

PHYSICS (PHY)**456****311 Moulton Hall, (309) 438-8756****Web address: www.phy.ilstu.edu****Email address: info@phy.ilstu.edu****Chairperson:** Richard F. Martin, Jr.**Tenured/Tenure-track Faculty:***Distinguished Professor:* Grobe.*Professors:* Clark, Hassani, Holland, Karim, Martin, Ren, Su.*Associate Professors:* Matsuoka, Rosa, Rutherford.*Assistant Professors:* Marx.**General Department Information**

The Physics Major sequences at Illinois State University are sufficiently flexible to serve the needs of students with any of the following goals: (1) government or industrial research and development, (2) graduate study in Physics, or an allied field such as Engineering, (3) high school Physics/Science teaching, or (4) professional study in intellectual property law, patent law, or medicine.

Physics Programs

Degrees Offered: B.S.

MAJOR IN PHYSICS**Physics Sequence:**

- 44 hours in Physics required.
- Required courses: PHY 107, 110, 111, 112, 217, 220, 240, 270 (3 hours), 284, 325, 340, 384; 6 additional hours of 300-level Physics courses; CHE 140 and 141 are also required for the major.

Computer Physics Sequence:

- 43 hours in Physics required.
- Required courses: PHY 107, 110, 111, 112, 217, 220, 240, 270 (1 hour), 284, 318, 325, 388, 390; 6 additional hours of 300-level Physics courses, of which at least 1 course must be chosen from PHY 320, 340 and 384; ITK 254; majors should take Natural Science Alternative General Education courses.

Engineering Physics Program with University of Illinois or Other Approved Engineering University:

- 44 hours total in Physics and Engineering required.
- Required courses: PHY 107, 110, 111, 112, 217, 220, 240, 270 (1 hour), 284; 17 additional hours of approved upper division courses transferred from the chosen engineering university; CHE 140 and 141 are also required.
- Offered previously as Affiliated Engineering.

Teacher Certification Sequence:

- 40 hours in Physics required. Part of entitlement program leading to science certification at the secondary level.
- Required courses: PHY 107, 110, 111, 112, 205, 209, 217, 220, 270 (2 hours), 302, 310, 311, 312 and 353. Majors must also take either PHY 240 or 284. CHE 140 and 141 are also required for this major.

MINOR IN PHYSICS

- 23 hours in Physics required.
- Required courses: PHY 110, 111, 112; 11 additional hours of electives from 200- or 300-level Physics courses.

MINOR IN PHYSICS**For Teacher Education:**

- 26 hours in Physics required.
- Required courses: PHY 110, 111, 112, 270 (1 hour), 311.

CLINICAL EXPERIENCES IN TEACHER EDUCATION

Clinical Experiences are provided in off-campus clinical teaching centers, in local schools and in campus laboratory schools, in agencies and other approved non-school settings. All students will show verification of having completed pre-student teaching field experiences commensurate with attaining local, state, and national standards. Students must provide their own transportation to Clinical Experience sites.

The approximate number of clinical hours and type of activity associated with each course offering can be found with the appropriate course description. The following legend relates to the type and kind of activity related to a specific course.

Clinical Experiences Legend

1. Observation
2. Tutoring one-on-one contact
3. Non-instruction assisting
4. Instructional aiding a group
5. Micro teaching
6. Simulation lab exercises
7. Work with clinic client
8. Graduate practicum
9. Professional meeting
10. Other

Physics Courses**102 ATOMS TO GALAXIES IC-NS 3**

Not for cr maj/min or if had PHY 105, 108, or 110. May not be taken under the CT/NC option. Lecture and lab.

Concepts, history, and methodology of physical ideas such as motion, thermodynamics, electromagnetism, quanta, and relativity with interrelationships and applications.

- 105 FUNDAMENTALS OF PHYSICS** **IC-NSA 4**
Not for cr if had PHY 108, 110 or equiv. Lecture and lab. Intended for students not maj or min in the physical sciences. May not be taken under the CT/NC option.
 Concepts and principles of mechanics, heat, wave motion, electricity, magnetism, and light. Applications to everyday life.
- 107 FRONTIERS OF PHYSICS 2**
Designed for students in all physics sequences. Materials charge optional. CR/NC only.
 An introduction to selected contemporary topics in pure and applied physics. Orientation to physics and allied fields such as engineering as discipline and profession.
- 108 COLLEGE PHYSICS I IC-NSA 5**
2 years of high school algebra or equiv req. Not for cr if had PHY 110 or equiv. Lecture and lab. May not be taken under the CT/NC option.
 Basic principles of mechanics, wave motion, sound and heat, developed with algebra. Includes diverse scientific and technological applications.
- 109 COLLEGE PHYSICS II 5**
PHY 108 or 110 req. Not for cr if had PHY 111 or equiv. Lecture and lab. Continuation of PHY 108.
 Electrostatics, electrical currents, magnetism, light and optical instruments, quantum, atomic, and nuclear physics, special relativity.
- 110 PHYSICS FOR SCIENCE AND ENGINEERING I IC-NSA 4**
MAT 145 or conc reg req. Lecture and lab. May not be taken under the CT/NC option. Not for cr if had PHY 108 or equiv. Materials charge optional.
 Basic principles of mechanics, wave motion, and sound, developed with calculus. Includes diverse scientific and technological applications.
- 111 PHYSICS FOR SCIENCE AND ENGINEERING II 4**
PHY 110; MAT 146 or conc reg req. Not for cr if had PHY 109 or equiv. Lecture and recitation. Lab (every other week). Continuation of PHY 110. Materials charge optional.
 Thermodynamics, electrostatics, electrical currents and circuits, magnetism, Faraday's Law.
- 112 PHYSICS FOR SCIENCE AND ENGINEERING III 4**
PHY 111; MAT 147 or conc reg req. Lecture and lab. Materials charge optional.
 Electromagnetic waves, optics, relativity, quantum theory, atomic and nuclear physics. Lectures, demonstrations, discussions, laboratory exercises, computer lab.
- 117 NUMERICAL REASONING IN NATURE AND TECHNOLOGY MC-QR 3**
MAT 111, 120, 130, or 145 req. May not be taken under the CT/NC option.
 Logical, analytical, mathematical, and computational skills important to quantitative understanding of topics in nature and technology.
- 152 STATICS 3**
PHY 110 and MAT 147 req.
 Analysis of force systems; equilibrium of two- and three-dimensional systems; trusses, frames, friction; centroids; moments of inertia; hydrostatic pressure on submerged bodies; principle of virtual work.
- 201 ASTRONOMY LABORATORY 2**
PHY 101 and cons inst req; PHY Ed maj only; course may not be taken in fulfillment of ISBE req for second area certification.
 Optional lab to complement and extend concepts presented in PHY 101. Special emphasis placed on the role of astronomy in the secondary school curriculum.
- 205 ORIGIN OF THE UNIVERSE OC-SMT 3**
Inner Core and PHY 102 req. MC-QR category req.
 Big Bang Theory; observational and theoretical basis for its development; the early universe; and connection between the universe and subatomic particles.
- 206 CHAOS AND COMPLEXITY OC-SMT 3**
Inner Core req. MC-QR category req.
 Chaos and complexity science in historical/social context, strange attractors, fractals, and self-organization; diverse applications from weather forecasting to artificial life.
- 207 ENERGY AND SOCIETY OC-SMT 3**
Inner Core req. MC-QR category req.
 Scientific, technological, environmental, economic, health, ethical, and political aspects of energy production and use, from fossil and nuclear fuels to renewable energy sources.
- 209 INTRODUCTION TO TEACHING HIGH SCHOOL PHYSICS 1**
10 hrs in PHY req. Physics Teacher Ed maj/min only. Clin Exp: 25 hrs, Type 1-6.
 A weekly seminar in which students exchange information and share reflections derived from clinical observations made in area high schools.
- 217 METHODS OF THEORETICAL PHYSICS 3**
PHY 111; MAT 147; MAT 175 or conc reg req.
 Mathematics applied to physics: multivariate calculus, vector and tensor analysis, curvilinear coordinates, complex numbers, differential equations, numerical methods.
- 220 MECHANICS I 3**
PHY 112 and MAT 147 req.
 Newton's laws applied to the study of motion of point masses subjected to viscous, frictional, elastic, central, harmonic, interparticle, and conservative forces.
- 240 ELECTRICITY AND MAGNETISM I 3**
PHY 217 req.
 Electrostatic fields and potentials in vacuum, Gauss' law, electrostatics of dielectrics, magnetostatics, Biot-Savart, Ampere, and Faraday laws, magnetic induction, magnetic materials, and Maxwell's equations.

270 EXPERIMENTAL PHYSICS 1
PHY 112 and 220 req; ENG 249 rec. Repeatable for cr up to max of 3 hrs total.

Laboratory experiments that demonstrate principles of mechanics, electricity, magnetism, optics, and modern physics. Emphasis on experimental technique, analysis, and on the quality of written reports.

284 QUANTUM MECHANICS I 3
PHY 112 and MAT 175 req. PHY 217 or conc reg req.

Blackbody radiation, photoelectric effect, wave-particle duality, uncertainty principles, Schrodinger equation, probability amplitudes, one-dimensional potentials, hydrogen atom.

290 RESEARCH IN PHYSICS 1-3
20 hrs Physics req. May be repeated; max 3 hrs conference, lab or library research per week for each hr of cr.

An introduction to the scientific discovery process through participation in a departmental research program.

302 COMPUTER APPLICATIONS IN HIGH SCHOOL PHYSICS 1
1 hr of PHY 270 req.

Applications of computers in teaching of high school physics.

310 READINGS FOR TEACHING HIGH SCHOOL PHYSICS 3
10 hrs in PHY req.

Essential background readings for teaching high school physics that center around developing scientific literacy in students.

311 TEACHING HIGH SCHOOL PHYSICS 3
18 hrs in PHY req; PHY 310 req; C or better in C&I 216 or conc reg req. Clin Exp: 10 hrs, Type 1-6.

Strategies, curricula, and resources for the teaching of high school physics. Application of knowledge of physics, adolescent psychology, and pedagogical theory to secondary teaching.

312 PHYSICS TEACHING FROM THE HISTORICAL PERSPECTIVE 3
20 hrs in PHY req. Adm to Professional Studies req.

Overview of the development of classical scientific thought relating to physical phenomena with applications to pedagogy.

318 METHODS OF COMPUTATIONAL SCIENCE 3
ITK 165; CHE 140; PHY 109 or 111; CHE 360 or PHY 220 or conc reg; or cons inst req. Also offered as CHE 318. Formerly PHY 288.

Introduction to a wide variety of computational techniques and their application to problems in chemistry and physics.

320 MECHANICS II 3
PHY 220 and MAT 340 req.

Coordinate transformations, nonlinear oscillations, Hamilton's Principle, Lagrangian and Hamiltonian mechanics, rigid body motion.

325 THERMAL PHYSICS 3
PHY 284 req.

Thermodynamics, kinetic theory, and statistical mechanics with discussion on phase transitions and critical phenomena.

330 OPTICAL PHYSICS 3
PHY 240 req.

Optical systems, electromagnetic waves, interference and diffraction, quantum optics.

340 ELECTRICITY AND MAGNETISM II 3
PHY 240 and MAT 340 req.

Electrostatic boundary value problems; Maxwell's equations; polarization, reflection, and transmission of electromagnetic waves, waveguides; electromagnetic radiation, fundamentals of antenna theory, relativistic electromagnetism.

353 STUDENT TEACHING SEMINAR 1
Conc reg in STT 399.72 req. Clin Exp: 15 hrs, Type 1-6.

A seminar through which students exchange information, share reflections, and document observations and activities prior to and during student teaching.

355 SOLID STATE PHYSICS 3
PHY 325 req.

Crystal structures, X-ray and electron diffraction, lattice vibrations and thermal properties, binding energy, conduction of electrons, band theory, dielectric and magnetic properties, defects, metals, semiconductors, and insulators.

375 ELECTRONICS FOR SCIENTISTS 3
PHY 109 or 111 req. Lecture and lab

DC and AC circuit analysis with an introduction to the electrical properties of semiconductors; theoretical and experimental analysis of semiconductor diode, transistor, and operational amplifier circuits.

380 TOPICS IN CONTEMPORARY PHYSICS 1-3
Sr standing only. Cons inst req. May be repeated.

Recent developments in the fields of atomic, biomolecular, elementary particle, many-body, molecular, nonlinear, nuclear, plasma, and solid-state physics.

384 QUANTUM MECHANICS II 3
PHY 284 and MAT 340 req.

Operator formalism, Dirac bra and ket notation, angular momentum, perturbation theory, applications to laser physics.

387 METHODS OF MATHEMATICAL PHYSICS 3
PHY 240 and MAT 340 or conc reg req.

Finite- and infinite-dimensional vector spaces, matrices and determinants, Fourier analysis, complex analysis, differential equations. Emphasis on physical applications.

388 ADVANCED COMPUTATIONAL PHYSICS 3
PHY 220, 240, 284, and 318 or cons inst req.

Application of computational methods to contemporary topics in physics, including nonlinear classical and quantum dynamics or physical problems that involve many degrees of freedom.

**390 COMPUTATIONAL RESEARCH
IN PHYSICS** 1-2
PHY 388 req.

Independent computational project in physics.

**POLITICS AND GOVERNMENT
(POL)** 460

401 Schroeder Hall, (309) 438-8638
Web address: www.politicsandgovernment.ilstu.edu

Chairperson: Jamal Nassar.

Tenured/Tenure-track Faculty:

Distinguished Professor: Payne.

Professors: Bradley, Crothers, Lind, Nassar, Parodi, Wang.

Associate Professors: Kiser, Klass, Pope, Riaz.

Assistant Professors: Cox, Gelbman, Riverstone, Shapiro, Shawki, Tamas, Webber, Weiden.

General Department Information

The Department of Politics and Government provides students with a program that offers a broad liberal education and at the same time provides opportunities to begin a specialized concentration in one area of the discipline such as public service or global studies. The study of political science leads into careers in law and paralegal services; local, state, and federal governments and not-for-profit agencies; international public and private organizations; teaching and research; and in the private sector—especially government-related activities of business. Career information, including career-related courses offered by other departments, is available from the Department’s undergraduate, concentration, and pre-law advisors. Teacher Education students majoring in Political Science fulfill Professional Education requirements through the Social Sciences program.

INTERDISCIPLINARY MINORS

The Department of Politics and Government participates in a number of interdisciplinary minors at the University. Course work offered by the Department contributes to the following minors: African-American Studies, African Studies, Environmental Studies, Ethnic and Cultural Studies, International Studies, Middle Eastern and South Asian Studies, Peace and Conflict Resolution Studies, Tourism Studies, Urban Studies, and Women’s and Gender Studies. For further information on any of these minors and their advisors, please consult the University-Wide Curriculum section in this *Undergraduate Catalog*.

HONORS IN POLITICS AND GOVERNMENT

Students majoring or minoring in Political Science may be admitted to the Departmental Honors Program if they have: (1) completed at least 30 semester hours of college- or university-level courses, including at least 2 Political Science courses; (2) a minimum of 3 semesters remaining

before graduation; (3) a cumulative GPA of 3.30; (4) one letter of recommendation submitted by a Politics and Government faculty member to the undergraduate advisor; (5) membership in the University Honors Program; and (6) admission approval from the Departmental Honors Advisor.

In order to graduate with honors in Politics and Government a student must complete: (1) all regular requirements for the Political Science Major; (2) 3 hours of in-course honors; (3) 3 hours in POL 302: Honors Seminar; (4) 3 hours of POL 299: Independent Honors Study; and (5) have a major GPA of at least 3.50.

Any student admitted to the University Honors Program may earn honors credit by completing the honors requirements of either a designated honors course or of a course offering an in-course honors option.

Politics and Government Programs

Degrees Offered: B.A., B.S.

MAJOR IN POLITICAL SCIENCE

- 34 hours in Politics and Government including at least 18 hours at the 200-level or above and at least 6 hours at the 300-level (excluding internships, independent studies, and readings courses).
- Required courses: POL 105 or 106, 161, 138; either 140, or 141 and either 150 or 151, and 390.
- POL 390, the capstone experience, may be taken after completion of 90 hours and is taken concurrently with one of the following options with permission of the advisor, chair, or faculty member teaching the course:
 - an internship of 3 or more credits, or
 - an overseas academic experience, or
 - a 3 credit independent study project or honors project, or
 - a senior project that is contractually negotiated between the faculty member and the student in a 300-level POL course.
- A maximum of 6 hours in POL 398.01 and 398.20 may count toward a Political Science major.
- It is recommended that Political Science majors enroll in POL 105 or 106 in their first year of study and in POL 138 in their second year of study. Transfer students wishing to complete the Major are recommended to enroll in POL 105 or 106 and 138 in their first year at Illinois State University if they have not already had equivalent courses.

Global Studies Sequence:

- 12 credits in Politics and Government International Relations and Comparative courses as well as completing the POL major. Up to 18 hours outside the Department may be required (see below).
- **International Relations Component.** 6 hours from the following courses: POL 251, 252, 254, 255, 293.01, 335, 344, 351, 358, 363.