KO mice, transgenic mice, neurogenetic disorders, BAC transgenesis, polyglutamine disorders.

ns202 **Neuroscience 202**: Cellular Neurophysiology.
4 units

G. Fain, R. Olcese, T. O'Dell, and P. Narins.
Action and membrane potentials, channels and channel blockers, gates, ion pumps and neuronal homeostasis, synaptic receptors, drug-receptor interactions, transmitter release, modulation by second messengers, and sensory transduction. Passive electrical properties, cable equation, ion permeability, Nernst-Planck equation, ion pumps and ATPases, reversal potentials, Goldman-Hodgkin-Katz equation, Hodgkin-Huxley experiments, prepulse, voltage clamps, pair-pulse facilitation, voltage-gated channel activation and inactivation, gating currents, channel structure and diversity, presynaptic transmission, connexins and gap junctions, excitatory and inhibitory neurotransmitters, GABA, NMDA, AMPA, acetylcholine receptors, metabotropic receptors, second messengers, calcium signaling, protein kinases, beta-arrestins, anchoring proteins, calmodulin and calcineurin, phospholipases, hippocampus circuitry, long-term potentiation and depression, hearing, photoreceptors, olfaction.

Spring 2005.

mcb110
4 units

Molecular and Cell Biology 110: Biochemistry and Molecular Biology.

R. Tjian, K. Collins, and E. Nogales.

Molecular biology of prokaryotic and eukaryotic cells and their viruses. Mechanisms of DNA replication, transcription, translation. Structure of genes and chromosomes. Regulation of gene expression. Structure of DNA and RNA, gene regulation, recombinant techniques, transcription machinery, chromatin structure, nuclear receptors, RNA splicing, protein synthesis, mouse KO's and transgenes, molecular medicine, DNA replication polymerases and accessory factors, replication fork, cell division cycle, DNA damage repair, homologous and site-specific recombination, transposition, cancer, membrane lipids, membrane proteins, active transport, ER, Golgi, lysosome, signal transduction, G protein-coupled receptors, second messengers, receptor tyrosine kinases, integrins, apoptosis.

Fall 2004.

mcb100
4 units

Molecular and Cell Biology 100: General Biochemistry.

J. Kuriyan, M. Alper, and R. Glaeser.

Chemical and physical principles, concepts, and properties involved in life processes, including enzymes and enzymic catalysis, bioenergetics, metabolic pathways and regulation of metabolism. The chemistry, structure, function, synthesis and degradation of the constituent molecules (amino acids, fatty acids, sugars, and nucleotides) and cofactors of the major biological macromolecules. Designed for majors in the biochemistry and molecular biology, genetics and development, or immunology emphases. Hydrophobic effect, ionization of amino acids, alpha and beta conformations, protein folding, protein purification, allostery in hemoglobin, enzyme kinetics, oxidation and reduction cofactors, glycolysis, Krebs cycle, oxidative phosphorylation, glyoxylate pathway, pentose phosphate shunt, gluconeogenesis, regulation, glycogen mobilization, lipids and beta oxidation, fatty acid and cholesterol synthesis, ketone bodies, nitrogen fixation, photophosphorylation, Calvin cycle, amino acid and nucleotide oxidation and synthesis, interactions of pathways.

Summer 2003.

astro12
3 units

Astronomy C12: The Planets.

F. Marchis.

A tour of the planets and moons of the solar system, and an introduction to their internal structures, atmospheres, and surface features. Processes that form planets and act continually to change them (e.g. earthquakes, volcanoes, giant impacts) are discussed, as are comets, asteroids, rings, and life. Information gained from recent spacecraft missions is highlighted. Celestial sphere, angular and distance measurements, emission and absorption spectral lines, angular resolution, Earth, Moon and Mercury, Venus, Mars, exobiology, Jupiter, Galilean moons, Saturn, Titan, Uranus, Neptune, Triton, Pluto, comets, asteroids, condensation theory for solar system formation, Sun, search for stellar systems.

chem130
3 units

Chemistry 130A: Biophysical Chemistry.

D. Wemmer.

Problem solving and application of calculus in physical chemistry. Bioenergetics, equilibrium and non-equilibrium states, molecular distributions, active and passive transport, reaction rates and mechanisms, enzyme reactions. Gas laws, van der Waals equation, kinetic theory, Maxwell-Boltzmann distribution, laws of thermodynamics, heat and work, free energy, entropy, equilibrium constant, mixing, Rault's and Henry's laws, nonideal behavior, activity, fugacity, Debye-Huckel theory, ionic effects, kinetic rate laws, transition state, Arrhenius equation, catalysis, reaction mechanisms, Michaelis-Menten kinetics, allosteric interactions, biological control.

eng190
3 units

Engineering 190: Technical Communication.

J. Welsh.

Analyzing one's audience; organizing material; developing a clear, economical style; using proper formats and rhetorical strategies for formal technical reports, feasibility studies, abstracts, descriptions and instructions, proposals, letters, and memos. Practice in oral presentations to technical and nontechnical audiences.

ling100 **Linguistics 100**: Linguistic Science.
4 units

R. B. de Azcona.

A technical introduction to linguistic science. Practice in phonetics, production, and transcription; practice in phonological and morphological analysis; basic steps in grammatical parsing and textual analysis. Articulatory processes, IPA phonetic transcription, suprasegmentals, phonological typology, phonological rules, distinctive features, inflection and derivation, paradigms, suppletion, tonal morphology, morphological typology, phrase types, phrase structure rules and trees, transformations, clitics, ergativity, valence, subcategorization, language change and contact, reconstruction, genetic classification, writing systems.

Fall 2002.

cogscil26 **Cognitive Science C126**: Perception.
3 units

W. Prinzmetal.

An introduction to principal theoretical constructs and experimental procedures in visual and auditory perception. Topics include psychophysics; perception of color, space, shape, and motion; pattern recognition and perceptual attention. Constructive realism, Fechner's and Weber's laws, Multi-dimensional scaling, single cell recording, aftereffects, brightness contrast, spatial frequency, auditory illusions, mystery spot and other illusions, color constancy, dichotic listening, attentional blindness, imagery, visual attention, motion, infant speech perception, word perception.

cs199 **Computer Science 199**: Research.
4 units

D. J. Fleet and E. Poon.

Credit for research work done for Palo Alto Research Center under EECS Internship Program in computational vision for tracking people.

cs281
3 units

Computer Science C281A: Statistical Learning Theory.

M. Jordan.

Classification regression, clustering, dimensionality reduction, and density estimation. Mixture models, hierarchical models, factorial models, hidden Markov, and state space models, Markov properties, and recursive algorithms for general probabilistic inference. Nonparametric methods, including decision trees, kernel methods, neural networks, and wavelets. Ensemble methods. Elimination algorithms, sum-product algorithm, factor graphs, Frequentist and Bayesian models, generalized linear models, exponential family, density estimation, kernel methods, EM algorithm, hierarchical mixture models, HMMs, Junction tree algorithm, importance sampling, MCMC, simulated annealing, convexity-based variational methods, dynamic graphical models, model selection, Markov decision processes, decision networks.

ee40
4 units

Electrical Engineering 40: Microelectronic Circuits.

S. Ross.

Fundamental circuit concepts and analysis techniques in the context of digital electronic circuits. Transient analysis of CMOS logic gates; basic integrated-circuit technology and layout. Gate delays, pulse propagation, Kirchoff's laws, nodal and loop analysis, Thevenin and Norton equivalent circuits, capacitors and amplifiers, op-amps, load-line analysis, diodes, doping, NMOS theory, CMOS layout, CMOS inverter gate delays, CMOS logic gates, flip flops, Schmidt trigger, power.

ee120
4 units

Electrical Engineering 120: Signals and Systems.

J. Kahn.

Continuous and discrete time transform analysis techniques with illustrative applications. Linear and time-invariant systems, transfer functions. Convolution, Fourier series, Fourier transform, Laplace and Z-transforms. Sampling and reconstruction, Nyquist theorem, Hilbert transform. Solution of differential and difference equations using transforms. Frequency response, Bode plots, stability analysis. Illustrated by analysis of communication systems and feedback control systems.

uids192
2 units

Undergraduate Interdisciplinary Studies 192C: Research.

J. Diedrichsen and R. Ivry.

Credit for research work done for UC Berkeley Cognition and Action Laboratory under Undergraduate Research Apprentice Program in bimanual interference of motor control.

Summer 2002.

psyc110
3 units

Psychology 110: Biological Psychology.

S. Clarke.

Survey of relations between behavioral and biological processes. Topics include sensory and perceptual processes, neural maturation and evolution, natural bases of motivation, synaptic changes in learning, biological bases of mental illness, hormones and behavior, distress and disease, and theories of emotion.

psyc119
3 units

Psychology 119: Drugs and Behavior.

R. Rule.

A survey course exploring the basic principles of psychopharmacology. The major focus is on the relationship between behavior and the physiological actions of drugs. Emphasis will be placed on effects of pharmacological agents on complex mental processes such as attention motivation, learning, and memory.

Fall 2001.

cogsci127
3 units

Cognitive Science C127: Cognitive Neuroscience.

R. Ivry.

This course examines research investigating the neurological basis of cognition. Material covered includes the study of brain-injured patients, neurophysiological research in animals, the study of normal cognitive processes in humans with noninvasive behavioral and physiological techniques (e.g. PET scan, brain waves), and computer modelling. Topics covered include visual perception and object recognition, attention, motor control, language, and development.

cogsci237
1 unit

Cognitive Science 237A: Cognitive Science Graduate Seminar.

R. Ivry.

Weekly presentations by local and visiting researchers on a range of topics in cognitive science, with ensuing discussion.

cs199
4 units

Computer Science 199: Research.

K. Everitt, S. Klemmer, and J. Landay.

Credit for research work done for UC Berkeley Group for User Interface Research in tangible interfaces for web site design.

cs289 **Computer Science 289**: Knowledge Representation and Reasoning.

3 units

S. Russell.

Fundamentals of knowledge representation and use in computers. Predicate calculus, non-monotonic logics, probability and decision theory, and their use in capturing commonsense and expert knowledge. Theorem-provers, planning systems, belief networks, and influence diagrams as reasoning methods. Integrated architectures for intelligent agents. Model-finding algorithms, logic programming, resolution, reasoning about action and time, intelligent internet systems, planning, probabilistic representation in Bayesian networks, HMMs, Kalman filters, logic and probability, utility and game theory, information value, bounded rationality.

math104 **Mathematics H104**: Honors Analysis.

4 units

M. Hitrik.

For students who enjoy mathematics and are good at it. Greater emphasis on theory and challenging problems. The real number system. Sequences, limits, and continuous functions in \mathbb{R} and \mathbb{R}^n . The concept of a metric space. Uniform convergence, interchange of limit operations. Infinite series. Mean value theorem and applications. The Riemann integral.

math110 **Mathematics H110**: Honors Linear Algebra.

4 units

C. Pugh.

For exceptional students with strong mathematical inclination and motivation. Emphasis on rigor, depth, and hard problems. Matrices, vector spaces, linear transformations, inner products, determinants. Eigenvectors. QF factorization. Quadratic forms and Rayleigh's principle. Jordan canonical form and applications. Linear functionals.

Summer 2001.

ethstd122 **Ethnic Studies 122AC**: Ethnicity and Race in American Film.

4 units

M. Barrera.

The depiction of race and ethnic relations in American films from the 1960s to the present. The course covers independent features as well as main-stream Hollywood studio films.

Spring 2001.

cs170 **Computer Science 170**: Efficient Algorithms and Intractable Problems.

4 units

J. Demmel and J. Shewchuk.

Concepts and basic techniques in the design and analysis of algorithms; models of computation; lower bounds; algorithms for optimum search trees, balanced trees and union-find algorithms; numerical and algebraic algorithms; combinatorial algorithms. Turing machines, how to count steps, deterministic and nondeterministic Turing machines, NP-completeness. Unsolvable and intractable problems. Recurrences, depth and breadth first search, topological sort, connected components, Dijkstra's algorithm, Bellman-Ford algorithm, minimum spanning tree, disjoint sets, Huffman coding, dynamic programming, linear programming, network flows, NP-complete problems, matrix multiplication, fast Fourier transform, computational geometry, number theory and cryptography.

cs182 **Computer Science C182**: Neural Basis of Thought and Language.

4 units

J. Feldman and G. Lakoff.

Consideration of the following: 1. How is it possible for the human brain, which is a highly structured network of neurons, to think and to learn, use, and understand language? 2. How are language and thought related to perception, motor control, and our other neural systems, including social cognition? 3. How do the computational properties of neural systems and the specific neural structures of the human brain shape the nature of thought and language? Focus on the Neural Theory of Language, which seeks to answer these questions in terms of architecture and mechanism, using models and simulations of language and learning phenomena.

cs188 **Computer Science 188**: Artificial Intelligence.

4 units

J. Malik.

Idea techniques underlying the design of intelligent computer systems. Topics include heuristic search, problem solving, game playing, knowledge representation, logical inference, planning, reasoning under uncertainty, expert systems, learning, perception, language understanding. Focus on probabilistic reasoning: perceptrons, neural networks, support vector machines, character recognition, Bayesian learning, belief networks, decision networks, information theory, decision trees, reinforcement learning, adaptive dynamic programming, Q-learning, speech recognition, Viterbi algorithm, computer vision.

ee126 **Electrical Engineering 126**: Probability and Random Processes.

4 units

J. Walrand.

This course covers the fundamentals of probability and random processes useful in fields such as networks, communication, signal processing, and control. Sample space, events, probability law. Conditional probability. Independence. Random variables. Distribution, density functions. Random vectors. Law of large numbers. Central limit theorem. Estimation and detection. Foundations of probability, Borel sets, probability spaces, conditional independence, expectation, Gaussian random variables, detection and estimation theory, hypothesis testing, limits of random variables, inequalities and limit theorems, Bernoulli and Poisson random processes, discrete and continuous time Markov chains.

ee129 **Electrical Engineering 129**: Neural Nonlinear Information Processing.

3 units

L. Chua.

Principles of massively parallel real-time computation, optimization, and information processing via nonlinear dynamics and analog VLSI neural networks, applications selected from image processing, pattern recognition, feature extraction, motion detection, data compression, secure communication, bionic eye, auto waves, and Turing patterns.

Fall 2000.

cs61 **Computer Science 61C**: Machine Structures.

3 units

D. Patterson.

The internal organization and operation of digital computers. Machine architecture, support for high-level languages (logic, arithmetic, instruction sequencing) and operating systems (I/O, interrupts, memory management, process switching). Elements of computer logic design. Tradeoffs involved in fundamental architectural design decisions. C programming language, pointers, memory maps and allocation, assembly programming MIPS, floating point number representations, I/O, interrupt handling, disks, Verilog, networks, cache, virtual memory, pipelining, logic design.

cs160 **Computer Science 160**: User Interface Design and Development.

4 units

J. Landay.

The design, implementation, and evaluation of human/computer interfaces. Interface devices (keyboard, pointing, display, audio), metaphors (desktop, notecards, rooms, ledger sheets, tables), interaction styles and dialog models, design examples, and user-centered design and task analysis. Interface-development methodologies, implementation tools, testing, and quality assessment. Development of a direct-manipulation interface. Wizard of Oz paper prototyping and heuristic evaluation.

cs184 **Computer Science 184**: Foundations of Computer Graphics.

4 units

D. Forsyth.

Techniques of modeling objects for the purpose of computer rendering: boundary representations, constructive solids geometry, hierarchical scene descriptions. Mathematical techniques for curve and surface representation. Elements of a computer graphics rendering pipeline; architecture of modern graphics display devices. Geometrical transformations such as rotation, scaling, translation, and their matrix representations. Homogeneous coordinates, projective and perspective transformations. Algorithms for clipping, hidden surface removal, rasterization, and anti-aliasing. Scan-line based and ray-based rendering algorithms. Lighting models for reflection, refraction, transparency.

cs199 **Computer Science 199**: Research.

2 units

A. C. Long and J. Landay.

Credit for research work done for UC Berkeley Group for User Interface Research in pen-based interface gesture set design tool.

ee20 **Electrical Engineering 20N**: Interpretation of Signals and Systems.

4 units

P. Varaiya.

Mathematical modeling of signals and systems: deterministic and nondeterministic finite state machines and behaviors. Continuous and discrete signals, with applications to audio, images, video, communications, and control. State-based models, beginning with automata and evolving to LTI systems. Frequency domain models for signals and frequency response for systems, and sampling of continuous-time signals. Convolution and impulse response, state and output response, filtering and filter design, hybrid systems. A Matlab-based laboratory is an integral part of the course.

Spring 2000.

bio54 **Biology 54**: Biology Laboratory.

1 unit

M. Williams.

Investigations in neurobiology, biochemistry, ecology, molecular biology, and other areas of experimental biology. Experiments in enzyme kinetics, Mendelian genetics, statistical ecology, and gel electrophoresis analysis of plasmid DNA in a DNA nuclease solution.

cs70 **Computer Science 70**: Data Structures and Program Development.

3 units

M. Fleck.

Abstract data types including priority queues, dynamic dictionaries, and disjoint sets. Efficient data structures for these data types, including heaps, self-balancing trees, and hash tables. Analysis of data structures, including worst-case, average-case, and amortized analysis. Storage allocation and reclamation. Secondary storage considerations. Extensive practice building programs for a variety of applications.

cs80 **Computer Science 80**: Logic for Computer Science.

3 units

E. Bull.

Introductory logic (propositional and first-order) with a focus on its applications to the field of computer science, stressing three aspects of that relationship: the use of logic in programs (AI, databases), the use of logic to reason about programs (program specification and verification), and the relationship between systems of proof and systems of computation. Particular emphasis is placed on syntactic proof systems and computational aspects of proof search, as well as on the use of first-order logic as a descriptive language.

eng96 **Engineering 96**: Electrical Engineering.

3 units

S. Tanenbaum.

Study of fundamental topics in electrical engineering: circuit concepts and theorems; electronic devices and circuits, both digital and analog; energy storage, transmission, and conversion. Magnetic circuits, RLC circuit analysis, phasors, electrical power systems, diodes, op-amps, Karnaugh maps, flip-flops, transformers, DC motors, synchronous and induction AC motors, rail guns.

math82 **Mathematics P82**: Linear Algebra II, Differential Equations II.

3 units

M. Moody.

Vector spaces, null space, column space, linear transformations, bases, coordinate systems, rank, change of basis, eigenvectors and eigenvalues, diagonalization, complex eigenvalues, inner product spaces, orthogonality, Gram-Schmidt process, least-squares, symmetric matrices, spectral theorems, quadratic forms, constrained optimization. General theory of ordinary differential equations, the Wronskian, linear systems of DEs, orbital portraits, matrix exponential, theory of general linear systems, stability and sensitivity analysis, Laplace's equation, series solutions, Legendre polynomials, regular singular points, Bessel functions. Part of new pilot section.

psyc199 **Psychology 199**: Research.

3 units

W. Banks.

Credit for research work done for Pomona College Psychology Department in semantic information processing and priming effects.

Fall 1999.

cs60 **Computer Science 60**: Principles of Computer Science.

3 units

R. Keller.

Introduction to principles of computer science. Information structures, functional programming, object-oriented programming, grammars, logic, logic programming, correctness, algorithms, complexity analysis, finite-state machines, basic processor architecture, and theoretical limitations. Functional programming in Rex, lists, pattern matching, recursive structures, trees and graphs, static and dynamic binding, higher-order functions, predicates, tail recursion, guards, types, stacks and queues in Java, open and closed lists, interfaces, mutability, inheritance, polymorphism, virtual functions, applets, event-handling, double buffering, grammars, expression trees, parsing with tokenizers, propositional logic, tautologies, minterm reduction, Shannon expansions, Karnaugh maps, predicate logic, satisfiability, DeMorgan's laws, Prolog and logic programming, assertions and loop invariants, computational complexity, sorting algorithms, heaps, greedy algorithms, divide and conquer, regular expressions, DFA and NFA, buses multiplexors latches and registers, ISC assembly, signals traps and interrupts, P and NP, Turing's thesis.

math55 **Mathematics 55**: Discrete Mathematics.

3 units

G. Levin.

Topics include combinatorics, number theory, and graph theory, with an emphasis on creative problem solving and learning to read and write rigorous proofs. Applications include probability, analysis of algorithms, and cryptography. Equivalence relations, multisets, inclusion-exclusion, pigeonhole principle, permutations, Euclidean algorithm, modular arithmetic, Chinese remainder theorem. Groups, group isomorphism, Lagrange's theorem, Fermat's little theorem, public key cryptography. Subgraphs, cliques and independent sets, forests and trees, Eulerian graphs, graph coloring, bipartite graphs, planar graphs. Partially ordered sets.

math73 **Mathematics P73**: Multivariable Calculus II, Probability, Statistics.

3 units

M. Moody.

Lagrange multipliers, multiple integrals, Monte Carlo integration, cylindrical and spherical coordinates, change of variable, parameterized curves and surfaces, implicit function theorem, vector fields, line integrals, Green's theorem, flux integral, divergence and curl, Divergence theorem, Stokes' theorem. Events and sample space, combinatorics, conditional probability, Bayes' rule, random variables, Binomial Poisson Hypergeometric Normal and other probability distributions, box stem dot plots, sampling distributions, central limit theorems, confidence intervals, standard error, hypothesis testing, type I and II errors, p-values, t-test, paired-difference test, analysis of variance, chi-square test, linear regression and correlation, multiple regression. Part of new pilot section.

phys51 **Physics 51**: Electromagnetic Theory and Optics.

3 units

T. Donnelly and J. Townsend.

Introduction to electricity and magnetism leading to Maxwell's electromagnetic equations in differential and integral forms. Coulomb's law, electric field, electric dipole, Gauss' law, conductors and insulators, electric potential, equipotential surfaces, capacitors and dielectrics, DC and AC analysis, magnetic field, Hall effect, Biot-Savart law, Ampere's law, solenoids and toroids, Faraday's law, Lenz' law, magnetization, inductors, displacement current, Maxwell's equations, electromagnetic waves, Poynting vector. Refraction and reflection, thin lenses, double-slit interference, interference from thin films, single-slit diffraction, x-ray diffraction, polarization.

phys53
1 unit

Physics 53: Electricity and Optics Laboratory.

J. Eckert.

Electrical and magnetic techniques in such measurements as the Hall effect and the Earth's magnetic field. Introduction to electronics, including use of the oscilloscope and measurements on RC and RCL circuits. Experiments in physical optics, including studies of diffraction patterns.

psycl60
3 unit

Psychology 160: Perception and Cognition.

W. Banks.

Psychophysics, Fechner's Weber's and Steven's laws, visual system, spatial frequency, color perception, auditory system, auditory scene analysis, taste and smell, touch and pain, motion parallax, binocular depth perception, form, Gestalt theory, object recognition and identification, speech and music, time and motion, the constancies, theories of attention, development, sensory-motor learning, individual differences.

Summer 1999.

psycl12
3 units

Psychology 112: Human Growth and Development.

M. Grimes-Hillman.

Research designs, stages of prenatal development, reflexes, Piaget's theory of cognitive development, motor development, attachment, development of the self, speech acquisition, information processing theory, Freud's theory of personality, memory, identity, social learning theory, Erickson's theory of social development, adjustment, family, Kohlberg's theory of moral development, theories of aging, disengagement theory, death and dying, Kubler-Ross's stages of dying.

Spring 1999.

bio52
3 units

Biology 52: General Biology.

J. Manser, S. Adolph, and C. McFadden.
Biology of molecules, cells, organisms, and populations. Nucleic acids and DNA, Hershey-Chase experiment, heredity and DNA, Meselson-Stahl experiment, protein structure and function, protein folding, enzyme kinetics, metabolism, genetic code, Beadle-Tatum experiments, transcription and translation, point and chromosomal mutations, regulation of gene expression, lac operon, genetic engineering, DNA sequencing and finger printing, PCR, catalytic RNA, control of cell division, cell division, Mendelian genetics, gene therapy, cloning. History of evolution, Hardy-Weinberg theorem, nonrandom mating, selection, genetic drift, speciation, population genetics, punctuated equilibrium, ecology, cohort, life tables, Euler equation, competition, biodiversity, species-area curve, extinction.

chem22
3 units

Chemistry 22: General Chemistry II.

S. Baker and K. Karukstis.
Thermodynamics, thermochemistry, Carnot cycle, entropy, Gibbs free energy, electrochemistry, Nernst equation, chemical kinetics, rate laws, Arrhenius equation, nuclear chemistry, atomic structure, chemical bond, molecular orbitals, VSEPR theory, transition metals, coordination complexes, crystal field and ligand field theories, organometallics, crystal structure, organic chemistry, polymers.

chem26
1 unit

Chemistry 26: Chemistry Laboratory II.

S. Baker and R. Cave.
Laboratory taken concurrently with Chemistry 22. Experiments in thermochemistry, electrochemistry, chemical kinetics, chemical bonding, and organic chemistry.

hum2
3 units

Humanities 2G: Science Fiction in Literature and Film.

K. Ross.
What future futurisms. Topical and interdisciplinary course in the humanities and social sciences that build on the methods and skills of Humanities 1. Science fiction vision of the future as depicted in novels such as *Looking Backward* and *Do Androids Dream of Electric Dream?*, films such as *2001: A Space Odyssey* and *Metropolis*, and essays such as *The Two Cultures* and *Questioning the Millennium*.

- math4 **Mathematics P4:** Differential Equations I, Multivariable Calculus I.
3 units
- F. Su and M. Moody.
First-order and second-order differential equations, visualizing solution curves, modeling with linear DEs, separable DEs, change of variables, existence and uniqueness, approximate solutions, Euler's method, undriven and driven constant coefficient linear DEs, periodic solutions, simple harmonic motion, general theory of linear DEs. Functions of several variables, dot and cross products, partial derivatives, local linearity, gradients, directional derivatives, chain rule, partial differential equations, Taylor approximations, local extrema, constrained optimization, Lagrange multipliers, iterated integrals, triple integrals, polar coordinates. Part of new pilot section.
- phys24 **Physics 24:** Relativity, Rotational Mechanics, and Quantum Physics.
3 units
- T. Helliwell, P. Saeta, and J. Townsend.
Special relativity, Michelson-Morley experiment, time dilation, length contraction, Lorentz transformation, principle of equivalence, twin paradox, relativistic momentum and energy, particle collisions and decays, relativistic Doppler effect. Angular momentum, rotational inertia, torque, parallel axis theorem, rotational energy, central force motion, simple harmonic motion, oscillation, damped and driven oscillators, wave equation, transverse and longitudinal waves, Doppler effect, superposition principle. Blackbody radiation, Planck's law, photoelectric effect, Compton scattering, Rayleigh scattering, de Broglie's postulate, wave-particle duality, Uncertainty principle, Bohr's model of the atom, Correspondence principle, Schrödinger's equation.
- phys28 **Physics 28:** Physics Laboratory.
1 unit
- D. Petersen.
Experiments in mechanics using digital electronic measuring devices. Experiments include projectiles, pendulums, rotational mechanics, and waves mechanics.
- Fall 1998.**
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chem21 **Chemistry 21**: General Chemistry I.

3 units

R. Cave, H. Van Ryswyk, and W. Daub.

Atomic theory, stoichiometry, Lewis structures, redox reactions, ideal gas laws, gas mixtures, kinetic theory, phase equilibrium, phase diagrams, colligative properties, distillation, colloids, chemical equilibrium, equilibrium constants, acids and bases, buffer solutions, acid-base titration, dissolution and precipitation equilibria, solubility product, pH and solubility.

chem25 **Chemistry 25**: Chemistry Laboratory I.

1 unit

G. Van Hecke.

Laboratory taken concurrently with Chemistry 21. Experiments in basic chemistry, distillation, titration, acids and bases, buffers, solubility, chemical equilibria, practice in stoichiometry.

cs5 **Computer Science 5**: Structured Programming and Problem Solving.

3 units

J. Hodas.

Introduction to programming. Problem solving, algorithms, simple and structured data types, data representation, flow-control structures, subroutines, and program design. Introduction to objects. Specification, testing, debugging, and documentation. Use of a programming environment, operating systems, and networks.

hum1 **Humanities 1**: News, Print Culture, and Textuality.

4 units

J. Groves.

Reading the news. Introduction to college level studies in the humanities and social sciences focusing on the development of essential reading, critical thinking, research, and writing skills. Reading assignments combine fiction and nonfiction works addressing interdisciplinary themes. The politics, culture, and theories of journalism in print as represented in books such *The Press of Ideas* and *All the President's Men*, films such as *Citizen Kane* and *Network*, and manuals on writing such as *Style* and *Elements of Style*.

math3 **Mathematics P3**: Calculus, Discrete Dynamics, Linear Algebra I.

4 units

L. Ward and F. Su.

Complex numbers, limits of complex sequences, triangle inequality, review of differentiation and integration, proof by contradiction and induction, implicit differentiation, Taylor polynomials, Newton's method, sequences and series, tests of convergence, infinite series, divergence integral root ratio comparison and alternating series tests, Lagrange's form of the remainder, countability, Cantor diagonalization, partial fractions and integration techniques, Fundamental Theorem of Calculus, complex integration, Residues theorem. Discrete dynamical systems, graphical analysis, attracting and repelling fixed points, Mean Value theorem, Multiplier theorem, logistic map, stable and unstable periodic points, bifurcation diagrams, transcritical tangent and period-doubling bifurcations, complex dynamics, Mandelbrot set, Julia set, period-doubling cascade, chaos, Feigenbaum's universal constant, Cantor set, topological transitivity, perfect sets, shift map, Sarkovskii's theorem. Systems of linear equations, echelon forms, linear independence, matrix of a linear transformation, matrix operations, matrix inverse, partitioned matrices, determinants, Cramer's rule, eigenvectors and eigenvalues, characteristic equation, eigenvalue decomposition for discrete dynamical systems. Part of new pilot section.

math196 **Mathematics 196**: Putnam Seminar.

1 unit

F. Su and A. Bernoff.

Weekly problem solving seminar in preparation for the Putnam exam. Creative solution methods, oral and written communication of solutions, review of discrete mathematics.

phys23 **Physics 23**: Classical Mechanics.

2 units

T. Helliwell.

Inertial reference frame, Newton's laws, elastic and inelastic collisions, conservation of momentum, center of mass, impulse, uniformly accelerated motion, normal force, isolation diagrams, projectile motion, friction, kinetic and gravitational potential energy, power and work in two and three dimensions, Hooke's law, work-energy theorem, collisions in three dimensions, principle of equivalence.

psycl
3 units

Psychology 1B: Biological Psychology.

J. Bower.

Evolution and genetics, nervous system anatomy, neural conduction, synaptic transmission, research methods, human brain damage, animal models, visual system, sensorimotor system, eating and drinking, hormones and sex, sleeping and circadian rhythms, drug addiction, reward circuits, memory and amnesia, language and lateralization, emotion and stress.

phil112
3 units

Philosophy 112: Logic.

G. Lujan.

Language and fallacies, arguments, types of fallacies (distraction, appeal to motive, changing the subject, inductive, statistical, causal, missing the point, ambiguity, category errors, explanation, definition), the syllogism, immediate inference, Venn diagrams, translation, syllogistic fallacies, propositional logic, truth trees, predicate logic, causal reasoning.