

987. 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 solid state physics, statistical mechanics, relativistic theory and cosmology.

989. Electrodynamics of Plasmas II

Winter of odd-numbered years. 3(3-0) E E 850. Interdepartmental with Astronomy and Astrophysics, and Electrical Engineering. Administered by Electrical Engineering.

One fluid plasma model, magnetohydrodynamics, Maxwell's stress tensor, low frequency waves, transport phenomena, Landau damping, collision and rate coefficients. Diffusions in a magnetic field; investigation of dc, rf and microwave discharges.

999. Doctoral Dissertation Research

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

Astronomy and Astrophysics AST

119. General Astronomy (N)

Fall, Winter, Spring, Summer. 4(4-0) Intended primarily for nonscience majors. Not open to engineering or physical science majors. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229, N S 135, N S 155.

A qualitative presentation of the current view of the universe including birth and death of stars, cosmology, comparisons of planets, and life in the universe.

217. General Astronomy (N)

Fall, Winter, Spring. 4(4-0) MTH 109 or MTH 111. High school physics recommended. Students without the necessary science or math background are directed to AST 119. Intended primarily for physical science majors. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229, N S 135, N S 155.

A semiquantitative presentation of current views of the universe including birth and death of stars, cosmology, comparisons of planets, and life in the universe, and their interpretation through physical laws.

229. General Astronomy

Fall. 4(4-0) PHY 287 or PHY 291H or concurrently; MTH 113. Intended for physical science majors and recommended for astrophysics majors. Students may not receive credit in more than one of the following: AST 119, AST 217, AST 229, N S 135, N S 155.

Fundamental observations in astronomy and their interpretation through physical laws. Quantitative discussions of orbital motion, time, telescopes, solar system, stars, galaxies, and cosmology.

230. General Astronomy

Winter. 3(3-0) AST 229.

Fundamental observations in astronomy and their interpretation through physical laws. Continuation of AST 229.

327. Practical Astronomy

Spring. 3(3-0) AST 230.

Celestial coordinate systems. Time conversion and sidereal time. Atmospheric refraction, parallax, proper motion, aberration, and precession. Star catalogs and ephemerides. Finding charts and setting of equatorial telescopes.

437. Observatory Practice

Spring. 3(1-4) AST 327 and approval of department.

Stellar photography. Photographic photometry. Photoelectric photometry and corrections for atmospheric extinction. Multicolor photometric systems. Astronomical spectroscopy and radial velocity determinations.

442. Radiation Astrophysics

Winter. 3(3-0) PHY 395.

Emission, absorption and transfer of radiation in an astrophysical context. Stellar atmospheres, line formation, plasma diagnostics. Synchrotron radiation.

443. Astrophysical Fluid Dynamics

Spring. 3(3-0) PHY 396.

Dynamics of fluids in an astrophysical context. Fundamental equations. Applications to stellar structure, interstellar medium, and compact objects.

490. Special Problems

Fall, Winter, Spring, Summer. 1 to 5 credits. May reenroll for a maximum of 10 credits. Approval of department.

Individual study or project under the direction of a faculty member. An oral report on the work may be required in department seminar.

800. Research Methods

Fall, Winter, Spring, Summer. 2(0-6) May reenroll for a maximum of 6 credits. Beginning graduate students. Interdepartmental with and administered by Physics.

Problems and techniques of current research by taking part in the design and setup of experiments, data taking and reduction; study and practice of theoretical methods. Areas of study: solid state and molecular structure, nuclear, elementary particles, astronomy, astrophysics.

820. Advanced Topics in Astrophysics

Winter. 3(3-0) May reenroll for a maximum of 15 credits. AST 452 or PHY 395 or PHY 429 or approval of department.

Possible topics include dynamics of stars in galaxes, astrophysical fluid dynamics, quasar theory, stellar atmospheres, stellar interiors, stellar spectroscopy, and stellar photometry.

850. Electrodynamics of Plasmas I

Fall. 3(3-0) E E 835 or PHY 448; E E 874. Interdepartmental with Electrical Engineering and Physics. Administered 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.

860. General Relativity and Cosmology I

Fall of even-numbered years. 3(3-0) PHY 858 or approval of department. Interdepartmental with and administered by Physics.

Conceptual foundations of general relativity theory; elements of tensor calculus; Riemann-Christoffel curvature tensor; the field equations; experimental tests; special solutions; the extension to cosmology.

861. General Relativity and Cosmology II

Winter of odd-numbered years. 3(3-0) PHY 860. Interdepartmental with and administered by Physics.

Relativistic cosmology: the model universes; steady-state theory; observational evidence and possibilities for decision among models; current problems.

984. Advanced Readings in Physics or Astronomy

Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 6 credits. Interdepartmental with and administered by Physics.

989. Electrodynamics of Plasmas II

Winter of odd-numbered years. 3(3-0) E E 850. Interdepartmental with Electrical Engineering, and Physics. Administered by Electrical Engineering.

One fluid plasma model, magnetohydrodynamics, Maxwell's stress tensor, low frequency waves, transport phenomena, Landau damping, collision and rate coefficients. Diffusions in a magnetic field; investigation of dc, rf and microwave discharges.

PHYSIOLOGY

PSL

**College of Human Medicine
College of Natural Science
College of Osteopathic Medicine
College of Veterinary Medicine**

240. Introductory Physiology

Fall, Spring. 4(4-0) Sophomores or approval of department.

Physiology of the cell, nerve and reflex activity, skeletal muscle, brain, and cardiovascular system emphasizing environmental influences such as disease and exercise.

241. Introductory Physiology

Winter. Summer of even-numbered years. 4(4-0) PSL 240 or approval of department.

Continuation of PLS 240. Physiology of respiration, digestion, metabolism, kidney, endocrinology, and reproduction.

323. Physiology, Anatomy, and Hygiene of the Eye

Fall. Summer of even-numbered years. 3(2-2) PSL 240; Elementary Education or Special Education major, or approval of department.

Basic course in anatomy, physiology, and hygiene of the visual system; includes discussion of normal visual functioning and abnormal visual functioning, with methods of correction and education implications.

401. Comparative Physiology I

Fall. 4(3-4) PSL 240 or B S 212; CEM 131 or CEM 141. Interdepartmental with the Department of Zoology.

A comparison of osmoregulation, digestion, respiration, and other physiological processes in a wide range of organisms.

402. Comparative Physiology II

Winter. 4(4-0) PSL 401 or approval of department. Interdepartmental with and administered by the Department of Zoology.

A comparison of sensory, motor, endocrine and other integrative mechanisms in animals.

416. Physiology of the Cell

Fall. Summer of odd-numbered years. 3(3-0) BCH 401 or BCH 451.

Physiologic mechanisms common to all living cells with emphasis on those of the vertebrates. The functions of the cell membrane and cytoplasm are studied as the basis for the physiologic behavior of vertebrate organs and systems.

**Descriptions — Physiology
of
Courses**

418. Introductory Biophysics: Membranes and Electrical
(BPY 403.) Spring, 3(3-0) *One year organic chemistry or biochemistry, PHY 239, PHY 259; MTH 113 or approval of department.*
Salient features of biophysics, principles and methods; radiation biophysics; membrane biophysics; bioelectric phenomena; neurobiology; and psychophysics.

431. Human Physiology
Winter, 4(4-0) *One year of biological science or ANT 316; CEM 131 or CEM 141.*
Physiology of the digestive, endocrine, nervous, and reproductive systems.

432. Human Physiology
Spring, 4(4-0) PSL 431 or approval of department.
Physiology of the autonomic nervous, cardiovascular, renal, and respiratory systems.

435. Mammary Physiology
(444.) Fall, 4(3-2) PSL 241, BCH 200 or BCH 401. *Interdepartmental with and administered by the Department of Animal Science.*
Anatomy of mammary gland. Hormonal and nervous control of mammary growth, initiation and maintenance of lactation. Biochemistry of milk secretion. Physiology of milking; physiological, pathological and management factors affecting lactation.

455. Principles of Animal Reproduction
(445.) Winter, 4(5-0) PSL 241, BCH 200 or BCH 401. *Interdepartmental with and administered by the Department of Animal Science.*
Processes of reproduction and endocrinology with special emphasis on anatomy of reproductive systems, folliculogenesis, gametogenesis, reproductive cycle, fertilization, sex determination, gestation and artificial regulation of these reproductive events for economic benefit.

465. Avian Physiology
(440.) Spring, 4(3-3) *Approval of department. Interdepartmental with and administered by the Department of Animal Science.*
Systemic physiology of birds emphasizing respiration, circulation, temperature regulation, the endocrines, and reproduction.

470. Biological Membranes
(IDC 470.) Spring, 3(3-0) BCH 401. *Interdepartmental with the departments of Biochemistry, and Microbiology and Public Health.*
The chemistry, physics and mathematics of the permeability, energy transductions and surface functions of differentiated cell membranes and membranous organelles are compared. A brief discussion of theoretical and experimental models is included.

480. Special Problems
Fall, Winter, Spring, Summer, 1 to 5 credits. *Approval of department.*

481. Honors Research Paper
Fall, Winter, Spring, Summer, 2 credits. PSL 480 and approval of department.
Oral and written presentation of undergraduate research project initiated and carried forward under PSL 480.

497. Principles of Endocrinology
Winter, 4(4-0) *One year organic chemistry; ZOL 317. Interdepartmental with and administered by the Department of Zoology.*
Hormonal principles, illustrated by experimental observations, in vertebrates and invertebrates. Emphasis on cellular endocrinology. Group discussion, background in organic chemistry and cell biology strongly recommended. Term paper required.

500A. Introductory Physiology for Medicine
Spring, 5(5-0) *Admission to the professional program in a college of medicine.*
Concepts and problems in physiology to be followed by supplemental physiology instruction during subsequent phases of medical training.

500B. Introductory Physiology for Medicine
Fall, 4(4-0) *Admission to the professional program in a college of medicine.*
Principles of systemic physiology germane to the practice of medicine with introduction to clinical physiopathology.

500C. Introductory Physiology for Medicine
Winter, 5(5-0) *Admission to the professional program in a college of medicine.*
Continuation of PSL 500B.

500D. Introductory Physiology for Medicine
Winter, 4(4-0) *Admission to a college of medicine or approval of department.*
Concepts and problems in physiology germane to the practice of medicine.

500E. Introductory Physiology for Medicine
Spring, 4(4-0) *Admission to a college of medicine or approval of department.*
Continuation of PSL 500D.

503. Introduction to Medical Biology
Fall, 5(5-0) *Admission to the College of Human Medicine. Interdepartmental with the departments of Biochemistry, Microbiology and Public Health, and Pharmacology and Toxicology. Administered by the Department of Microbiology and Public Health.*
Principles of medical biology for medical students.

801. Advanced Cell Physiology
Fall, 5(6-0) PSL 431, PSL 432 or PSL 401, PSL 402; BCH 451, BCH 452, BCH 453 or concurrently; or approval of department; calculus recommended.
Concepts in advanced cellular physiology, including bioenergetics, transport, regulation of metabolic reactions, and specialized cell functions including nerve, muscle, secretory, epithelial and lymphocyte.

804A. Neuroscience Laboratory I
Winter, 4(2-4) ZOL 827 and approval of instructor. *Interdepartmental with the departments of Psychology and Zoology. Administered by the Department of Psychology.*
Development of skills in the methods, techniques and instrumentation necessary for research in a variety of areas concerned with neuroscience.

804B. Neuroscience Laboratory II
Spring, 4(2-4) PSY 804A. *Interdepartmental with the departments of Psychology and Zoology. Administered by the Department of Psychology.*
Continuation of PSL 804A.

805. Advanced Mammalian Physiology I
Winter, 1(2-0) PSL 500D, PSL 801 or concurrently or approval of department.
Readings and discussions to supplement PSL 500D on basic research principles of neural, cardiovascular and respiratory physiology.

806. Advanced Mammalian Physiology II
Spring, 1(2-0) PSL 500E, PSL 801 or concurrently or approval of department.
Readings and discussions to supplement PSL 500E on basic research principles of renal, gastrointestinal and endocrine physiology.

824. Membrane Biophysics
(BPY 824.) Winter of odd-numbered years. 4(3-2) *Approval of department.*
Interfacial phenomena in biology and chemistry; structure and function, theoretical and experimental models for biological membranes; membrane biochemistry. Labs will emphasize biomolecular lipid membrane techniques.

836. Physical Principles of Biological Systems
Winter of even-numbered years. 3(3-0)
Application of laws and methods of physics to measurement and description of physiological phenomena.

837. Radiobiology
Fall of even-numbered years. 3(3-0) *Approval of department.*
Application of radioactive tracer techniques to study of biological functions. Determination of turnover rates and tissue constituents by isotope dilution. Control of radiation hazards.

839. Systems Neuroscience
Winter, 5(4-2) PSL 801 or approval of course coordinator. *Interdepartmental with the departments of Anatomy, and Pharmacology and Toxicology.*
Physiology, anatomy and pharmacology of sensory, somatomotor and autonomic neural systems.

840. Advanced Cardiovascular Physiology
Spring of odd-numbered years. 4(5-0) PSL 500D or approval of course coordinator.
Physiology of peripheral cardiovascular system including arteries, veins, capillaries, and their functions, control mechanisms and integration.

841. Advanced Endocrine Physiology and Pharmacology
Fall of odd-numbered years. 5(6-0) PSL 500E or approval of course coordinator. *Interdepartmental with the Department of Pharmacology and Toxicology.*
Basic and advanced physiologic and pharmacologic concepts of general endocrinology including reproductive endocrinology.

843. Advanced GI/Metabolism Physiology
Fall of even-numbered years. 3(3-0) PSL 500E or approval of course coordinator.
Physiology of gastrointestinal motility, secretion, absorption, and their functions, control mechanisms and integration. Physiology of energy balance, overall metabolism and control of food intake.

844. Advanced Renal Physiology
Spring of even-numbered years. 3(4-0) PSL 500D, PSL 500E or approval of course coordinator.
Current concepts of renal physiology.

859. Analysis of Hormone Action
Spring, 4(4-0) ZOL 317, or approval of department. Interdepartmental with and administered by the Department of Zoology. Discussion of recent work on the molecular and developmental aspects of hormone action in vertebrates and invertebrates. Selected topics to vary from year to year.

865. Advanced Neurobiology
(BIM 865.) Spring, 4(4-0) ZOL 827. Interdepartmental with the departments of Anatomy, Psychology, and Zoology. Administered by the Department of Anatomy.

Basic organization, structure and function of neural networks comprising sensory, motor and autonomic systems including examples from invertebrates and vertebrates. Attendance at neuroscience seminar is required.

875. Advanced Physiology Laboratory
Summer of odd-numbered years. 4(2-5) PSL 500D, PSL 500E, PSL 801, approval of department.

Experiments in animal and human physiology; data collection, analysis and interpretation.

885. Vertebrate Neural Systems I
(PSY 885.) Winter of even-numbered years. 5(3-4) ANT 815, ANT 865 recommended. Interdepartmental with the departments of Anatomy, Psychology and Zoology. Administered by the Department of Anatomy.

Structure and function of major component systems of vertebrate brains, their evolution, ontogeny and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical and physiological studies.

886. Vertebrate Neural Systems II
(ZOL 886.) Spring of even-numbered years. 5(3-4) ANT 885. Interdepartmental with the departments of Anatomy, Psychology, and Zoology. Administered by the Department of Anatomy.

Continuation of PSL 885. Major component systems of vertebrate brains, their evolution, ontogeny, and comparative analysis in mammals, birds, reptiles, amphibians and fish. Interrelation of behavioral, anatomical, and physiological studies.

890. Readings in Biophysics
(BPY 890.) Fall, Winter, Spring, Summer. 3 to 6 credits. Approval of department.

Reading course in special topics adapted to the individual preparation and needs of the student.

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

919. Cardiovascular System
Fall. 4(3-3) May reenroll for a maximum of 12 credits if different topics are taken. PSL 840.

Classical and current literature on physiology of heart, circulation, and microcirculation. Each fall a different one of these three topics will be discussed. Laboratory work illustrates methodology and special procedures.

950. Topics in Physiology
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Approval of department.

Classical and modern concepts in selected areas of physiology.

980. Problems
Fall, Winter, Spring, Summer. 1 to 3 credits. May reenroll for a maximum of 9 credits. Approval of department.

Limited amounts of individual work on selected research problems.

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

POLITICAL SCIENCE PLS

College of Social Science

100. American National Government
Fall, Winter, Spring, Summer. 3(3-0)

Major aspects of national government with emphasis on the policy-making process.

140. Comparative Politics
Fall, Winter, Spring. 3(3-0)

Comparison of political systems in western and non-western nations.

160. International Relations
Fall, Winter, Spring, Summer. 3(3-0)

Contemporary world affairs surveyed. The struggle for power, the nation-state system; factors creating harmony and hostility among nations. War and peace in our time.

170. The Isms
Fall, Winter, Spring, Summer. 3(3-0)

Introduction to basic contemporary political ideologies; theoretical foundations of democracy, socialism, communism, political elitism, and nationalism. Special attention to ideology underlying contemporary political problems.

200. Introduction to Political Science
Fall, Winter, Spring, Summer. 3(3-0)

Acquaints the student with the theories, methods and concepts of political science. Emphasis is on ideology and interests in the political process.

251. Human Values and Politics: On Liberty (S)
Fall. 4(4-0)

Liberty as a basic value underlying public issues of life or death; right to live; rights of women and children; slavery; justification of war and terrorism; capitol punishment; biological planning.

252. Human Values and Politics: Equality and Justice (S)
Winter. 4(4-0)

Equality and justice as basic values underlying major public issues in areas such as crime and punishment, education, family and employment. Effect of public policy on equal opportunity.

253. Human Values and Politics: Authority and the Individual (S)
Spring. 4(4-0)

Individualism and authority as basic values underlying public issues; free speech; rights of minorities; right of privacy; community norms and individual preferences.

290. Methods of Political Research
Fall, Winter, Spring, Summer. 3(3-0)

Design and execution of research in political behavior and institutions. Major emphasis on logic underlying various types of political research, on identification of appropriate data sources and field methods.

291. Methods of Political Research
Fall, Winter, Spring. 4(4-0) PLS 290.

Analysis of political data, with major emphasis on quantitative techniques.

301. American State Government
Fall, Winter, Spring, Summer. 3(3-0)

Major aspects of policy-making process at the state government level. Comparison of state political systems.

302. American Urban Government
Fall, Winter, Spring, Summer. 3(3-0)

Urban political process in America. Politics of policymaking for urban functions; politics of intergovernmental relations.

303. Michigan Government
Spring. 3(3-0)

How Michigan government is organized and conducted and how policies are made; sources of executive-legislative conflict; politics of taxation; role of the state in local affairs; balance of political forces in the state.

310. Public Bureaucracy in the Policy Process
Fall, Winter, Spring, Summer. 3(3-0)

Introduces student to following major areas of public administration: development of administration in the U.S.; theories of administrative organization; principles and methods of administrative management; executive leadership; interpersonal and intergroup relationships; levels of decision making, ethics and responsibility.

313. Public Policy Analysis
Fall, Winter, Spring. 3(3-0)

Problems and methods in perception of public problems, determination of goals, generation and evaluation of alternatives, policy choice. Planning and program budgeting, political and analytical methods of policymaking compared.

320. The American Judicial Process
Fall, Winter, Spring, Summer. 3(3-0)

Analysis of the structure and functions of judicial systems. Organization, administration, and politics of judicial bureaucracies. Roles of judges, juries, counsel, litigants, and interest groups in adjudication processes.

321. Judicial Policymaking
Fall, Winter, Spring. 3(3-0)

Consideration of political behavior of judges (especially Justices of Supreme Court) and their policymaking. Focus on policy questions currently important, including civil liberties, national economic policy and interrelationships among governmental units.

324. The American Legislative Process
Fall, Winter. 3(3-0)

Nature of legislative process in the United States; organization and procedure of legislative bodies; direct legislation; relationship of legislative branch to other branches of government.