Interdisciplinary Engineering Programs

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The University of Kansas School of Engineering offers interdisciplinary engineering programs on the undergraduate and graduate level.

- Bachelor of Science in Engineering Physics (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/bs-engineering-physics/)
- Minor in Biomedical Engineering (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/minor-biomedical-engineering/)
- Undergraduate Certificate in Bioengineering (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/bioengineering-ucrt/)
- Master of Engineering in Bioengineering (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/me-bioengineering/)
- Master of Science in Bioengineering (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/ms-bioengineering/)
- Doctor of Philosophy in Bioengineering (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/phd-bioengineering/)
- Graduate Certificate in Biomedical Product Design (https://catalog.ku.edu/engineering/interdisciplinary-engineering-programs/gcrt-biomedical-product-design/)

Bioengineering Courses

BIOE 800. Bioengineering Colloquium. 0.5-1 Credits.
A colloquium series featuring speakers from industry, government, other universities, research centers and research organizations of the university campus presenting talks on various topics related to bioengineering.

BIOE 801. Responsible Conduct of Research in Engineering. 1 Credits.
Lectures and discussion on ethical issues in the conduct of a scientific career, with emphasis on practical topics of special importance in bioengineering. Topics include the nature of ethics, the roles of the scientist as a reviewer, entrepreneur, employer and teacher, research ethics in the laboratory, social responsibility and research ethics regulation. (Same as ME 801.) Prerequisite: Permission of instructor.

BIOE 802. Bioengineering Internship. 1-6 Credits.
An approved bioengineering industrial or clinical internship. The student is supervised by a preceptor at the internship site. Biweekly reports and a final report detailing work performed are filed with the course instructor. Prerequisite: Permission of instructor.

BIOE 860. Advanced Bioengineering Problems. 1-3 Credits.
An analytical or experimental study of problems or subjects of immediate interest to a student and faculty member and which is intended to develop students capability for independent research or application of engineering science and technology. Maximum credit toward any degree is three hours unless waived in writing by the academic director. Prerequisite: Consent of instructor.

BIOE 890. Special Topics: _____. 1-5 Credits.
Advanced courses on special topics of current interest in bioengineering, given as the need arises. Prerequisite: Approval of instructor.

BIOE 899. Independent Investigation. 1-6 Credits.
An original and independent research or design investigation involving analytical, experimental and/or modeling methodology applied to solve a bioengineering problem as a part of the degree requirements for the Master of Science. Graded on a satisfactory progress/limited progress/no progress basis.

BIOE 999. Independent Investigation. 1-12 Credits.
An original and independent research or design investigation involving analytical, experimental and/or modeling methodology applied to solve a bioengineering problem as a part of the degree requirements for the Doctor of Philosophy. Graded on a satisfactory progress/limited progress/no progress basis.

Engineering Physics Courses

EPHX 210. General Physics I for Engineers. 3 Credits.
This course is an introduction to classical mechanics and thermodynamics designed for students in the School of Engineering who have completed MATH 125 or MATH 145 with a grade of C or better. Students not admitted to the School of Engineering must receive permission from instructor. EPHX 210 and PHSX 211 cannot both be taken for credit. Prerequisite: MATH 125 or MATH 145 with a grade of C or better. Corequisite: MATH 126 or MATH 146; courses in high school physics and/or chemistry recommended.

EPHX 211. General Physics I. 4 Credits.
Introduction to classical mechanics and thermodynamics. Designed for students in engineering and physical science majors. Prerequisite: MATH 116 or MATH 125 or MATH 145; corequisite MATH 126 or MATH 146; courses in high school physics and/or chemistry are recommended.

EPHX 212. General Physics II. 3 Credits.
Study of electricity, magnetism, waves, and optics. Prerequisite: PHSX 201, PHSX 210, PHSX 211 or PHSX 213; MATH 126 or MATH 146. Co-enrollment in MATH 127 or MATH 147 is strongly encouraged.

EPHX 400. Topics in Engineering Physics: _____. 1-3 Credits.
A course on special topics in engineering physics, given as the need arises. Course may be repeated for different topics. Each section may have additional prerequisites to be determined by the instructor.

EPHX 501. Honors Research. 1-4 Credits.
This course is for students seeking Departmental Honors in Astronomy, Engineering Physics, or Physics to fulfill the undergraduate research requirement. At the completion of the required four hours of total enrollment, a written and oral report of the research is required. (Same as ASTR 501 and PHSX 501.) Prerequisite: Junior/Senior standing in Astronomy, Engineering Physics, or Physics, or permission of instructor.

EPHX 503. Undergraduate Research. 1-4 Credits.
This course is for students seeking to fulfill the undergraduate research requirement. Students are expected to participate in some area of ongoing research in the department, chosen with the help of their advisor. At the end of the term, students will present their results in a seminar to other students and faculty. (Same as ASTR 503 and PHSX 503.) Prerequisite: Junior/Senior standing in Astronomy, Engineering Physics, or Physics, or permission of instructor.

EPHX 518. Mathematical Physics. 3 Credits.
Applications of modern mathematical methods to problems in mechanics and modern physics. Techniques include application of partial

differential equations and complex variables to classical field problems in continuous mechanics, unstable and chaotic systems, electrodynamics, hydrodynamics, and heat flow. Applications of elementary transformation theory and group theory, probability and statistics, and nonlinear analysis to selected problems in modern physics as well as to graphical representation of experimental data. (Same as PHSX 518.) Prerequisite: PHSX 313; MATH 220 or MATH 221 or MATH 320; or permission of instructor.

EPHX 521. Mechanics I. 3 Credits.
Newton's laws of motion. Motion of a particle in one, two, and three dimensions. Motion of a system of particles. Moving coordinate systems. (Same as PHSX 521.) Prerequisite: PHSX 213 or PHSX 211 and PHSX 216; MATH 127 or MATH 147; MATH 290 or MATH 291; and MATH 220, MATH 221 or MATH 320.

EPHX 531. Electricity and Magnetism. 3 Credits.
This course will explore the properties of electric and magnetic fields, including electrostatics, Gauss' Law, boundary value methods, electric fields in matter, electromagnetic induction, magnetic fields in matter, the properties of electric and magnetic dipoles, and of dielectric and magnetic materials. (Same as PHSX 531.) Prerequisite: PHSX 214, or PHSX 212 and PHSX 236, or PHSX 202; PHSX 521 or EPHX 521 or special permission; MATH 127 or MATH 147; MATH 290 or MATH 291; and MATH 220, MATH 221, or MATH 320.

EPHX 536. Electronic Circuit Measurement and Design. 4 Credits. LFE
A laboratory course that explores the theory and experimental techniques of analog and digital electronic circuit design and measurement. Topics include transient response, transmission lines, transistors, operational amplifiers, and digital logic. (Same as PHSX 536.) Prerequisite: PHSX 214 or PHSX 212 and PHSX 236; MATH 127 or MATH 147; and MATH 290 or MATH 291. PHSX 313 and 316 recommended.

EPHX 600. Special Topics in Physics and Astrophysics: _____. 1-3 Credits.
Different topics will be covered as needed. This course will address topics in physics and astrophysics not covered in regularly offered courses. May be repeated if topic differs. (Same as PHSX 600.) Prerequisite: Permission of instructor.

EPHX 601. Design of Physical and Electronic Systems. 4 Credits. LFE
A laboratory course emphasizing the application of physical principles to the design of systems for research, monitoring, or control. Topics include the use of microcomputers as controllers, interfacing microcomputers with measurement devices, and use of approximations and/or computer simulation to optimize design parameters, linear control systems, and noise. (Same as PHSX 601.) Prerequisite: Twelve hours of junior-senior credit in physics or engineering, including one laboratory course.

EPHX 611. Introductory Quantum Mechanics. 3 Credits.
An introduction to quantum mechanics, emphasizing a physical overview. Topics include the formalism of nonrelativistic quantum mechanics with emphasis on linear algebra, the 3-dimensional Schrodinger equation with applications to the hydrogen atom; harmonic oscillator; and time-independent perturbation theory. (Same as PHSX 511.) Prerequisite: PHSX 313, PHSX 521 or EPHX 521, and MATH 290 or MATH 291.

EPHX 615. Numerical and Computational Methods in Physics. 3 Credits.
An introduction to the use of numerical methods in the solution of problems in physics for which simplifications allowing closed-form solutions are not applicable. Examples are drawn from mechanics, electricity, magnetism, thermodynamics, and optics. (Same as PHSX 615.) Prerequisite: PHSX 313, MATH 320 or equivalent, and EECS 138 or equivalent.

EPHX 616. Physical Measurements. 4 Credits. LFE
A laboratory course emphasizing experimental techniques and data analysis, as well as scientific writing and presentation skills. Experiments will explore a range of classical and modern physics topics. Students will also practice ethical decision making using case studies appropriate for the discipline. (Same as PHSX 616.) Prerequisite: PHSX 313, PHSX 316 or EPHX 316, and PHSX 521 or EPHX 521. (PHSX 521 or EPHX 521 may be taken concurrently.)

EPHX 621. Mechanics II. 3 Credits.
Continuation of PHSX 521. Lagrange's equations and generalized coordinates. Mechanics of continuous media. Tensor algebra and rotation of a rigid body. Special relativity and relativistic dynamics. (Same as PHSX 621.) Prerequisite: EPHX 521 or PHSX 521.

EPHX 631. Electromagnetic Theory. 3 Credits.
Maxwell's equations, wave propagation, optics and waveguides, radiation, relativistic transformations of fields and sources, use of covariance and invariance in relativity. Normally a continuation of PHSX 531. (Same as PHSX 631.) Prerequisite: EPHX 531 or PHSX 531.

EPHX 641. Introduction to Nuclear Physics. 3 Credits.
Experimental methods in nuclear physics, elementary concepts and simple considerations about nuclear forces, alpha and beta decay, gamma radiation, nuclear structure, and reaction systematics. (Same as PHSX 641.) Prerequisite: PHSX 313 and PHSX 611 or EPHX 611.

EPHX 655. Optics. 3 Credits.
Geometric optics. Wave properties of light: interference, diffraction, coherence. Propagation of light through matter. Selected topics in modern optics, e.g., lasers, fibers. (Same as PHSX 655.) Prerequisite: PHSX 531 or EPHX 531 or PHSX 212 or PHSX 214 and special permission from instructor.

EPHX 661. Introduction to Elementary Particle Physics. 3 Credits.

This course covers properties and interactions of quarks, leptons, and other elementary particles; symmetry principles and conservation laws; broken symmetry; gauge bosons; the fundamental interactions, grand unified theories of strong, electromagnetic, and weak interactions; the cosmological implications of elementary particle physics. (Same as PHSX 661.) Prerequisite: PHSX 611 or EPHX 611, and MATH 220, MATH 221, or MATH 320.

EPHX 671. Thermal Physics. 3 Credits.
This course introduces thermodynamics from statistical considerations and presents the associated techniques for calculating the thermodynamic properties of systems. Highlighted applications of these techniques include the elementary kinetic theory of transport processes and statistical descriptions of both Fermi-Dirac and Bose-Einstein systems. (Same as PHSX 671.) Prerequisite: PHSX 611 or EPHX 611.

EPHX 681. Introduction to Solid State Physics. 3 Credits.
This course is an introduction to the properties of crystals and amorphous solids, including lattice vibrations and thermal properties, with a particular emphasis on the behavior of electrons and holes in the energy bands of metals, semiconductors, superconductors, and insulators. (Same as PHSX 681.) Prerequisite: PHSX 313 and PHSX 611 or EPHX 611.

EPHX 691. Astrophysics I. 3 Credits.
An introduction to radiation processes, thermal processes, and radiative transfer in stellar atmospheres and the interstellar medium. (Same as ASTR 691 and PHSX 691.) Prerequisite: PHSX 313 or consent of instructor.

EPHX 693. Gravitation and Cosmology. 3 Credits.
An overview of topics relevant to gravitation and modern cosmology: special relativity, tensor notation, the equivalence principle, the Schwarzschild solution, black holes, and Friedmann models. Cosmic black body radiation, dark matter, and the formation of large-scale structure. The idea of quantum gravity and an introduction to the current literature in cosmology. (Same as PHSX 693.) Prerequisite: PHSX 313 and MATH 220, MATH 221, or MATH 320.