

Bachelor of Science in Physics and Physical Oceanography

Course Code	Course Title	Credits		Course Description	Remarks
Fall of Year 1					
MTH141	Introductory Calculus with Analytic Geometry	4		Topics in analytic geometry, functions and their graphs, limits, the derivative, applications to finding rates of change and extrema and to graphing, the integral, and applications.	
OCG110	The Ocean Planet	3		Introduces the origin and structure of the solar system; interaction of earth's solid interior, oceans' atmosphere and biosphere with emphasis on earth science; energy resources and present environment on Earth.	This course satisfies a general education requirement from the category (N).
PHY203/273	Elementary Physics I	4		Introduction to Newtonian mechanics. Kinematics and dynamics of particles and systems of particles. Motion of rigid bodies and oscillatory motion. Conservation principles. Separate registration for Laboratory [Secs. (01) etc] and Recitation [Secs. (R01) etc].	Consider HPR122A (honors section of PHY203/273) offered every fall semester.
URI101	Freshman Seminar	1			Special section for physics majors offered every fall semester.
	General Education Requirements or Electives	5	17		
Spring of Year 1					
CHM101	General Chemistry I	3		Fundamental chemical concepts and principles. Topics include states of matter, stoichiometry, reactivity, atomic structure, thermochemistry,	This course satisfies a general education

				bonding, molecular structure and solutions.	requirement from the category (N).
CHM102	Laboratory for Chemistry 101	1		Experimental applications of chemical concepts and reactivity emphasizing safety and technique. Experiments follow the content of 101.	
MTH142	Intermediate Calculus with Analytic Geometry	4		Continues the study of calculus for the elementary algebraic and transcendental functions of one variable. Topics include the technique of integration, improper integrals, indeterminate forms, and calculus using polar coordinates.	
OCG123	Oceans, Atmospheres, and Global Change	4		The impact of human activities on the oceans, atmospheric composition, and climate set against a background of natural processes in and history of global changes in climate and ecosystems.	This course satisfies a general education requirement from the category (N).
PHY204/274	Elementary Physics II	4	16	Introduction to electricity and magnetism, leading to Maxwell's equations. Electric fields and Gauss' law; magnetic fields and Ampere's law. Capacitance and inductance, DC and AC circuits. Electromagnetic waves. Separate registration for Laboratory [Secs. (01) etc] and Recitation [Secs. (R01) etc].	Consider HPR122B (honors section of PHY204/274) offered every spring semester.
Fall of Year 2					
CSC211	Introductory Programming and Design	4		Problem specification, solution design, and algorithm development. Object oriented programming and program structure. Functions, selection, iteration, recursion, classes, arrays, and files. Required programs will solve numerical and nonnumerical problems.	
MTH243	Calculus for Functions of Several	3		Topics include coordinates for space, vector geometry, partial derivatives, directional derivatives,	

	Variables			extrema, Lagrange multipliers, and multiple integrals.	
PHY205/275	Elementary Physics III	4		Introduction to topics of thermodynamics, kinetic theory, wave motion, acoustics, and optics. Separate registration for Laboratory [Secs. (01) etc] and Recitation [Secs. (R01) etc].	Consider HPR319Z (honors section of PHY205) offered every fall semester.
	General Education Requirements or Electives	6	17		
Spring of Year 2					
MTH244	Differential Equations	3		Classification and solution of differential equations involving one independent variable. Applications to the physical sciences. Basic for further study in applied mathematics and for advanced work in physics and engineering.	
PHY306	Elementary Modern Physics	3		Introduction to relativistic and quantum physics. Special relativity theory, structure of atoms, molecules, and solids including semiconductor devices; wave and particle properties of matter, Schrodinger equation in one dimension.	
PHY410	Computational Physics	3		Development and application of computer techniques to classical and quantum physics problems. Emphasis will be on approximation techniques and numerical methods for solving matrix, integral, and differential equations arising in physics.	
	General Education Requirements or Electives	8	17		
Fall of Year					

3					
MTH215	Introduction to Linear Algebra	3		Detailed study of finite dimensional vector spaces, linear transformations, matrices, determinants and systems of linear equations.	
PHY322	Mechanics	3		Introduction to Newtonian statics and dynamics using vector analysis; particle motion, Lagrange's equations; rigid body motion. Application to various topics in physical mechanics.	
PHY381	Advanced Laboratory Physics I	3		Key experiments covering a wide range of disciplines including nuclear physics, properties of the electron, magnetism thermodynamics, and optics. Quantitative analysis is stressed, including statistics and curve fitting. Technical skills are developed.	
	General Education Requirements or Electives	8	17		
Spring of Year 3					
MCE354	Fluid Mechanics	3		Physical properties of fluids, development of continuity, energy, and momentum concepts using vector methods; application to problems involving viscous and nonviscous fluids including boundary layer flows, flows in closed conduits and around immersed bodies.	
PHY331	Electricity and Magnetism	3		Electrostatic fields and dielectric materials; magnetic fields, magnetic induction and magnetic materials; introduction to Maxwell's equations.	
PHY382	Advanced Laboratory Physics II	3		Key experiments covering a wide range of disciplines including nuclear physics, properties of the electron, magnetism thermodynamics, and optics.	

				Quantitative analysis is stressed, including statistics and curve fitting. Technical skills are developed.	
	General Education Requirements or Electives	8	17		
Fall of Year 4					
OCG501	Physical Oceanography	3		Basic course covering physical properties of seawater, heat budget, distribution of variables, dynamics, water masses and general circulation, waves and tides.	
PHY401	Seminar in Physics	1		Preparation and presentation of papers on selected topics in physics.	Consider PHY402 in spring as an alternative.
PHY420	Introduction to Thermodynamics and Statistical Mechanics	3		Emphasis on laws of thermodynamics and properties of thermodynamic systems, kinetic theory of gases, molecular velocity distributions, transport phenomena, Maxwell-Boltzmann statistics.	
PHY451	Introduction to Quantum Mechanics	3		Particle-wave duality, uncertainty principle; Schrodinger equation: eigenvalues, wavefunctions, time dependence; Dirac notation; Heisenberg representation: operators, matrices, eigenvectors; angular momentum: spin and polarization, Pauli matrices, hydrogen atom, application to quantum computation; symmetries: conservation laws, fermions and bosons.	
PHY483	Laboratory and Research Problems in Physics	3		Research in current areas of physics. Students perform research projects with individual faculty members. Students may coordinate their research project with a faculty member of the Graduate School of Oceanography.	Senior project at the Graduate School of Oceanography

	General Education Requirements or Electives	3	16		
Spring of Year 4					
OCG510	Descriptive Physical Oceanography	3		Observed distributions of temperature, salinity, currents; methods of deducing deep flow; physical properties of seawater; flow in estuaries; practical work in the analysis of oceanographic data; study of recent literature.	This course can be substituted by OCG594: Principles of Ocean Circulation
PHY425	Acoustics	3		Mathematical theory of vibrating systems; harmonic wave motion. Topics include: transmission and absorption of sound waves, microphones, psychoacoustics, underwater acoustics, and ultrasonics.	This course can be substituted by OCE471: Underwater Acoustics
PHY484	Laboratory and Research Problems in Physics	3		Research in current areas of physics. Students perform research projects with individual faculty members. Students may coordinate their research project with a faculty member of the Graduate School of Oceanography.	Senior project at the Graduate School of Oceanography
PHY510	Mathematical Methods of Physics I	3	12	Topics designed to include applications in physics. Vector and tensor analysis; linear algebra; coordinate systems. Determinants, matrices; introductory group theory. Infinite series, complex analysis, analytic properties, conformal mapping, calculus of residues. Fourier analysis and Laplace transforms.	This course will substitute the required course MTH461, which is not currently offered.
		Total	129		
				Comments [1] The six general education credits in the category (N) are satisfied by any two of the courses	

			<p>OCG110, OCG123, CHM101.</p> <p>[2] Students are encouraged to take OCG451: Oceanographic Science (3) as an elective.</p> <p>[3] Students are encouraged to explore possibilities of conducting research at the GSO during the summer before their senior year.</p>	
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