PHIL 3750 Minds and Machines 3(3) Examines controversial questions in artificial intelligence and the Computational Theory of Mind. Topics may include: "Can machines think?" "What's involved in being able to think?" "Can machines reason, understand, be conscious, be self-aware, learn, be creative, have emotions, and use natural language?" Focus is on manmade computers and the mind as computer.

PHIL 3990 Philosophy Portfolio 2(2) Creation of a digital portfolio to demonstrate competence in reasoning, critical thinking, and problem solving skills as well as ethical judgment. Course also serves as a resource for academic and professional development. Prereq: Junior standing in Philosophy.

PHIL 400 Studies in the History of Philosophy 3(3) In-depth study of a selected philosopher, philosophical school, or movement. Topics vary. With departmental consent, may be repeated once for credit. Current topics and course descriptions are available in the department's course offering brochure.

PHIL 400 Topics in Philosophy 3(3) Thorough examination of a particular philosophical topic, issue, or problem. Topics vary. May be repeated once for credit with departmental consent. Current topics and course descriptions are available in the department's course offering brochure.

PHIL 4220 Anarchism 3(3) Philosophical study of the roots of anarchist thought and its current articulations.

PHIL 4750 Philosophy of Film 3(3) Pursues several issues at the center of recent debate in the philosophy of film. Questions investigated include whether film has an essence that differentiates it from other art forms, whether films ought to be thought of as having authors or narrators, and whether films can themselves philosophize.

PHIL 4900 Law, Liberty and Justice Prelaw Internship 1-3(1-3) Faculty-supervised internship designed for students in the Law, Liberty and Justice emphasis area of the Philosophy major. Interns are placed with law offices or with institutions and agencies in fields related to law and social policy. May be repeated for a maximum of six credits. To be taken Pass/No Pass only. Prereq: Philosophy major and junior standing and consent of internship coordinator.

PHIL 4920 Creative Inquiry-Philosophy 1-4(1-4) Small group work on particular issues with emphasis on involving students in research. Content varies. May be repeated for a maximum of nine credits. Prereq: Consent of instructor.

PHIL 4970 Philosophy Honors Research 3(3) Students conduct research, clearly define the topic, and complete an annotated bibliography under the supervision of the thesis advisor. Prereq: Consent of department chair and thesis advisor.

PHIL 4980 Philosophy Honors Thesis 3(3) In consultation with the thesis advisor and committee, students write, revise, defend, and complete the thesis. Prereq: PHIL 4970 and consent of department chair and thesis advisor.

PHIL 4990 Independent Study 1-3(1-3) Course of study designed by the student in consultation with a faculty member who agrees to provide guidance, discussion, and evaluation of the project. Student must confer with the faculty member prior to registration. May be repeated for a maximum of six credits. Prereq: Consent of instructor.

PHYSICS

PHYS 1010 Current Topics in Modern Physics 1(0) Demonstrations and lectures serving as an introduction to different areas of physics and astronomy are presented by various members of the staff. May include such topics as astrophysics, energy, relativity, and weather, as well as visits to the planetarium.

PHYS 1220 Physics with Calculus I 3(3) First of three courses in a calculus-based physics sequence. Topics include vectors, laws of motion, conservation principles, rotational motion, oscillations, and gravitation. Credit for a degree will be given for only one of PHYS 1220, 2000, or 2210. Includes Honors sections. Prereq: MATH 1060 or MATH 1070.

PHYS 1240 Physics Laboratory I 1(3) Introduction to physical experimentation with emphasis on mechanical systems, including oscillatory motion and resonance. Computers are used in the experimental measurements and in the statistical treatment of data. Credit for a degree will be given for only one of PHYS 1240 or 2040. Prereq or concurrent enrollment: PHYS 1220.

PHYS 1990 Creative Inquiry-Physics and Astronomy 1-4(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Prereq: Consent of faculty member/mentor.

PHYS 2000 Introductory Physics 4(3) Introduction to classical physics. Includes elements of mechanics, heat, electricity, and light. May not be substituted for PHYS 2070 with the approval of the student's program of study department. Credit for a degree will be given for only one of PHYS 2200, 2000, or 2070. Prereq or concurrent enrollment: MATH 1020. Coreq: PHYS 2010.


PHYS 2070 General Physics I 3(3) Introductory course for students who are not majoring in physical science or engineering. Covers such topics as mechanics, waves, fluids, and thermal physics. Credit for a degree will be given for only one of PHYS 2200, 2000 or 2070. Prereq: MATH 1020 or MATH 1040 or MATH 1050 or MATH 1060 or MATH 1070.

PHYS 2080 General Physics II 3(3) Continuation of PHYS 2070. Covers such topics as electricity, magnetism, electromagnetic waves, optics, and modern physics. Credit for a degree will be given for only one of PHYS 2080 or 2210. Prereq: PHYS 2070.
Courses of Instruction 2016-2017 Undergraduate Announcements

PHYS 2090 General Physics I Laboratory 1(2) Introductory laboratory course for students who are not majoring in physical science or engineering. Covers such topics as mechanics, waves, fluids, and heat. Credit for a degree will be given for only one of PHYS 2120 or 2090. Prereq or concurrent enrollment: PHYS 2070.

PHYS 2100 General Physics II Laboratory 1(2) Covers such topics as electricity, magnetism, electromagnetic waves, optics, and modern physics. Credit for a degree will be given for only one of PHYS 2210 or 2230. Prereq: PHYS 2070. Prereq or concurrent enrollment: PHYS 2080.

PHYS 2210 Physics with Calculus II 3(3) Continuation of PHYS 2220. Topics include thermodynamics, kinetic theory of gases, electric and magnetic fields, electric currents and circuits, and motions of charged particles in fields. Credit for a degree will be given for only one of PHYS 2080 or 2210. Includes Honors sections. Prereq: MATH 1080 or MATH 1110.

PHYS 2220 Physics with Calculus III 3(3) Continuation of PHYS 2210. Topics include wave motion, electromagnetic waves, interference and diffraction, relativity, atomic particles, and atomic and nuclear structure. Includes Honors sections. Prereq: PHYS 2210.

PHYS 2230 Physics Laboratory I 1(3) Experiments in heat and thermodynamics, electrostatics, circuits, and magnetism. Computers are used in statistical treatment of data. Credit for a degree will be given for only one of PHYS 2230 or 2110. Prereq or concurrent enrollment: MATH 1080 or MATH 1110.

PHYS 2240 Physics Laboratory III 1(3) Experiments involve atomic, molecular, and nuclear systems. Wave particle dualism of light and matter is emphasized. Calculators and computers are used in statistical treatment of data. Prereq or concurrent enrollment: PHYS 2220.

PHYS 2400 Physics of the Weather 3(3) Descriptive introduction to meteorology. Includes atmospheric thermodynamics, solar radiation, heat budget, atmospheric circulation, force laws governing air motion, fronts, precipitation, synoptic prediction. Special topics of current interest, such as the effect of environmental pollution on weather and the effect of weather on health, are included.

PHYS 2450 Physics of Global Climate Change 3(3) Descriptive study of the heating and cooling balance of the Earth's atmosphere and surface and feedback mechanisms that regulate our climate. Past and future temperature trends, atmospheric greenhouse gas inventories, and solar radiative forcing. Evaluation of claims and news about climate change, and their interaction with public opinion.

PHYS 2800 Physics and Reality 3(3) An technical study of the content and meaning of modern physics. Begins with first principles of physics. Evaluates concepts of substance, matter, locomotion, atomization, fields, space, time, and randomness. Includes quantum mechanics, Bell's Theorem, theory of relativity, and Godel's Theorem. Intended for a broad audience, including specialists and non-specialists.

PHYS 2900 Physics Research 1-3(1-3) Individual research project in any area of experimental or theoretical physics or astronomy supervised by a physics or astronomy faculty member. Project need not be original but must add to students' ability to carry out research. May be repeated for a maximum of six credits. Students must have a 3.0 minimum grade-point average to enroll in this course. Prereq: Consent of instructor.

PHYS 2910 Creative Inquiry-Physics and Astronomy 1-4(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. To be taken Pass/No Pass only. May be repeated for a maximum of six credits. Prereq: Consent of faculty member/mentor.

PHYS 3000 Introduction to Research 2(2) Acquaints students with current research in physics. Seminars are provided where research activities in various areas of physics and astronomy are summarized. Provides a basis for students to choose a suitable topic for a senior thesis. Includes Honors sections. Prereq: PHYS 2210.

PHYS 3110 Introduction to the Methods of Theoretical Physics 3(3) Survey of methods and techniques of problem-solving in physics. Emphasizes the application of mathematical techniques to the solution of problems of vectors, fields, and waves in mechanics, electromagnetism, and quantum physics. Prereq: PHYS 2220.

PHYS 3120 Methods of Theoretical Physics II 3(3) Continuation of PHYS 3110 focused on introducing various mathematical notions widely used in upper level physics courses, such as differential equations, special functions and complex numbers, and complex functions. Prereq: PHYS 3110.

PHYS 3150 Introduction to Computational Physics 3(3) Basic numerical methods important for data interpretation and modeling in physics, such as interpolation, derivatives, integration, solving differential and matrix equations, and Monte Carlo simulation. Methods are applied to physics problems, including realistic projectile motion, harmonic oscillators, chaotic pendulum, nonlinear systems, and Ising model. Prereq: PHYS 2220.

PHYS 3210 Mechanics I 3(3) Statics, motions of particles and rigid bodies, vibratory motion, gravitation, properties of matter, flow of fluids. Includes Honors sections. Prereq: PHYS 2210.

PHYS 3220 Mechanics II 3(3) Dynamics of particles and rigid bodies, Lagrangian and Hamiltonian formulations, vibrations of strings, wave propagation. Includes Honors sections. Prereq: PHYS 3210.

PHYS 3230 Experimental Physics I 3(1) Introduction to experimental modern physics, measurement of fundamental constants, repetition of crucial experiments of modern physics (Stern-Gerlach, Zeeman effect, photoelectric effect, etc.). Includes Honors sections. Prereq or concurrent enrollment: PHYS 2220. Coreq: PHYS 3251.

PHYS 3251 Experimental Physics I Laboratory 0(4) Non-credit laboratory to accompany PHYS 3250. Coreq: PHYS 3250.

PHYS 3260 Experimental Physics II 3(1) Continuation of PHYS 3250. Includes Honors sections. Coreq: PHYS 3261.

PHYS 326E Experimental Physics II Laboratory 0(4) Non-credit laboratory to accompany PHYS 3260. Coreq: PHYS 3260.

PHYS 3350 Modern Physics 3(3) Study of the topics of modern physics, including relativity, atomic physics, quantum mechanics, condensed-matter physics, nuclear physics, and elementary particles. Includes Honors sections. Prereq: PHYS 2220 and MATH 2060.

PHYS 3350 Modern Physics I Overview 1(1) Overview of topics in modern physics, including a short description of the structure of solids, nuclear physics, and particle physics. Prereq: PHYS 2220.

PHYS 3390 Creative Inquiry-Physics and Astronomy 1-4(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. To be taken Pass/No Pass only. May be repeated for a maximum of six credits. Prereq: Consent of faculty member/mentor.

PHYS 4010 Senior Thesis 1-3(1-3) Semi-original, theoretical, experimental, or computational research project performed under the direction of a faculty member. Fields available include astrophysics, atmospheric physics, biophysics, high energy physics, relativity, solid state physics, and statistical mechanics. May be repeated for a maximum of six credits. Includes Honors sections. Prereq: Nine credits of physics at the 3000 or 4000 level.

PHYS 4170 Introduction to Biophysics 1(3) Introduction to the application of physics to biological problems. Topics include review of elementary chemical and biological principles, physics of biological molecules, and fundamentals of radiation biophysics. Includes Honors sections. Prereq: MATH 2060 and PHYS 2210.

PHYS 4200 Atmospheric Physics 3(3) Study of physical processes governing atmospheric phenomena. Topics include thermodynamics of dry and moist air, solar and terrestrial radiative processes, convection and cloud physics, precipitation processes, hydrodynamic equations of motion and largescale motion of the atmosphere, numerical weather prediction, atmospheric electricity. Prereq: MATH 1080; and PHYS 2080 or PHYS 2210.

PHYS 4320 Optics 3(3) Covers a selection of topics, depending on the interest of the student. Topics may include the formation of images by lenses and mirrors, design of optical instruments, electromagnetic wave propagation, interference, diffraction, optical activity, lasers, and holography. Includes Honors sections. Prereq: PHYS 2210.

PHYS 4410 Electromagnetics I 3(3) Study of the foundations of electromagnetic theory. Topics include electric fields, electric potential, dielectrics, electric circuits, solution of electrostatic boundary-value problems, magnetic fields, and magnetostatics. Includes Honors sections. Prereq: PHYS 2210 and MATH 2080.
PHYS 4420 Electromagnetics I (3) Continuation of PHYS 4410. Study of foundations of electromagnetic theory. Topics include magnetic properties of matter, microscopic theory of magnetization, electromagnetic induction, magnetic energy, AC circuits, Maxwell’s equations, and propagation of electromagnetic waves. Other topics may include waves in bounded media, antennas, electrodynamics, special theory of relativity, and plasma physics. Includes Honors sections. Prereq: PHYS 4410.

PHYS 4450 Solid State Physics I (3) Continuation of PHYS 4450, including selected topics in solid-state physics such as optical properties, superconductivity, non-crystalline solids, dielectrics, ferroelectrics, and nanomaterials. Plasmons, polarons, and excitons are discussed. Brief introduction into methods of solid-state synthesis and characterization tools is presented. Includes Honors sections. Prereq: PHYS 4450.

PHYS 4450* Solid State Physics II (3) Continuation of PHYS 4450, including selected topics in solid-state physics such as optical properties, superconductivity, non-crystalline solids, dielectrics, ferroelectrics, and nanomaterials. Plasmons, polarons, and excitons are discussed. Brief introduction into methods of solid-state synthesis and characterization tools is presented. Includes Honors sections. Prereq: PHYS 4450.

PHYS 4470 Quantum Physics I (3) Discussion of the Schrödinger equation for free particles, the hydrogen atom, and the harmonic oscillator. Includes Honors sections. Prereq: PHYS 3210.

PHYS 4470* Quantum Physics II (3) Continuation of PHYS 4450. Application of principles of quantum mechanics as developed in PHYS 4450 to atomic, molecular, solid state, and nuclear systems. Includes Honors sections. Prereq: PHYS 4450.

PHYS 4480 Thermodynamics and Statistical Mechanics I (3) Study of temperature development of the laws of thermodynamics and their application to thermodynamic systems. Introduction to low temperature physics is given. Includes Honors sections. Prereq: PHYS 4480.

PHYS 4480* Thermodynamics and Statistical Mechanics II (3) Study of temperature development of the laws of thermodynamics and their application to thermodynamic systems. Introduction to low temperature physics is given. Includes Honors sections. Prereq: PHYS 4480.

PHYS 4481 Surface Experiments Laboratory I (3) Non-credit laboratory to accompany PHYS 4820. Coreq: PHYS 4820.

PHYS 4490 Creative Inquiry-Physics and Astronomy 1-4(1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. To be taken Pass/No Pass only. May be repeated for a maximum of eight credits. Consent of faculty member/mentor.

PACKAGING SCIENCE


PKSC 1000 Packaging Orientation 1(1) Overview of the various principles and practices in packaging science, historical development, packaging as a career.

PKSC 1000 Introduction to Packaging Science 2(2) Considers functions of a package; materials, processes, and technology used in package development; and the relationship of packaging to the corporation, consumer, and society as a whole.

PKSC 1020 Packaging Perishable Products 3(3) Covers fundamental characteristics and applications of various materials and systems used to package perishable products such as foods and pharmaceuticals. Discusses packaging issues regarding food, pharmaceutical, and medical packaging. Includes product/package interactions and packaging requirements to address basic theory in food and pharmaceutical protection. Preq or concurrent enrollment: CH 1010 and PKSC 1020 and PKSC 2020.


PKSC 2030 Packaging Research Fundamentals 2(2) Principles, methods, and resources for organizing, researching, and reporting technical work in packaging science. Preq: PKSC 1020 and PKSC 1030 and ENGL 1030 and Packaging Science major.

PKSC 2040 Container Systems (Rigid and Flexible) 3(3) Examination of all the packages and containers used to develop systems to distribute products. Compatibility of product and package, structural design, costs, and merchandising considerations are stressed. Preq: PKSC 1020 and PKSC 2020. Coreq: PKSC 2060.


PKSC 2200 Product/Package Design and Prototyping 2(2) Overview of structural and graphic development tools for product and packaging design. Focus on digital creation, photo rendering, wideformat plotting, printing, rapid prototyping, visualization and real-time 2d/3d design. Course utilizes online lectures and hands-on laboratory experience at The Center Institute. Preq: PKSC 1020. Coreq: PKSC 2201.

PKSC 2201 Product/Package Design and Prototyping Laboratory I (6) Non-credit laboratory to accompany PKSC 2200. Coreq: PKSC 2200.

PKSC 3200 Packaging Design Theory 3(2) Study of human factors psychology as it relates to product and package development. Lecture topics center on advanced color theory, space, shape, texture, pattern, typography, branding, marketing, consumer studies, ergonomics, sustainability and applied packaging. Laboratory focuses on developing retail packaging through applying course theory, group development and peer critique. Preq: PKSC 1020 and PKSC 2200. Coreq: PKSC 3201.

PKSC 3201 Packaging Design Theory Laboratory 0(3) Non-credit laboratory to accompany PKSC 3200. Coreq: PKSC 3200.

PKSC 3680 Packaging and Society 3(3) Study of the role of packaging in society as it specifically relates to the responsibilities of the packaging scientist in protecting people and the environment. Includes study of packaging and environmental regulations and guidelines currently in place to achieve these goals. Ability to make informed decisions and ethical judgments is an encompassing goal. Includes Honors sections.

PKSC 4010 Packaging Machinery 3(3) Systematic study of types of machinery used to form, fill, seal, and handle various packaging products, and packaging materials. Emphasizes basic mechanical, electrical, pneumatic, and hydraulic components of packaging machinery along with packaging machinery terminology. Discusses methods for machine line optimization and layout. Preq: Packaging Science major or minor or Food Science and Human Nutrition major or Food Science minor; and FDSC 2140 or PKSC 2040.

PKSC 4030 Packaging Career Preparation 1(1) Preparation for a successful career in Packaging Science by completing the professional eportfolio, and finalizing a resume and career eportfolio. Refines career skills through role playing. Topics include presentations, interviewing, effective collaboration and communication, business and foreign travel etiquette. Preq: Packaging Science major or minor. Coreq: PKSC 4200.

PKSC 4040 Mechanical Properties of Packaging and Principles of Protective Packaging 3(3) Study of the mechanical properties of products and packages and standard methods of determining these properties. Focuses on the functional properties of packages related to shock and vibration isolation and compression. Includes Honors sections. Preq: Packaging Science major or minor and junior standing; and MATH 1060 and PKSC 1020 and PKSC 2040; and one of PHYS 1220 or PHYS 2070.