826. Laboratory Animal Pathology
Spring. 4(3-2) Graduate status and approval of department. Interdepartmental with and administered by Laboratory Animal Resources.
Macro and microscopic studies on the diseases of laboratory animals with special emphasis on naturally-occurring diseases which might interfere with the interpretation of experimental results.

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

910. Biology of Disease
Fall. 3(2-3) Approval of department. Primarily for students in the biological sciences.
Basic morphologic changes in disease with emphasis on the related physiologic pathology. Laboratory includes relevant problems in post-mortem diagnosis.

980. Histopathologic Diagnosis
Fall, Winter, Spring, Summer. 3(0-0) May re-enroll for a maximum of 6 credits. 803, 820.
Trimming, histopathologic examination, description, diagnosis and reporting of specimens from biopsy and necropsy.

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

PHARMACOLOGY PHM

College of Human Medicine
College of Osteopathic Medicine
College of Veterinary Medicine

350. Introductory Human Pharmacology
Spring. 3(3-0) PSL 332 or concurrently, or approval of department. Survey of pharmacology including general principles, central nervous system drugs, autonomic nervous system drugs, cardiovascular and renal drugs, endocrine drugs, anti-infectives, poisoning therapy, and other basic related topics.

430. Drug Abuse
Fall, Spring. 4(4-0) Juniors or approval of department. Biology and chemistry recommended. Actions, mechanism of action, toxicity and uses of drugs of abuse. Sociological and psychological aspects of drug abuse and the legal aspects of the sale and distribution of drugs are considered.

480. Special Problems
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 5 credits. Approval of department.

520A. Principles of Pharmacology
Fall. 4(4-0) PSL 509B, 509C. Primarily for students of Veterinary Medicine.
Pharmacology principles, including absorption, distribution, biotransformation, drug antagonism, receptor theory and pharmacogenetics; literature data analysis; adverse drug reactions. Chemotherapy including anti-neoplastic, anti-viral and anti-microbial agents; endocrine and emergency therapies.

520B. Principles of Pharmacology
Pharmacology principles, including absorption, distribution, biotransformation, drug antagonism, receptor theory and pharmacogenetics; literature data analysis; adverse drug reactions. Chemotherapy including anti-neoplastic, anti-viral and anti-microbial agents; endocrine and emergency therapies.

520C. Principles of Pharmacology—Independent Study
Summer. 4(1-0) Approval of department. Primarily for students of Human and Osteopathic Medicine.
Independent study of pharmacology principles, including absorption, distribution, biotransformation, drug antagonism, receptor theory and pharmacogenetics; literature data analysis; adverse drug reactions. Chemotherapy including anti-neoplastic, anti-viral and anti-microbial agents; endocrine and emergency therapies.

521A. Pharmacodynamics
Winter. 5(4-4) 520A. Primarily for students of Veterinary Medicine.
Pharmacology of the nervous systems (central, peripheral and autonomic); cardiovascular, renal, gastrointestinal drugs.

521B. Pharmacodynamics
Spring. 4(4-0) 520B. Primarily for students of Human and Osteopathic Medicine.
Pharmacology of the nervous systems (central, peripheral and autonomic); cardiovascular, renal, gastrointestinal drugs.

521C. Pharmacodynamics—Independent Study
Summer. 3(1-1) 520B or 520C. Primarily for students of Human and Osteopathic Medicine.
Independent study of pharmacology of the nervous systems (central, peripheral and autonomic); cardiovascular, renal, gastrointestinal drugs.

522. Toxicology
Spring. 3(3-0) 521A or 521B or 521C.
Toxicology of economic and household poisons, noxious gases and vapors, minerals solvents, pesticides and pollutants.

810. Sympathetic Transmission
Winter of odd-numbered years. 4(4-0) Approval of department. Chemical and electrical aspects of the transmission of nervous impulses at sympathetic and autonomic junctions and the influence of drugs upon these processes.

811. Organ System Pharmacology
Fall of odd-numbered years. 4(3-3) 521A or 521B or 521C and approval of department. Current concepts and recent advances in the areas of cardiovascular, renal and sympathetic smooth muscle pharmacology.

812. Advanced Principles of Pharmacology and Toxicology
Spring of odd-numbered years. 4(4-0) 522 and approval of department.
Kinetics of drug absorption, elimination and metabolism; drug-receptor interaction. Principles of drug toxicity in evaluation and treatment; includes problems of modern toxicology, i.e., teratogenesis, mutagenesis, carcinogenesis.

870. Problems
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 5 credits. Approval of department. Limited amounts of individual work on selected research problems.

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

910. Seminar
Fall, Winter, Spring. 1(1-0) May re-enroll for a maximum of 3 credits.

980. Problems
Fall, Winter, Spring, Summer. Variable credit. May re-enroll for a maximum of 5 credits. Approval of department. Limited amounts of individual work on selected research problems.

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

PHILOSOPHY

PHL

College of Arts and Letters

Each of the courses 101, 102, 103 is an independent gateway to an area of philosophy. Together they provide a comprehensive introduction to philosophical inquiry through contact with philosophical issues.

101. Introduction to Philosophy: Ethics and Value
Fall, Winter, Spring, Summer. 3(3-0) Students may not receive credit for both 101 and 340. Moral responsibility, praise and blame, good and evil, justice, law and morality, individual liberty and collective authority and contemporary moral issues are typical problems.

102. Introduction to Philosophy: Epistemology and Metaphysics
Fall, Winter, Spring, Summer. 3(3-0) Skepticism and certainty, existence, matter and mind, God, space and time, knowledge and belief, perception, personal identity, causality, and free-will are typical problems.

103. Introduction to Philosophy: Logic
Fall, Winter, Spring, Summer. 3(3-0) Deductive and inductive reasoning and such topics as rational argumentation, fallacies, definitions, meaning, truth and evidence.

200H Honors Work
Fall, Winter, Spring. 1 to 16 credits. Approval of department.
211. Introduction to the History of Philosophy, Part I  
Fall, Winter, Spring. 3(3-0)  
The Greek and Roman period with emphasis on Plato and Aristotle.

212. Introduction to the History of Philosophy, Part II  
Winter, Spring. 3(3-0)  
The Middle Ages and early modern periods, with emphasis on Aquinas, Descartes, Spinoza and Leibniz.

213. Introduction to the History of Philosophy, Part III  
Fall, Spring. 3(3-0)  
The eighteenth and nineteenth centuries with emphasis on British empiricism, Kant, and post-Kantian philosophy.

294. Special Topics  
Fall, Winter, Spring, Summer. 2 to 6 credits approved by department.  
Intensive study of some particular problem or author in philosophy.

311. Indian Philosophy  
Fall, Winter. 3(3-0)  
Metaphysical, ethical and social theories developed within the major Indian philosophical systems; e.g., philosophical Buddhism, Vedantist transcendentalism, Samkhya dualism, and the Realist schools.

312. Chinese Philosophy  
Spring. 3(3-0)  
Major cosmological and ethical doctrines of such Chinese authors and movements as Confucius, The Tao, Lao Tzu, Tz'ao, Lui-Yang dualism, Buddhism, responses to Western influences, the new China.

313. American Philosophy  
Spring, Summer. 3(3-0)  
Three credits in philosophy or approval of department. Examination of a major existentialist author (or authors), so designed as to place existentialist views in significant relation to the tradition of European thought.

322. Existentialism  
Fall, Winter, Spring. 3(3-0)  
Three credits in philosophy or approval of department. An examination of a major existentialist author (or authors), so designed as to place existentialist views in significant relation to the tradition of European thought.

330. Elements of Ethics  
Fall, Winter, Spring. 3(3-0)  
Students may not receive credit for both 101 and 330. An inquiry into the nature of the right and the good, addressed to such fundamental problems as the objectivity of moral judgments, the criteria of right and wrong, and the grounds of moral responsibility.

337. Logic I  
Fall, Winter, Spring. 4(4-0)  
Modern symbolic methods in deductive reasoning. The logic of connectives and quantifiers.

338. Logic II  
Fall, Winter, Spring. 4(4-0)  
337 or approval of department. The logic of identity, functions, and descriptions. Theorey-building: axioms, definitions, theorems.

350. Philosophy of Art  
Fall, Winter, Spring. 3(3-0)  
Three credits in philosophy or 6 credits in art, music, or literature. Inquiry into the principles of artistic activity made with a view to determining the conditions under which art is produced, the nature of its product, and the sources of its value.

351. Contemporary Aesthetic Theory  
Winter, Spring. 3(3-0)  
Three credits in philosophy or 6 credits in art, music, or literature. Critical examination of contemporary theory in aesthetics and the philosophy of art, in which the primary categories of reflection upon the arts have gained their currency. Readings from such authors as Tolstoy, Santayana, Coe, Balloough, Freud, Parker, Prall, Greene.

355. Philosophy of Religion  
Winter, Spring. 3(3-0)  
Three credits in philosophy or 6 in religious studies or approval of department. Alternative philosophical approaches to religion as a personal and/or social phenomenon. Contemporary problems of meaning, evidence and obligation in relation to religious beliefs and practices.

360. Philosophy of Law  
Fall, Winter, Spring. 3(3-0)  
Three credits in philosophy or 6 credits in political science or approval of department. Philosophical examination of such legal concepts as punishment, responsibility, right and duties, judicial decisions and justice, and such legal theories as natural law, positivism and realism.

365. Social and Political Philosophy  
Winter, Spring. 3(3-0)  
Three credits in philosophy or approval of department. Philosophical justifications for political authority and individual liberty. Consideration of such theories as natural law, social contract, utilitarianism and historicism.

366. The Philosophy of Karl Marx  
Spring. 3(3-0)  
Three credits in philosophy or approval of department. Structural and critical analysis of Karl Marx's philosophical thought. Theory of objectification and alienation; its application to the religious, philosophical, political, social, and economic spheres; reform of the Hegelian dialectic.

370. Philosophy of Language  
Fall, Winter. 3(3-0)  
Three credits in philosophy or approval of department. An elucidation of elementary topics in semantics and philosophy of language, including such topics as meaning, denotation and truth.

380. The Nature of Science, Part I  
Fall, Winter, Spring. 3(3-0)  
Three credits in philosophy or 6 credits beyond basic in natural science or social science or mathematics or approval of department. Contending views about science. Such topics as scientific methodology, the objectivity of science, the presuppositions, goals and limits of science.

381. The Nature of Science, Part II  
Winter, Spring. 3(3-0)  
Issues concerning science and man. Such topics as: the value neutrality of science, science and ideology, science and decision making, the scientific predictability of human actions.

390. Philosophy in Literature  
Spring. 3(3-0)  
Juniors. Philosophical problems found in such writers as Arastchyan, Goethe, Dostoevsky, Tolstoy, Mann, Hesse, Camus.

400H. Honors Work  
Fall, Winter, Spring. Variable credit. Approval of department. Individually selected program of supervised group or individual study dealing with some phase of philosophy.

410. Plato  
Fall. 5(4-0)  
Three credits in philosophy at the 300 level or 9 credits in philosophy or approval of department. The most important Socratic dialogues, including the Republic and the dialogues of the early Academy.

411. Aristotle, Part I  
Winter. 4(3-0)  
Three credits in philosophy at the 300 level or 9 credits in philosophy or approval of department. Introduction to the philosophy of Aristotle. Readings from the texts of Aristotle and lectures on his philosophy with emphasis on his logical, epistemological and metaphysical inquiries.

412. Aristotle, Part II  
Spring. 4(3-0)  
411 or approval of department. Continuation of 411, with emphasis on Aristotle's method in relation to his ethics, politics and rhetoric.

413. Continental Rationalism  
Fall. 5(4-0)  
Three credits in philosophy at the 300 level or 9 credits in philosophy or approval of department. The rationalists of the seventeenth century, with emphasis on Descartes, Spinoza and Leibniz.

414. Medieval Philosophy  
Winter. 4(3-0)  
Three credits in philosophy at 300 level or higher, or 9 credits in philosophy, or approval of department. Significant philosophical and philosophical problems of the Medieval period.

416. British Empiricism  
Winter. 5(4-0)  
Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department. The development of the philosophical school of British Empiricism, with emphasis on the writings of Locke, Berkeley, and Hume.

419. Nineteenth Century Philosophy  
Fall. 4(3-0)  
Three credits in philosophy at 300 level or higher or approval of department. Significant philosophical developments in 19th century thought, with emphasis on post-Kantian idealism.

420. Analytic Philosophy, 1900-1945  
Fall. 4(3-0)  
Three credits in philosophy at the 300 level or higher or 9 credits in philosophy or approval of department. Issues in the works of such philosophers as Frege, Russell, Moore, Wittgenstein and Carnap. Will provide a background for recent analytic philosophy.

421. Formal Linguistic Analysis  
Winter. 4(3-0)  
337 and 420 or approval of department. Issues in the works of such philosophers as Carnap, Quine, Goodman and Bergman.

422. Non-Formal Linguistic Analysis  
Spring. 4(3-0)  
420. Issues in the works of such philosophers as Wittgenstein, Ryle, Austin and Strawson.
423. Kant
Spring. 5(4-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or approval of department.
Kant's metaphysical and epistemological system as expressed in the Critique of Pure Reason.

424. Contemporary Continental Philosophy
Spring. 4(3-0) Three credits of philosophy at the 300 level or higher or approval of department.
Typical areas of study are phenomenology, structuralism, contemporary interpretation of Marx, hermeneutics (Gadamer), critique of institutional reason (Horstheimer, Adorno, Habermas) ontologies of the person.

427. Hegel
Winter. 4(3-0) Three credits in philosophy at the 300 level or higher or 9 credits in philosophy or approval of department.
Hegel's Phenomenology of Spirit, Science of Logic, or Philosophy of Right. Textual analysis and critical study of epistemological, metaphysical or ethical-political aspects of Hegelian philosophy.

428. Special Topics in Existentialism
Winter, Spring. 4(3-0) 323 or approval of department.
An examination of existentialist thought in terms of a single author or topic.

431. Modern Ethical Theories
Fall. 4(3-0) 3 credits in philosophy at the 300 level or higher or approval of department.
Study of some of the important writers and problems in moral philosophy since the seventeenth century.

432. Contemporary Ethical Theories
Winter. 4(3-0) 431 or 9 credits in philosophy or approval of department.
Study of some of the leading contemporary views of the nature of moral language and consciousness.

437. Nonstandard Logics
Winter. 4(4-0) 337 or approval of department.
Such topics as the logic of possibility, of existence, of knowledge and belief, of obligation, of tense; many-valued logics; intuitionist logic.

439. Introduction to Metatheory
Spring. 4(4-0) 327 or approval of department.
Metatheory for quantification logic and first order theories— including consistency and completeness theorems, independence of axioms. Introduction to model theory and proof theory.

440. Epistemology, Part I
Fall of even-numbered years. 4(3-0)
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.

441. Epistemology, Part II
Winter of odd-numbered years. 4(3-0)
440 or approval of department.
Continuation of 440.

442. Metaphysics, Part I
Fall of odd-numbered years. 4(3-0)
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.

444. Metaphysics, Part II
Winter of even-numbered years. 4(3-0)
445 or approval of department.
Continuation of 445.

446. Metaphysics, Part II
Winter of even-numbered years. 4(3-0)
445 or approval of department.
Continuation of 445.

447. Philosophy of Mind
Winter. 4(3-0) 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.).

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

449. Philosophy of the Social Sciences
Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or 9 credits in social science or approval of department.
Selected problems in the methodology of the behavior sciences, including such topics as: concept formation and theory construction, explanation and insight, subjectivity and value judgments, emergence and telology, historicism, reductionism, measurement, and statistical inference.

451. Philosophy of Science, Part I
Winter. 4(3-0) 337 or approval of department.
Topics such as: the logical structure of scientific theories, empirical meaningfulness and testability, deductive and probabilistic explanation, prediction.

452. Philosophy of Science, Part II
Spring. 4(3-0) 337 or approval of department.
Topics such as: discovery vs. validation of theories, probability, induction and confirmation theory.

453. Philosophy of Physical Science
Fall, Spring. 4(4-0) Nine credits in physical science or approval of department. Interdepartmental with and administered by Lyman Briggs College.
Philosophical problems of the physical sciences. The topics will be taken from such areas as quantum mechanics, space-time, classical mechanics, relativity.

454. Philosophy of History of Science
Winter, Spring. 4(4-0) Nine credits in history of science or approval of department. Interdepartmental with and administered by Lyman Briggs College.
Philosophical problems concerned with the nature of science as such. The topics will be taken from such areas as the history of scientific thought, the growth of science, the nature of scientific information, the relationship of science to society, the evolution of scientific thought, and the role of the scientist in society.

456. Existentialism
Winter, Spring. 4(3-0) 341 or approval of department.
An examination of existentialism in terms of a single author or topic.

457. Social Philosophy
Winter, Spring. 4(3-0) 345 or approval of department.
An examination of social philosophy in terms of a single author or topic.

458. Philosophy of the Critique of Pure Reason
Winter, Spring. 4(3-0) 348 or approval of department.
An examination of the critique of pure reason in terms of a single author or topic.

459. Philosophy of the Critique of Practical Reason
Winter, Spring. 4(3-0) 349 or approval of department.
An examination of the critique of practical reason in terms of a single author or topic.

460. Moral and Political Issues
Fall, Winter, Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy, or approval of department.
Philosophical aspects of issues such as freedom of speech and action, civil disobedience, violence, war, justice and equality, human rights and punishment.

461. Philosophy of Mathematics
Spring. 4(3-0) 337 and 338 or approval of department.
An analysis of the nature of mathematical truth. The theses of logicism, formalism, intuitionism, and conventionalism are critically examined.

462. Philosophy of Science, Part I
Winter. 4(3-0) 337 or approval of department.
Topics such as: the logical structure of scientific theories, empirical meaningfulness and testability, deductive and probabilistic explanation, prediction.

463. Philosophy of Science, Part II
Spring. 4(3-0) 337 or approval of department.
Topics such as: discovery vs. validation of theories, probability, induction and confirmation theory.

464. Philosophy of Physical Science
Fall, Spring. 4(4-0) Nine credits in physical science or approval of department. Interdepartmental with and administered by Lyman Briggs College.
Philosophical problems of the physical sciences. The topics will be taken from such areas as quantum mechanics, space-time, classical mechanics, relativity.

465. Philosophy of the Social Sciences
Winter, Spring. 4(3-0) Three credits in philosophy at 300 level or higher or 9 credits in philosophy or 9 credits in social science or approval of department.
Selected problems in the methodology of the behavior sciences, including such topics as: concept formation and theory construction, explanation and insight, subjectivity and value judgments, emergence and telology, historicism, reductionism, measurement, and statistical inference.

466. Special Topics
Fall, Winter, Spring, Summer. 2 to 6 credits. May re-enroll for credit. Approval of department.
Intensive study of some particular problem or author in philosophy.

467. Proseminar
Winter, Spring. 4(3-0) Three credits in philosophy or approval of department. Approval of instructor.
Each section will examine a particular topic or author. Emphasis on discussion of student papers.

468. Seminar in the History of Philosophy
Winter, Spring, Summer. 4 credits. Approval of department.

469. Seminar in Ethics
Winter, Spring, Summer. 4 credits. May re-enroll for credit. Approval of department.

470. Seminar in Logic
Fall. 4(3-0) May re-enroll for credit. Approval of department.

471. Seminar in Epistemology
Fall, Winter, Spring. 4 credits. May re-enroll for credit. Approval of department.

472. Seminar in Metaphysics
Fall, Winter, Spring. 4 credits. May re-enroll for credit. Approval of department.

473. Seminar in Aesthetics
Fall. 4(3-0) Approval of department.

474. Seminar in Social Philosophy
Spring. 4(3-0) Approval of department.

475. Seminar in the Philosophy of Language
Fall. 4(3-0) Approval of department.
Concrete bases of language and nature of meaning.
890. Seminar in the Philosophy of Science
Fall, Winter. 4 credits. Approval of department.

890. Graduate Reading Course
Fall, Winter, Spring, Summer. 1 to 10 credits. Approval of department.

891. Graduate Reading Course
Fall, Winter, Spring, Summer. 1 to 10 credits. May re-enroll for credit. Approval of department.

899. Research
Fall, Winter, Spring, Summer. Available credit. Approval of department.

PHYSICAL SCIENCE

College of Natural Science

203. Foundations of Physical Sciences
Fall, Winter, Spring, Summer. 4(3-3)
Primarily for elementary school teachers.

400. Physical Science for Teachers
Fall, Winter, Spring, Summer. 3 or 4 credits. May re-enroll for a maximum of 12 credits. Teacher certification with science major or minor.

403. Mathematics for Teachers
Winter, Spring. 4(4-0) or 402 or approval of department.

410. Seminar on Recent Advances in Physical Science
Fall, Winter, Summer. 3(0-0)
May re-enroll for a maximum of 6 credits if different topics are taken. Approval of department.

411. Seminar on Man, His Universe
Fall, Winter, Spring. 3(0-0)
Approval of department.

412. Seminar on Man, His Earth
Fall, Winter, Spring, Summer. 3(0-0)
Approval of department.

PHYSICS

College of Natural Science

Introductory physics courses are divided into four groups:

1) 237, 238, 239 (Theory) and 257, 258, 259 (Laboratory). These are for students who are taking the same time, or who have taken, first year mathematics through college algebra and trigonometry.

2) 281, 282, 283 (Theory) for students of the natural sciences who have taken Calculus I (MTH 112).

3) 281A, 282A, 283A, 287, 288, 289 (Theory) for students of the physical sciences, mathematics, engineering, and others taking Calculus III (MTH 214). May be taken as 281 or as 281A plus 281A, 288, or as 282 plus 282A, 289 or 283 plus 283A.


A student may change from one group of introductory courses to another, but may not earn credit for more than one complete sequence. Credit may not be earned for more than one of the courses PHY 294, 357 or 364.

PHY 201, 236, 301, 357 and 430 cannot be used to meet the requirements for a major in physics. All 400 level physics courses (except 430) require PHY 259 or 293B as prerequisites.

PHYSICAL SYSTEMS IN AGRICULTURE AND NATURAL RESOURCES

See Agricultural Engineering

PHYSICS

Course Description

PHY 201. The Science of Sound I: Rock, Bach and Oscillators
Fall, Winter, 3(3-0) or 4(4-0) Interdepartmental with the Mechanical Engineering Department.

PHY 202. The Science of Sound II
Spring. 3(3-0) or 4(4-0) 201. Interdepartmental with and administered by the Mechanical Engineering Department.