482. Electricity and Magnetism II
Spring. 3(3-0) P: (PHY 481) RB: A Mathematics course on Boundary-Value Problems.
Maxwell`s equations, scalar and vector potentials, electromagnetic plane waves.

490. Senior Thesis
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P: (PHY 390) and completion of Tier I writing requirement.
Design, carry out, and analyze an original experiment or computation. A written and oral report is required.

491. Atomic, Molecular, and Condensed Matter Physics
Fall. 3(3-0) P: (PHY 471 and PHY 410) and completion of Tier I writing requirement.
Many-electron atoms. Molecules, crystal structure, lattice dynamics. Band models of metals and semiconductors. Transport properties.

492. Nuclear and Elementary Particle Physics
Spring. 3(3-0) P: (PHY 471) and completion of Tier I writing requirement. (PHY 472)
Properties of nuclei, nuclear models, nuclear reactions. High-energy accelerators. Weak, electromagnetic and strong interactions. Symmetries and conservation laws. Elementary particle spectrum, quarks, gluons.

800. Research Methods
Fall, Spring, Summer. 3(3-0) A student may earn a maximum of 6 credits in all enrollments for this course.
Design and setup of experiments in various faculty research areas. Data collection and analysis. Study and practice of theoretical methods.

810. Methods of Theoretical Physics
Fall. 3(3-0)
Theoretical methods used in classical mechanics, quantum mechanics, electrodynamics, and statistical mechanics.

820. Classical Mechanics
Fall. 3(3-0)
Two-body central force problem, Hamilton's principle, Lagrangian and Hamiltonian equations of motion, variational methods, small oscillations, classical fields.

825. Epidemiologic Modeling
Spring of odd years. 3(3-0) Interdepartmental with Epidemiology. Administered by Epidemiology. P: EPI 810, STT 422. R: Approval of department.
Mathematical modeling of epidemics. Stochastic and chaotic systems approaches. Applications through personal computer software.
SA: HM 825

831. Statistical Mechanics
Spring. 3(3-0)
Equilibrium statistical mechanics and thermodynamics. Boltzmann transport equations and hydrodynamics. Brownian and Langevin motion.

832. Topics in Statistical Mechanics (MTC)
Spring. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. P: (PHY 831)
Advanced topics in statistical matter physics and nuclear physics.

841. Classical Electrodynamics I
Spring. 3(3-0) P: (PHY 810)
Electrostatics, magnetostatics, time-varying fields and Maxwell's equations. Gauge transformations. Poynting's theorem and conservation laws.

842. Classical Electrodynamics II
Fall. 3(3-0) P: (PHY 841 and PHY 810 or concurrently)
Plane electromagnetic waves, polarization states, reflection, refraction. Wave guides and resonant cavities. Radiating systems, dipole fields, radiated power. Special theory of relativity.

850. Electrodynamics of Plasmas
Spring of odd years. 3(3-0) Interdepartmental with Electrical and Computer Engineering; Astronomy and Astrophysics.. Administered by Electrical and Computer Engineering. P: ECE 835 or PHY 488.
Plasma kinetic and macroscopic plasma transport theory. Electromagnetic wave propagation and charged particle diffusion processes in plasma. Electromagnetic energy absorption via elastic and inelastic collisions. Dc, rf, and microwave discharges.

851. Quantum Mechanics I
Fall. 3(3-0) R: Open only to graduate students in the College of Engineering or College of Natural Science.
Axioms of quantum and wave mechanics, applications to spherically symmetric potentials. Hydrogen atom, harmonic oscillator, matrix mechanics, angular momentum theory, rotations.

852. Quantum Mechanics II
Spring. 3(3-0) P: PHY 851.
Approximation methods, perturbation theory, atomic physics applications, scattering theory, identical particles, Pauli principle, Bose and Einstein statistics, Hartree-Fock approximation, collisions of identical particles, radiation.

853. Advanced Quantum Mechanics
Fall. 3(3-0) P: PHY 852.
Quantum description of relativistic particles and fields. Dirac equation, interpretation of negative energy states, Lagrangian field theory, quantization of free fields, interactions, perturbation theory, S-matrix, and Feynman rules.

854. Quantum Electrodynamics
Spring of odd years. 3(3-0) P: PHY 853.
Application of quantum field theory to the interaction of electrons and photons: pair annihilation, Compton scattering. Bound states, renormalization theory.

861. Beam Physics
Spring of odd years. 3(3-0) P: PHY 820, PHY 841.
Particle accelerator theory and design.

871. Condensed Matter Physics
Spring. 3(3-0) P: PHY 852.
Structure and vibrations of solids. Electrons in solids, electron gas, Bloch's theorem. Cohesion. Electron states in solids. Electronic properties of solids, electron transport, conductivity, semiconductors. Cooperative phenomena.

881. Subatomic Physics
Fall. 3(3-0) P: PHY 851.
Application of conservation laws and physical principles to basic quantum mechanical problems in MeV energy range and femtometer size range. Application to nuclear data.

891. Elementary Particle Physics
Spring. 3(3-0) P: PHY 853.
Nonabelian gauge theory, spontaneously broken gauge theory, electroweak interaction, QCD, W and Z boson coupling to quarks and leptons, charm, top and bottom quarks, particle generations.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 24 credits in all enrollments for this course. R: Open only to graduate students in Physics.

905. Special Problems
Fall, Spring. 1 to 4 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Open only to graduate students in the Department of Physics and Astronomy.
In-depth study of a topic in physics or in astrophysics and astronomy.

962. Topics in Beam Physics (MTC)
Fall, Spring, Summer. 3 credits. A student may earn a maximum of 12 credits in all enrollments for this course. P: PHY 861.
Selected topics in accelerator physics.

972. Topics in Condensed Matter Physics (MTC)
Fall, Spring. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. P: PHY 831, PHY 852, PHY 871.
Advanced topics in many-body problems, disordered solids, superfluidity superconductivity magnetism, or macroscopic systems.

980. Advanced Reading in Physics
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 4 credits in all enrollments for this course. R: Approval of department.

982. Topics in Nuclear Physics (MTC)
Fall, Spring. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. P: PHY 852, PHY 881.
Heavy ion reactions or nuclear structure.

992. Quantum Chromodynamics (MTC)
Fall. 3(3-0) A student may earn a maximum of 12 credits in all enrollments for this course. P: PHY 891.
Hadron-hadron interactions, interaction of hadrons with leptons.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A student may earn a maximum of 99 credits in all enrollments for this course. R: Open only to graduate students in Physics.

PHYSIOLOGY PSL

Department of Physiology
College of Human Medicine
College of Natural Science
College of Osteopathic Medicine
College of Veterinary Medicine

101. Current Issues in Physiology
Fall. 2(2-0) Not open to students with credit in PSL 250 or PSL 431 or PSL 432.
Physiological bases of health issues of broad social significance, and new approaches for the treatment of specific disorders.

250. Introductory Physiology
Fall, Spring. 4(4-0) R: Not open to students in Physiology.
Function, regulation and integration of organs and organ systems of higher animals emphasizing human physiology.

323. Physiology and Hygiene of the Eye
Fall of odd years. Summer of even years. 3(3-0) R: Not open to Physiology majors.
Basic anatomy, physiology, and hygiene of the visual system: normal and abnormal visual function, methods of correction, and educational implications.

410. Computational Problem Solving in Physiology
Fall, Spring. 3(3-0) P: PSL 432. R: Approval of department.
Quantitative analysis of physiological data: mathematical models, curve fitting, data analysis and interpretation. Problem solving involving exponential and logistic growth. Cerebral blood flow, convective cooling, oxygen consumption, thermoregulation, other applications.

431. Human Physiology I
Fall. 3(3-0) P: BS 111, CEM 142.
Neural function including autonomic nervous system, physiological control systems, endocrinology, reproduction and digestive function.

432. Human Physiology II
Spring. 3(3-0) P: PSL 431.
Continuation of PSL 431. Function and regulation of the cardiovascular, respiratory, and renal systems. Control of tissue blood flow, blood pressure, blood gases, body fluid volume and electrolytes.

440. Topics in Cell Physiology
Fall, Spring. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Critical discussion and evaluation of a selected problem of mammalian cell physiology including cell biophysics, molecular biology of the cell.

441. Topics in Endocrinology
Fall, Spring. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic on the role of hormones in the regulation of growth, metabolism, differentiation.

442. Topics in Cardiovascular Physiology
Fall. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic in blood flow physiology.

443. Topics in Respiratory Physiology
Fall of odd years. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic in the physiology of gas exchange and lung mechanics.

445. Topics in Environmental Physiology
Spring of odd years. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic in environmental physiology with an emphasis on thermoregulation.

446. Topics in Visual Physiology
Fall of even years. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic in the functioning of the visual system in health and disease.

447. Topics of Brain Function
Fall. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic on the functioning of the mammalian brain.

448. Topics in Gastrointestinal Physiology
Fall. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Selected topic in the physiology of the digestive system.

449. Developmental Neurophysiology
Fall. 2(2-0) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Development of the nervous system in invertebrate and vertebrate animals.

450. Laboratory in Human Physiology
Fall. 2(1-3) P: PSL 432. R: Open only to Physiology majors. Completion of Tier I writing requirement.
Demonstration of fundamental physiological processes. Sensory input response. Data collection and analysis.

475. Capstone Laboratory in Physiology
Spring. 2(1-3) P: PSL 432. R: Open only to Physiology majors.
Laboratory exercises in animal physiology including osmoregulation, receptor mediated regulation, nervous and hormonal control of function.

480. Special Problems
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 5 credits in all enrollments for this course. P: PSL 432. R: Open only to Physiology majors.
Independent study under the auspices of a faculty member.

483. Environmental Physiology
Spring. 4(4-0) Interdepartmental with Zoology. Administered by Zoology. P: (BS 110 or LBS 144 or LBS 148H) and (BS 111 or LBS 145 or LBS 149H) and (CEM 141 or CEM 151 or CEM 181H or LBS 165) and completion of Tier I writing requirement.
Aspects of physiology important to the environmental relations of vertebrates and invertebrates: energetics, thermal relations, osmotic-ionic relations, and exercise physiology.

501. Introductory Medical Physiology
Fall. 3(3-0) R: Graduate-professional students in colleges of Human and Osteopathic Medicine.
Physiological basis of medical practice.

511. Veterinary Physiology
Spring. 5(5-0) R: Open only to graduate-professional students in College of Veterinary Medicine.
Physiology of the nervous, cardiovascular, renal, respiratory, digestive, endocrine, and reproductive systems. Homeostasis.

552. Medical Neuroscience
Spring. 4(3-2) Interdepartmental with Anatomy; Radiology. Administered by Anatomy. R: Graduate-professional students in colleges of Human Medicine and Osteopathic Medicine.
Correlation of normal structure and function of the human nervous system with clinical testing, classical lesions, and common diseases.

611. Research Problems in Physiology Clerkship
Fall, Spring, Summer. 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. P: PSL 511 R: Open only to graduate professional students in College of Veterinary Medicine.
Individual work on a research problem.

825. Cell Structure and Function
Spring. 3(3-0) Interdepartmental with Biochemistry; and Microbiology. Administered by Biochemistry. P: BCH 401 or BCH 461.
Molecular basis of structure and function. Cell properties: reproduction, dynamic organization, integration, programmed and integrative information transfer. Original investigations in all five kingdoms.

827. Advanced Neurobiology
Fall. 4(4-0) Interdepartmental with Pharmacology and Toxicology; and Zoology. Administered by Pharmacology and Toxicology.
Nervous system function at the cellular level: membrane biophysics and potentials, synaptic transmission.

839. Systems Neuroscience
Spring of odd years. 4(4-0) Interdepartmental with Anatomy; and Pharmacology and Toxicology. Administered by Anatomy. R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Agriculture and Natural Resources, Natural Science, and Veterinary Medicine.
Anatomy, pharmacology, and physiology of multicellular neural systems. Sensory, motor, autonomic, and chemo-regulatory systems in vertebrate brains.

841. Advanced Endocrine Physiology and Pharmacology
Fall. 4(4-0) Interdepartmental with Animal Science; Pharmacology and Toxicology; and Psychology. P: BCH 461, PSL 432. R: Open only to graduate students in the Colleges of Human Medicine, Osteopathic Medicine, Veterinary Medicine, Natural Science, and Agriculture and Natural Resources.
Basic and advanced concepts of endocrine and reproductive physiology and pharmacology.

850. Research Topics in Physiology
Spring. 1(0-2) P: PSL 432, PSL 910. R: Open only to graduate students in Physiology.
Readings, presentations and discussions of selected research literature in physiology.

885. Vertebrate Neural Systems
Spring of odd years. 3(2-2) Interdepartmental with Anatomy. Administered by Anatomy.
Comparative analysis of major component systems of vertebrate brains. Evolution, ontogeny, structure, and function in fish, amphibians, reptiles, birds and mammals.

899. Master's Thesis Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 24 credits in all enrollments for this course.

901. Investigating the Lung
Fall of even years. 3(3-0) Interdepartmental with Large Animal Clinical Sciences; and Pathology. Administered by Large Animal Clinical Sciences. R: Open only to M.S. and Ph.D. students in Large Animal Clinical Sciences, Small Animal Clinical Sciences, Physiology, and Pathology. Approval of department.
Classic and current concepts of respiratory structure and function in health and disease. Mechanisms of lung injury.

910. Cellular and Molecular Physiology
Fall. 4(4-0) P: BCH 802; PSL 432 or PSL 501 or PSL 511; one calculus course. R: Open only to graduate students in Physiology or Pharmacology and Toxicology.
Readings in cell physiology and physiological aspects of molecular biology.

950. Topics in Physiology
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 9 credits in all enrollments for this course. R: Approval of department.
Classical and modern concepts in selected areas of physiology.

980. Problems in Physiology
Fall, Spring, Summer. 1 to 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. R: Approval of department.
Individual research problems in physiology.

999. Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 99 credits in all enrollments for this course.

POLITICAL SCIENCE PLS

Department of Political Science
College of Social Science

100. Introduction to American National Government
Fall, Spring, Summer. 3(3-0)
The policymaking process in national government, with emphasis on political participation, the presidency, Congress, Supreme Court, bureaucracy, and civil rights and civil liberties.

140. Introduction to Comparative Politics
Fall, Spring, Summer. 3(3-0)
Comparative analysis of political systems in first, second, and third-world countries. Alternative methods for comparative cross-cultural analyses of political systems.

160. Introduction to International Relations
Fall, Spring, Summer. 3(3-0) Not open to students with credit in MC 220 or MC 221.
Dynamics of conflict and cooperation. Processes of foreign policy decision making. Major international economic issues. Basic future trends. Primary analytical approaches for studying world politics.

170. Introduction to Political Philosophy
Fall, Spring, Summer. 3(3-0)
Basic questions of political philosophy as considered from ancient to modern times. Primary focus on the origins, defense, and radical critiques of modern liberal democracy.

200. Introduction to Political Science
Fall, Spring, Summer. 4(4-0)
The science of politics. Theory construction, model building, empirical testing, and inductive inference. Examples from American, international and comparative politics.

201. Introduction to Methods of Political Analysis
Fall, Spring, Summer. 4(4-0) P: (PLS 200)
Philosophy of social science. Principles of research design, measurement, hypothesis testing, measures of association, cross tabulations, and regression analysis.

301. American State Government
Spring. 3(3-0)
Structure and processes of American state government. Interstate differences. Constitutions, elections, political parties, interest groups, and intergovernmental relations. Policy focus on education, welfare, and criminal justice.

302. Urban Politics
Fall. 3(3-0)
Structure and processes of American urban politics. Relationship of cities to U.S. federal system. Interstate variations. Policy focus on public education, crime, social welfare, and economic development.

304. Minority Politics
Fall. 3(3-0)
Minority groups and the political process in the United States. Civil rights movements, political organizations, legal decisions, political participation, and legislative politics.

305. Environmental Politics
Fall. 3(3-0)
The impact of political and legal institutions on U.S. environmental policy. Public opinion, environmental interest groups, and the environmental movement. The politics of air and water pollution, toxic wastes, public lands, risk assessment, and environmental justice.

310. Public Bureaucracy in the Policy Process
Fall, Spring. 3(3-0)
Role of public bureaucracy in the U.S. Theories of administrative behavior and the impact of hierarchy on policymaking. Relations with the president, Congress, interest groups, and the public. Administrative functions, responsiveness, and ethics.

313. Public Policy Analysis
Fall, Spring, Summer. 3(3-0) Not open to students with credit in MC 444.
Political and economic concepts for evaluating the consequences of government decision making. Issues of problem identification, policy adoption, and implementation affecting program evaluation.

320. The American Judicial Process
Fall, Spring. 3(3-0) R: Not open to freshmen or sophomores.
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 the adjudication process.

321. American Constitutional Law
Fall, Spring. 3(3-0) R: Not open to freshmen or sophomores.
U.S. Supreme Court policy making and its effect on issues of current importance, including First Amendment freedoms, due process, race relations, sex discrimination, and privacy.

322. Comparative Legal Systems
Spring, Summer. 3(3-0)
Cross-national study of common law and civil law systems. Judicial review and selection of judges. Models of judicial decision-making. High court-low court relations. Role of courts in society.

324. American Legislative Process
Spring. 3(3-0)
The design of Congress. Rules, structures, and procedures affecting policy making. Impact of regular elections on legislative behavior.

325. American Executive Process
Fall. 3(3-0) P: (PLS 100)
Role of the president in the U.S. political system. Constitutional questions, presidential selection, presidential power, interbranch relations, and presidential policy making.

331. Political Parties and Interest Groups
Spring of even years. 3(3-0)
Origins, structure, and activities of political parties. Role of parties and interest groups in elections and in government. Internal politics of parties and of private associations.

333. Political Socialization and Public Opinion
Fall, Spring. 3(3-0)
Role of public opinion in political systems and its impact on the political process. Group differences, political socialization, development and change of political attitudes and behavior patterns. Methods of studying public opinion.

334. Campaigns and Elections
Fall, Spring. 3(3-0)
The nominating process. Recruitment of candidates and the formation of electoral coalitions. Analysis of election results. Trends in electoral support for officeholders and parties.

342. Comparative Political Economy
Spring. 3(3-0) P: (EC 201 or EC 202)
Democratic politics and the linkages among political, social, and economic conceptions of equality in developed and developing countries.

344. Politics in the Third World
Fall, Spring. 3(3-0) P: (PLS 140)
Politics of modernization, democratic and authoritarian regimes, and class and ethnicity in developing countries.

351. African Politics
Fall. 3(3-0)
Political institutions and governmental processes in Sub-Saharan Africa.