436. Philosophical Logic
Winter, 4(4-0) May reenroll for a maximum of 8 credits if different topic is taken. PHL 337 or approval of department. Such topics as metaphysics, model theory, artificial intelligence and deviant logics, e.g., logic of existence, intuitionist logic, many valued logic.

440. Epistemology
Fall of even-numbered years, 4(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department. Study of evidence, grounds of assent, conviction, belief, and certainty.

445. Metaphysics
Fall of odd-numbered years, 4(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department. Fundamental concepts and categories in metaphysics: substance, process, cause, universal, particular, space, time, endurance, eternity, change, and value.

447. Philosophy of Mind
Winter, Spring, 4(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department. Examines classical and contemporary treatments of such concepts as "mind", "self", "intentionality", "mental act", and associated problems (the body-mind relation, "thinking", machines, the connection of thought with action, etc.).

460. Moral and Political Issues
Fall, Spring, 4(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department. Philosophical aspects of such issues as freedom of speech and action, civil disobedience, violence, war, justice and equality, human rights and punishment.

480. The Nature of Scientific Theory and Explanation
Winter, 4(4-0) PHL 337 or approval of department. Topics such as: the logical structure of scientific theories, empirical meaningfulness and testability, deductive and probabilistic explanation, prediction.

481. Foundations of Scientific Inference
Spring, 4(4-0) PHL 337 or approval of department. Topics such as: discovery vs. validation of theories, probability, induction and confirmation theory.

484. Philosophy of Biological Sciences
Spring, 4(4-0) Nine credits in science or approval of department. Interdepartmental with and administered by Lyman Briggs School. Methodological notions and problems of the biological sciences such as: observation and measurement, classification, teleological and functional explanation, teleological systems, emergenesis, vitalism, value neutrality.

485. Philosophy of the Social Sciences
Spring, 4(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or 9 credits, other than basics, in social science or approval of department. Selected problems in the methodology of the behavioral sciences, including such topics as: concept formation and theory construction, explanation and insight, subjectivity and value judgments, emergence and teleology, historicism, reductionism, measurement, and statistical inference.

490. Individual Reading
Fall, Winter, Spring, Summer. 1 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department. Supervised reading on a particular author or topic.

494. Special Topics (MTC)
Fall, Winter, Spring, 2(2-0) to 6(0-0) May reenroll for a maximum of 12 credits if different topics are taken. Approval of department. Intensive study of some particular problem or author in philosophy.

495. Seminar in Philosophy
Winter, Spring, 1 credit. May reenroll for a maximum of 4 credits. Juniors. Fifteen credits in philosophy or approval of instructor. Each section will examine a particular topic or author. Emphasis on discussion of student papers.

805. Business Ethics
Spring, 4(4-0) Graduate student in the College of Business or approval of instructor. Interdepartmental with General Business—Business Law Programs. Ethical dimensions of such topics as corporate responsibility, preferential hiring, profit and taxation, deception and bribery, self-regulation versus government regulation, "whistleblowing", and advertising. Readings from philosophical and business sources.

825. Seminar in the History of Philosophy
Fall, Winter, Spring, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

830. Seminar in Ethics
Winter, Spring, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

837. Seminar in Logic
Fall, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

841. Seminar in Epistemology
Fall, Winter, Spring, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

845. Seminar in Metaphysics
Fall, Winter, Spring, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

860. Seminar in Social Philosophy
Spring, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department. Philosophy of law and of the state.

870. Seminar in the Philosophy of Language
Fall. 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department. Concrete bases of language and nature of meaning.

880. Seminar in Philosophy of Science
Fall, Winter, 2 to 4 credits. May reenroll for a maximum of 12 credits. Approval of department.

890. Graduate Reading Course
Fall, Winter, Spring, Summer. 1 to 10 credits. May reenroll for credit. Approval of department. Supervised reading course for advanced graduate students for more thorough investigation of special fields.

899. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.
Descriptions — Physics and Astronomy of Courses

Lecture-Recitation Format
227, 228, 230, four credits each, designed primarily for students with interests in the life and earth sciences. The mathematics prerequisite is credit for or concurrent enrollment in college algebra and trigonometry (MTH 109 or 111).

228, 229, 230, 231, four credits each, designed primarily for students with interest in the physical sciences, mathematics and engineering. The mathematics prerequisite is credit for or concurrent enrollment in calculus III with vectors (MTH 214).

231H, 231H, 233, 234, four credits each, designed primarily for Physics majors and others with a special interest in Physics. The mathematics prerequisite is credit for or concurrent enrollment in calculus III with vectors (MTH 214). The Honors section recommended.

Competency Based Instructional Format
237B, 238, 239B, an alternate way to earn credit in 237, 238, an alternate way to earn credit in 239B, 239, 239B, 239, three credits each, designed for students with interest in the natural sciences, including the life and earth sciences. The mathematics prerequisite in Calculus and Analytic Geometry I (MTH 112).

237A, 288A, 289A, one credit each, to follow 237, 238, 239 to give a four credit per term introductory series. However, 237A may not be taken concurrently with 237, 238A may not be taken concurrently with 238, and 239A may not be taken concurrently with 239B.

237B, 238B, 239B, in which the four credit introductory series is covered in one term for each course.

237A, 239A, one credit each to follow 231, 238A, 239A, 239A or 238, 239, 237B, 238B, 239B to give a five credit introductory series.

239B, 239B, 239B in which the five credit introductory series is covered in one term for each course.

The courses taught via the two formats may be grouped to give a wide variety of introductory physics courses. The following equivalences exist:

237, 238, 239 may be taken as 237B, 238, 239.

237, 238, 239 may be taken as 231, 238A, 239, 239A or 237B, 238B, 239B.

239B, 239B, 239B may be taken as 281, 287A, 287A, 289A, 289A or 237B, 238, 239, 237B, 238B, 239B to give a five credit introductory series.

A student may change from one group of introductory courses to another, but may not earn credit for more than one complete sequence. This statement also applies to the Lyman Briggs School Physics courses LBS 162, 261, and 263 except that credit for LBS 162 may be earned in addition to calculus-based introductory physics courses.


201, 203, 205, 227, 229, and 357 cannot be used to meet the requirements for a major in Physics or Astronomy and Astrophysics.

Prerequisites to nearly all the first courses in the 230, 280 level course sequences are stated in terms of the Introductory Physics courses. The course selected for prerequisite is that which requires the least number of credits and the least mathematical background the department considers adequate. The corresponding term of any introductory sequence that requires a mathematics background equal to or greater than that of the stated prerequisite may be substituted for the stated prerequisite.

All 400 level physics courses (except 430 and 431) require 283 or 289H.

201. The Science of Sound I: Rock, Bach and Oscillators (N)
Winter, 4(4-0) Interdepartmental with the Department of Mechanical Engineering.

203. Science of Light and Color (N)
Spring, 4(4-0)

205. Bohr and Einstein: The Concept of Nature in Our Day (N)
PHY 301. Fall, 4(4-0)
Basic contemporary ideas about the natural world and their significance presented through study of the lives of Niels Bohr (quantum theory) and Albert Einstein (relativity theory).

227. Physics for Audiology and Speech Sciences
Fall, Spring, 4(4-0) MTH 108. Not open to students with credit in PHY 237. Interdepartmental with the Department of Audiology and Speech Sciences.
Introductory physics for Audiology and Speech Sciences majors: kinematics, Newton's Law, conservation of energy and momentum, statics and vibrations, sound propagation, resonance, and speech production.

237. Introductory Physics
Fall, Winter, Spring, 3(4-0) MTH 109 or MTH 111 or concurrently. Not open to students with credit in PHY 227. Mechanics, including Newton's Law, momentum, energy, and conservation laws.

237B. Introductory Physics I, CBI
Fall, Winter, Spring, 3 credits. PHY 237B or MTH 111 or concurrently. Mechanics including Newton's Law, momentum, energy, and conservation laws.

238. Introductory Physics
Fall, Winter, Spring, 3(4-0) PHY 237. Heat, electricity and magnetism.

238B. Introductory Physics II, CBI
Fall, Winter, Spring, 3 credits. PHY 237B or PHY 238. Heat, electricity and magnetism.

239. Introductory Physics
Fall, Winter, Spring, 3(4-0) PHY 238. Wave motion, sound, light, and modern developments.

239B. Introductory Physics III, CBI
Fall, Winter, Spring, Summer, 3 credits. PHY 238B or PHY 239.
Wave motion, sound, light and modern developments.

239B. Energy Consumption and Environmental Quality (N)
Spring, 4(4-0) Interdepartmental with Lyman Briggs School.
The role of energy as a fundamental pollutant will be discussed along with the availability of fossil energy sources. Limitations on the safe utilization of both fossil and nuclear energy will also be considered.

255. Introductory Physics Laboratory
Fall, Winter, Summer, 1(0-2) PHY 237 or PHY 238 or concurrently.
Mechanics and heat.

255. Introductory Physics Laboratory
Winter, Spring, Summer, 1(0-2) PHY 238 or PHY 239 or concurrently.
Mechanics and heat.

281. Basic Physics I, CBI
Fall, Winter, Spring, Summer, 3 credits. MTH 112.
Statistical equilibrium, Newton's laws, power, harmonic motion, rotational motion.

282. Basic Physics II, CBI
Fall, Winter, Spring, Summer, 3 credits. PHY 281.
Microscopic origin of heat flow and first law of thermodynamics, electric and magnetic forces and sources, direct currents.

283. Basic Physics III, CBI
Fall, Winter, Spring, 3 credits. PHY 282.
Physics of sound, light, and optical instruments, wave-particle duality, radioactivity, fusion and fission, elementary particles, fundamental forces of nature.

284. Calculus Concepts in Physics I, CBI
Fall, Winter, Spring, 3 credits. PHY 284, MTH 113.

285. Calculus Concepts in Physics II, CBI
Fall, Winter, Spring, Summer, 2 credits. PHY 285, MTH 214.
Extension of PHY 238 involving calculus concepts. PHY 238 plus PHY 285 equals PHY 288. Electrostatic interactions, magnetic fields: forces and sources, magnetostatics, and electrical circuits.

286. Calculus Concepts in Physics III, CBI
Fall, Winter, Spring, Summer, 2 credits. PHY 286, MTH 214.
Extension of PHY 239 involving calculus concepts. PHY 239 plus PHY 286 equals PHY 289. Wave Phenomena, photons, atomic states and transitions, quantum mechanics, subatomic phenomena.
287. Principles of Physics
Fall, Winter, Spring, 4(3-0) MTH 113.

Mechanics.

287A. Physics IA, CBI
Fall, Winter, Spring, Summer, 1 credit. MTH 113; PHY 287A; PHY 287B. May not be taken concurrently with PHY 281.

Extensions of PHY 281, plus topics from: frames of reference, special relativity, rocket equation, forced oscillations, resonances, fluid motion, numerical (computer) solutions, moments of inertia, gyroscopic motion.

287B. Principles of Physics I, CBI
Fall, Winter, Spring, Summer, 4 credits. MTH 113.
The CBI version of PHY 287. Course content is identical to content of PHY 281 plus PHY 287A.

288. Principles of Physics
Fall, Winter, Spring, 4(3-0) PHY 287; MTH 214 or approval of department.

Heat and thermodynamics, electricity and magnetism.

288A. Physics IIA, CBI
Fall, Winter, Spring, Summer, 1 credit. PHY 282, MTH 214 or approval of department. May not be taken concurrently with PHY 282.

Extensions of topics from PHY 282, plus topics from: entropy, transport phenomena, general relativity, electrons, atoms, molecules, solids, electromagnetic fields, energy, alternating currents, numerical (computer) solutions.

288B. Principles of Physics II, CBI
Fall, Winter, Spring, Summer, 4 credits. PHY 287, PHY 287A or PHY 287B, MTH 214 or approval of department.
The CBI version of PHY 288. Course content is identical to content of PHY 283 plus PHY 288A.

289. Principles of Physics
Fall, Winter, Spring, 4(3-0) PHY 288; MTH 214 or approval of department.

Wave motion, sound, light, and modern developments.

289A. Physics IIIA, CBI
Fall, Winter, Spring, Summer, 1 credit. PHY 283, MTH 214 or approval of department. May not be taken concurrently with PHY 283.

Extensions of the PHY 283 material plus topics from: spectral origins and analysis, optics, standing wave phenomena, diffraction, quantum mechanics, numerical (computer) solutions, radioactivity, elementary particles.

289B. Principles of Physics III, CBI
Fall, Winter, Spring, Summer, 4 credits. PHY 288, PHY 288A, or PHY 288B, MTH 214 or approval of department.
The CBI version of PHY 289. Course content is identical to content of PHY 290 plus PHY 290A.

291A. Honors Physics IA, CBI
Fall, Winter, Spring, Summer, 1 credit. PHY 287A, MTH 113.
Subjects and topics as in PHY 281 and PHY 287A, generally on a more advanced level.

291B. Honors Physics IB, CBI
Fall, Winter, Spring, Summer, 5 credits. MTH 113.
Combined material of PHY 281 plus PHY 287A plus PHY 291A is taken in one term.

291H. Physics I Spring, 4(4-0) MTH 214 (honors section recommended) or concurrently.

Three term course sequence in elementary physics consisting of PHY 291H, 292H, 293H. In this sequence the principles of physics are presented in a unified manner that emphasizes modern concepts. Mechanics, including special relativity.

292A. Honors Physics IIA, CBI
Fall, Winter, Spring, Summer, 1 credit. PHY 288, MTH 214.

Subjects and topics as in PHY 282 and PHY 289A, generally on a more advanced level.

292B. Honors Physics IIB, CBI
Fall, Winter, Spring, Summer, 5 credits. PHY 291B, MTH 214.

Combined material of PHY 283 plus PHY 287A plus PHY 292A is covered in one term.

292H. Physics II
Fall 4(4-0) PHY 291H, MTH 214 or concurrently.

Continuation of PHY 291H. Electricity and magnetism with some special relativity.

293A. Honors Physics IIA, CBI
Fall, Winter, Spring, Summer, 1 credit. PHY 289A, MTH 215.
Subjects and topics as in PHY 283 and PHY 291A, generally on a more advanced level.

293B. Honors Physics IIB, CBI
Fall, Winter, Spring, Summer, 5 credits. PHY 291B, MTH 215.

Combined material of PHY 283 plus PHY 287A plus PHY 293A is covered in one term.

293H. Physics III
Winter, 4(4-0) PHY 292H.

Continuation of PHY 292H. Wave physics including optics.

296. Physics Computing Laboratory
Spring, 3(3-0) CPS 112 or CPS 251, MTH 214 or concurrently, PHY 287 or PHY 297 or concurrently.

Interfacing of microcomputers to laboratory equipment for control and data taking, simulation in mechanics, methods of applying computer to physics problems.

297. Principles of Physics Laboratory
Fall, Winter, Spring, 1(0-2) PHY 281 or concurrently.

Mechanics including data and error analysis.

299. Principles of Physics Laboratory
Winter, 1(0-2) PHY 291 or concurrently, PHY 297 or approval of department.

Heat and thermodynamics, electricity and magnetism.

304. Special Problems
Fall, Winter, Spring, Summer, 1 to 5 credits. May reenroll for a maximum of 5 credits. Approval of department.
404. Special Problems
Fall, Winter, Spring, Summer. 1 to 5 credits. PHY 289 or PHY 293H; approval of department.

419. Physical Phenomena and Electronic Instrumentation I
Winter. 4(3-3) PHY 289, PHY 298 or approval of department, MTH 215. Interdepartmental with Electrical Engineering.

420. Physical Phenomena and Electronic Instrumentation II
Spring. 3(2-3) PHY 419.

427. Intermediate Mechanics
Fall, Summer. 3(3-0) PHY 289; MTH 310 or concurrently.

429. Advanced Mechanics
Spring. 3(3-0) PHY 428.

430. Introduction to Radioactivity and Radiostotope Techniques
Spring. 3(3-0) One-year course of general college chemistry and physics. Interdepartmental with the Department of Chemistry.

431. Laboratory for Radioactivity and Radiostotope Techniques
Spring. 1(0-3) CEM 161, PHY 430 concurrently. CEM 162 recommended. Interdepartmental with the Department of Chemistry.

432. Geometrical Optics
Fall. 4(3-3) PHY 289, PHY 299 or approval of department, MTH 215.

433. Physical Optics
Winter. 2(3-3) PHY 289, PHY 299 or approval of department, MTH 215.

434. Electricity and Magnetism I
Fall, Summer. 3(3-0) Electricity and Magnetism II.

435. Electricity and Magnetism II
Winter, Summer. 3(3-0) PHY 447.

436. Electronic Instrumentation
Spring. 3(3-0) PHY 419.

437. Intermediate Mechanics
Winter, Summer. 3(3-0) PHY 427.

438. Introduction to Solid State Physics
Fall. 3(3-0) PHY 391.

439. Quantum Physics I
Fall. Summer. 3(3-0) PHY 391.

440. Quantum Physics II
Winter, Summer. 3(3-0) PHY 492.

441. Electromagnetic Theory I
Fall. 3(3-0) PHY 428, PHY 446.

442. Introduction to Electromagnetic Theory I
Fall. 3(3-0) PHY 428, PHY 446.

443. General Physics (General)
Fall. 3(3-0) Graduate students; or approval of department.

444. General Physics (Nuclear)
Fall. 3(3-0) Graduate students; or approval of department.

445. Laboratory for Solid State Physics
Fall. Summer. 3(3-0) PHY 391.

446. Quantum Physics I
Fall. Summer. 3(3-0) PHY 391.

447. Quantum Physics II
Winter, Summer. 3(3-0) PHY 492.

448. Quantum Physics III
Winter, Summer. 3(3-0) PHY 492.

449. Advanced Physics Laboratory (General)
Fall. 3(3-0) 15 credits in PHY 281 and above including PHY 298 and PHY 299.

450. Advanced Physics Laboratory (Nuclear)
Fall. 3(3-0) 15 credits in PHY 281 and above including PHY 298 and PHY 299.

451. Advanced Physics Laboratory (Solid State)
Spring. 3(3-0) 15 credits in PHY 281 and above including PHY 298 and PHY 299.

452. Advanced Physics Laboratory (Nuclear)
Fall. 3(3-0) 15 credits in PHY 281 and above including PHY 298 and PHY 299.

453. Advanced Physics Laboratory (Solid State)
Spring. 3(3-0) 15 credits in PHY 281 and above including PHY 298 and PHY 299.

454. Physical Optics
Winter. 3(3-0) PHY 289, PHY 299 or approval of department, MTH 215.

455. Physical Optics
Winter. 3(3-0) PHY 289, PHY 299 or approval of department, MTH 215.

456. Electromagnetic Theory I
Fall. 3(3-0) PHY 428, PHY 446.
845.  Electromagnetic Theory II  
Winter. 3(3-0) PHY 847.  
Multipole and multipole expansions; electrote­  
natics of macroscopic materials, dielectrics,  
magnetostatics, vector potential, magnetic  
memants; Maxwell's equations for time-varying  
fields, energy and momentum conservation.  
Plane electromagnetic waves and polarization.  

849.  Electromagnetic Theory III  
Spring. 3(3-0) PHY 849.  
Wave guides and resonant cavities, boundary-  
value problems. Simple radiating systems,  
tenna. Special relativity, covariance of  
electromagnetic phenomena. Transmission of  
electromagnetic fields. Radiation by moving charges, Lorentz-  
Wienert potentials.  

850.  Electrodynamics of Plasmas I  
Fall. 3(3-0) E E 835 or PHY 448; E E  
854. Interdepartmental with Astronomy  
and Astrophysics, and Electrical Engineering.  
Adinistered by Electrical Engineering.  
Boltzmann equation: moment equations; two-  
fluid theory of plasma, waves in cold, warm  
and anisotropic infinite plasma; waves in bounded  
plasma structures, energy flow in anisotropic plasmas.  

857.  Theoretical Mechanics I  
Winter. 3(3-0)  
Two-body central force problems, rigid body  
small motions, oscillations, Hamilton's principle,  
Lagrangean and Hamiltonian formalism for  
particles and fields, canonical transformations,  
relativity.  

858.  Theoretical Mechanics II  
Spring. 3(3-0) Approval of depart­  
ment.  
Hamiltonian formalism for particles and fields,  
variational methods, canonical transformations,  
small oscillators, classical fields, relativi­  
ity.  

890.  General Relativity and  
Cosmology I  
Fall of even-numbered years. 3(3-0)  
PHY 890. Interdepartmental with Astronomy and  
Astrophysics.  
Conceptual foundations of general relativity  
theory; elements of tensor calculus; Riemann-  
Christoffel curvature tensor; the field equations;  
experimental tests; special solutions; the exten­ 

dion to cosmology.  

891.  General Relativity and  
Cosmology II  
Winter of odd-numbered years. 3(3-0)  
PHY 891. Interdepartmental with Astronomy and  
Astrophysics.  
Relativistic cosmology: the model universes;  
steady-state theory; observational evidence and  
possibilities for decision among models; current  
problems.  

897.  Quantum Mechanics IV  
Fall. 3(3-0) PHY 897.  
Transformation theory and invariance princi­ 
ple; the rotation group and theory of angular  
moments; Wigner-Eckart theorem and applica­ 
tions.  

898.  Relativistic Quantum Mechanics  
Winter. 3(3-0) PHY 898.  
Relativistic equations of motion; Dirac Equa­ 
tion, free particle solutions and Lorentz trans­ 
formation properties; interaction with  
electromagnetic fields; quantization of scalar,  
electromagnetic and Dirac fields.  

899.  Solid State Physics III  
Fall of even-numbered years. 3(3-0)  
PHY 899.  
Dionic crystals. Imperfections in crystals, plastic  
deformations, color centers. Optical properties.  
Rectification, transistors, selected topics.  

851.  Nuclear Spectroscopy  
Winter of even-numbered years. 3(3-0)  
PHY 851.  
Angular momentum, electromagnetic transitions,  
nucler models: liquid drop, independent  
particle, shell; resonances, residual interactions.  

852.  Nuclear Reactions  
Spring of even-numbered years. 3(3-0)  
PHY 852.  
Direct reactions, inelastic scattering and particle  
transfer, statistical reaction theory, application  
to fission, time-dependent mean field theory,  
Boltzmann Transport Equation.  

857.  Nuclear Physics I  
Fall of odd-numbered years. 3(3-0)  
PHY 857.  
Nucleon-nucleon scattering, the nucleon-  
nucleon interaction, the deuteron; meson theory  
of the NN interaction; Racah algebra.  
Approved through Summer 1989.  

858.  Nuclear Physics II  
Winter of even-numbered years. 3(3-0)  
PHY 858.  
Bulk properties of nuclei: sizes and magnetic  
moments; the shell model; effective interactions;  
second quantization; Hartree-Fock theory.  
Approved through Fall 1989.  

859.  Nuclear Physics III  
Spring of even-numbered years. 3(3-0)  
PHY 859.  
Bethe-Goldstone Theory; Random-phase  
approximation; BCS theory; quark-parton;  
deforeations; nuclear reactions.  
Approved through Winter 1990.  

884.  Advanced Readings in Physics or  
Astronomy  
Fall, Winter, Spring, Summer. 1 to 3  
credits. May reenroll for a maximum of 6 credits.  
Interdepartmental with Astronomy and  
Astrophysics.  

887.  Advanced Topics in Physics  
Fall, Winter, Spring. 3(3-0) or 4(4-0)  
In any one term this course will be devoted to a  
single topic, such as advanced quantum theory,  
quantum electrodynamics, specialized topics in  
special relativistic mechanics, relativistic  
theory and cosmology.  

899.  Electrodynamics of Plasmas II  
Winter of odd-numbered years. 3(3-0)  
E E 890. Interdepartmental with Astronomy  
and Astrophysics, and Electrical Engineering,  
Administered by Electrical Engineering.  
One fluid plasma model, magnetohydro­  
dynamics, Maxwell's stress tensor, low  
frequency waves, transport phenomena, Landau  
damping, collision and rate coefficients. Diffu­ 
sions in a magnetic field, investigation of de, rf  
and microwave discharges.  

999.  Doctoral Dissertation Research  
Fall, Winter, Spring, Summer. Vari­  
able credit. Approval of department.