The Department of PHYSICS AND ENGINEERING

"Never regard study as a duty, but as the enviable opportunity to learn to know the liberating influence of beauty in the realm of the spirit for your own personal joy and to the profit of the community to which your later work."

~ Albert Einstein

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OBJECTIVES

- To prepare students for graduate studies in physics or engineering;
- To prepare students for a career in research or teaching;
- To prepare students for employment in various fields of applied physics and engineering;
- To satisfy pre-professional requirements for students choosing to attend engineering or architectural schools.

TRADITION OF EXCELLENCE...

The Department of Physics and Engineering offers a quality education in one of the best possible environments. The department's newly updated curriculum places PLNU at the cutting edge of physics instruction. Recently, the laboratories have been remodeled and tens of thousands of dollars have been invested into state-of-the-art equipment, which translates into a better education for Point Loma students. One of the advantages of PLNU is the ability to provide students with one-on-one instruction in smaller-sized classes, which means more time to talk with the faculty and more hands on experience with the research-grade equipment. One of the most valuable resources offered at PLNU is the practical work experience students have the opportunity to gain next door to our campus at the Naval Ocean System Center (NOSC) of the U.S. Navy. Many students work part-time in Computer Aided Design (CAD), electronics, and computer science applications. Not only is this a rewarding experience with good pay, it also leads to a government security clearance which is very useful when applying for jobs in defense industries after graduation. Another tradition that has been established in the department is the acceptance of the Junior Engineering Physics and Physics majors into summer research programs at major universities and government agencies. These summer research experiences provide an opportunity for the members of the junior class to begin establishing professional contacts with individuals around the country and significantly enhancing their entrance into the graduate school of choice.

STEP INTO YOUR FUTURE...

Most Physics majors continue their education in graduate school and eventually become research scientists or teachers. The Engineering Physics majors focus on electronic circuit and computer hardware design. Graduates with this major have the option to attend graduate school or enter the job market in industry or government immediately after graduation. Point Loma offers both a Bachelor of Science and a Bachelor of Arts in Physics as well as a Bachelor of Science in Engineering Physics.

FACULTY

Kenneth Aring, Ph.D.
Cornell University

Dee Puntenney, Ph.D.
Purdue University

Keith G. Walker, Ph.D.
University of Oklahoma

CORE CURRICULUM

The following courses are required of all physics and engineering physics majors:

COURSE #	TITLE	UNITS
EGR 110	Graphical and Numerical Methods	1
PHY 241	University Physics I	4
PHY 242	University Physics II	4
PHY 304	Modern Physics	4
PHY 341*	Analytical Mechanics	4
PHY 361	Electricity, Magnetism, and Waves I	3
PHY 401	Thermodynamics	3
PHY 431	Quantum Mechanics	3
PHY 495	Seminar in Physics	1
MTH 164	Calculus I	4
MTH 174	Calculus II	4
MTH 274	Calculus III	4
MTH 334	Applied Mathematics	4
CHE 152	General Chemistry I	4
	TOTAL	47

** Engineering Physics Majors may substitute Engineering 215 for Physics 341.*

RECOMMENDATION

COURSE #	TITLE	UNITS
CSC 134	Intro to Computer Science	4
CSC 154	Fundamentals of Computer Science	4

Engineering Physics (BS) MAJOR

The courses listed below are required in addition to the core curriculum to obtain a BS degree in Engineering Physics.

COURSE #	TITLE	UNITS
EGR 112	Descriptive Geometry	2
EGR 215	Engineering Mechanics	3
EGR 352	Analog Electronics	2
EGR 422	Digital Electronics	2
EGR 432	Computer Interfacing	2
EGR 442	Mobile Robotics	2
PHY 311	Nuclear Physics	3
PHY 362	Electricity, Magnetism, and Waves II	3
PHY 443	Solid State Physics	3
	TOTAL	22

Physics (BS) MAJOR

The courses listed below are required in addition to the core curriculum to obtain a BS degree in Physics.

COURSE #	TITLE	UNITS
CHE 153	General Chemistry II	4
PHY 311	Nuclear Physics	3
PHY 362	Electricity, Magnetism, and Waves II	3
PHY 443	Solid State Physics	3
PHY 481	Atomic, Molecular, and Optics Laboratory	1
CHE 295	Organic Chemistry I ***OR***	
EGR 422	Digital Electronics ***AND***	
EGR 432	Computer Interfacing	4-5
	TOTAL	18-19

Physics (BA) MAJOR

The following courses are required in addition to the core curriculum to obtain a BA in Physics:

COURSE #	TITLE	UNITS
CHE 153	General Chemistry II	4
One of the following courses:		
PHY 311	Nuclear Physics	3
PHY 362	Electricity, Magnetism, and Waves II	3
PHY 443	Solid State Physics	3
	TOTAL	7

Physics MINOR

COURSE #	TITLE	UNITS
PHY 241	University Physics I	4
PHY 242	University Physics II	4
PHY 304	Modern Physics	4

- Eight (8) more hours of physics or engineering courses at level 300 or above.

TOTAL 20

Engineering COURSES

EGR 110 (1) GRAPHICAL AND NUMERICAL METHODS

An introduction to techniques used in scientific analysis, including graphing of data, curve fitting, numerical methods of problem solution, error analysis, and the use of computers for solving problems in physics and engineering. Three hours laboratory each week.

EGR 111 (1) ENGINEERING DRAWING

Fundamentals of drafting methods, orthographic projection, isometric views, sketching, working drawings, and use of Computer Aided Design (CAD). Three hours laboratory each week.

EGR 112 (2) DESCRIPTIVE GEOMETRY

Use of orthographic projection to solve point, line, plane, and space problems of importance to engineering. Includes significant use of Computer Aided Design (CAD). Six hours laboratory each week. ***Prerequisites: Engineering 111, one year of high school drafting, or other equivalent.***

EGR 215 (3) ENGINEERING MECHANICS

Statics of particles and rigid bodies as applied to engineering design. Topics include vector algebra, forces, moments and couples, conditions of equilibrium, friction, and virtual work. Alt.* ***Prerequisite: Physics 241.***

EGR 352 (2) ANALOG ELECTRONICS

AC/DC circuit analysis, transients, characteristics of equivalent circuits for diodes, transistors, power supplies, transistor/operational amplifiers, and feedback applications. Two lectures and one laboratory each week. Alt.* ***Prerequisite: Physics 142 or 242.***

EGR 422 (2) DIGITAL ELECTRONICS

Boolean algebra, logic gates, combinational logic circuits, state minimization, flip/flops, sequential circuits, asynchronous and synchronous counters. Course emphasizes design aspects using electronic design software. Two lectures and one laboratory each week. Alt.* ***Prerequisite: Physics 142 or 242.***

EGR 432 (2) COMPUTER INTERFACING

Design, analysis, and implementation of digital controls systems using microcomputers and microcontrollers. Special attention given to the interfacing of hardware and digital devices to processors and controllers. Two lectures and one laboratory each week. Alt.* ***Prerequisite: Engineering 422.***

EGR 442 (2) MOBILE ROBOTICS

The objective of this course is to use a hands-on approach to introduce the basic concepts in robotics, focusing on mobile robots and the importance of sensors and the integration of those sensors. Also to be discussed are navigation mechanisms and the various robot learning and control paradigms. Two lectures and one laboratory each week. Alt.*

Prerequisite: Engineering 432.

Physics COURSES

PHY 103 (4) EARTH SCIENCE - GE

An introductory survey of the disciplines of geology, oceanography, meteorology, and astronomy, with a discussion of philosophical and societal issues.

Prerequisite: Mathematics 099 or equivalent.

PHY 110 (4) PHYSICAL SCIENCE - GE

An introductory survey of the principles of physics and chemistry with a discussion of societal and environmental issues. Intended for non-science majors. Three units of lecture and one laboratory each week. Identical to Chemistry 110. (Meets a General Education requirement; does not count toward the chemistry or physics major.)

Prerequisite: Mathematics 099 or equivalent.

PHY 141, 142 (4,4) GENERAL PHYSICS I, II - GE

A general introduction to physics including mechanics, thermodynamics, waves and sound, electricity and magnetism, optics, and modern physics. The course is taught primarily at the algebra/trigonometry level but does require limited use of calculus. Meets the professional requirements of life and medical science majors. Four lectures and one laboratory each week.

Prerequisite: Mathematics 123.

Corequisite: Mathematics 145 or consent of instructor.

PHY 241, 242 (4,4) UNIVERSITY PHYSICS I, II - GE

An analytic, calculus-based study of classical physics appropriate for science and engineering majors. Includes mechanics, thermodynamics, electromagnetism, and optics. Four lectures and one laboratory each week. Offered spring-fall.

Prerequisite: Mathematics 145 or 164.

PHY 304 (4) MODERN PHYSICS

An introduction to concepts of modern physics including relativity, quantum theory, atomic physics, and high energy physics. Four lectures and one laboratory each week.

Prerequisite: Physics 142 or 242.

PHY 311 (3) NUCLEAR PHYSICS

A survey of nuclear physics including nuclear models, laws of radioactive decay, radiation detection, and applications of nuclear science in engineering and medicine. Three lectures and one laboratory each week. Alt.*

Prerequisite: Physics 142.

PHY 341 (4) ANALYTICAL MECHANICS

Newtonian mechanics, dynamics of particles and rigid bodies, oscillatory motion, central forces, inertial tensors, Lagrangian and Hamiltonian formulations. Alt.*

Prerequisites: Physics 242 and Mathematics 274.

Recommended: Mathematics 334.

PHY 361, 362 (3,3) ELECTRICITY, MAGNETISM, AND WAVES I, II

Classical electromagnetism including electric and magnetic fields, the electromagnetic properties of matter, Maxwell's equations, and a study of electromagnetic radiation including interference, diffraction, and interaction with material bodies. Alt.*

Prerequisites: Physics 242 and Mathematics 274.

Recommended: Mathematics 334.

PHY 401 (3) THERMODYNAMICS

Fundamental concepts of thermodynamics and statistical mechanics; applications to both classical and quantum systems. Alt.*

Prerequisite: Physics 242.

Recommended: Mathematics 334.

PHY 431 (3) QUANTUM MECHANICS

A rigorous introduction to quantum physics including Schroedinger's equation, matrix mechanics, perturbation theory, and applications in atomic and molecular physics. Alt.*

Prerequisites: Physics 304 and Mathematics 274.

Recommended: Mathematics 334.

PHY 443 (3) SOLID STATE PHYSICS

An introduction to the study of solids, including crystal structure, reciprocal lattices, crystal binding, phonons, and electron band theory. Alt.*

Prerequisite: Physics 431.

PHY 481 (1) ATOMIC, MOLECULAR, AND OPTICS LABORATORY

To learn advanced experimental methods associated with vacuum systems, optical detection in the ultra-violet, visible, and infrared, atomic and molecular spectra, and electron-atomic impact collision phenomena.

Prerequisite: Physics 431.

PHY 490 (1-3) SPECIAL TOPICS IN PHYSICS

The topics in physics chosen depend on regular or visiting faculty expertise as well as student demand. May be repeated as topics vary.

PHY 495 (1) SEMINAR IN PHYSICS

Presentation of papers by students, faculty, and visiting scholars, as well as attendance at seminars at other institutions. May be repeated up to a maximum of four units. Graded Credit/No Credit.

PHY 499 (1-4) SENIOR RESEARCH IN PHYSICS

Independent investigation, under the supervision of a faculty member, of a specific problem in physics or engineering.

Prerequisite: Consent of instructor.