

DEPARTMENT OF PHYSICS, GEOSCIENCES, AND ASTRONOMY

Chair

Dr. Jessica Lair
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NSB 3140

Faculty

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Bachelor's

- Environmental and Applied Geology, Bachelor of Science with a Concentration in Academic (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/environmental-applied-geology-concentration-academic-bs/>)
- Environmental and Applied Geology, Bachelor of Science with a Concentration in Professional (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/environmental-applied-geology-concentration-professional-bs/>)
- Physics, Bachelor of Science with a Concentration in Engineering Physics (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/physics-concentration-engineering-bs/>)
- Physics, Bachelor of Science with a Concentration in Physics (General) (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/physics-concentration-general-bs/>)
- Physics, Bachelor of Science with a Concentration in Physics Teaching (B.S.) (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/physics-concentration-teaching-bs/>)

Associate's

No results were found.

Minor

- Earth Science/Teaching, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/earth-science-teaching-minor/>)
- Environmental Geosciences, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/environmental-geosciences-minor/>)
- Geography, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/geography-minor/>)
- Geology, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/geology-minor/>)

- Physics, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/physics-minor/>)
- Physics/Teaching, Minor (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/physics-teaching-minor/>)

Certificate

- Geographic Information Systems, University Certificate (<http://catalogs.eku.edu/undergraduate/science-technology-engineering-mathematics/physics-geosciences-astronomy/geographic-information-systems-certificate/>)

Courses

Astronomy

AST 130. Introductory Astronomy. (3 Credits)

I, II. Prerequisite: MAT 105 or higher. Elementary survey course; study of Moon, Sun, and eclipses; Solar System; near stars and Milky Way. Non-laboratory. Credit will not be awarded for students who have credit for AST 135.

AST 133. Astronomy Transition Lab. (1 Credit)

(1) I,II. Prerequisite: AST 130 or departmental approval. A transition laboratory that will allow students with credit for AST 130 to gain credit for a laboratory science course that is equivalent to AST 135. 2 Lab. Gen. Ed. E4B [NS].

AST 135. Introductory Astronomy. (3 Credits)

I, II. Prerequisite: Completion of all academic readiness requirements. Conceptual survey course; topics include backyard astronomy, motion of the Moon and stars, the use of light in astronomy, telescopes, the Solar System, and the Sun. 4 Lec/Lab. Gen. Ed. E-4B.

AST 335. Stars, Galaxies, & Cosmology. (3 Credits)

(3) A. Prerequisite: MAT 105 or higher or STA 215 or higher or departmental approval; and ENG 102 or ENG 105(B) or HON 102. A survey course describing the origin and evolution of stars, including black holes, galaxies, and the Universe. We will demonstrate how observations, models and quantitative analysis with graphs lead to the current state of knowledge. Credit will not awarded for both AST 335 and AST 330. 4 Lec/Lab. Gen. Ed. E-4.

Geography

GEO 100. Regions and Nations of the World. (3 Credits)

I, II. Survey of the physical, cultural, and economic geography of the world's major regions, with an emphasis on regions undergoing change and currently of international concern. Gen. Ed. 5B (SBS).

GEO 110. Environmental Geography. (3 Credits)

(3) A. Prerequisites: Freshman and Sophomore standing. A focus on ecological function and the physical and human dynamics contributing to environmental change across the globe and at various geographical scales. Environmental issues are examined through a geographical lens, and include clean air and water, energy systems, biodiversity, natural hazards, climate change, and food production. 2Lec/2Lab. Gen. Ed. E-4.

GEO 115. Hollywood Weather. (3 Credits)

A. This non-technical introduction to atmospheric processes examines how meteorological events are portrayed in popular movies. Topics may include severe weather events, climate change, and weather's impact on human systems.

GEO 210. Introduction to Physical Geography. (3 Credits)

I, II. Study of natural processes operating at the earth's surface with special emphasis on weather and climate and landforms as explanations for how and why physical and human phenomena vary from place to place. 2 Lec/2 Lab. Gen. Ed. IVB or VII (NS).

GEO 302. Global Environmental Problems. (3 Credits)

A. Course will be offered every odd Spring semester. Prerequisite: GEO 100, 110, or 210.; ENG 102, ENG 105 (B), or HON 102; MAT 105 or higher; or departmental approval. Examination of environmental problems and conservation strategies in the context of global change, with case studies from exemplary world religions, including rainforest, mountain, desert, and island biomes. Credit will not be awarded to students who have credit for GEO 302 or ENV 302.

GEO 315. Meteorology. (3,4 Credits)

I, II. Prerequisite: MAT 112 (A and B), 114, 122, 211 or 234. This course focuses on important phenomena and physical processes that occur in Earth's atmosphere, including atmospheric dynamics, radiation, stability, moisture, wind systems and severe storms.

GEO 321. Urban Geography. (3 Credits)

A. Prerequisites: GEO 100, 110, or 210; ENG 102 or ENG 105 (B) or HON 102. Study of city functions, patterns, and past and current problems confronting the city, including the problems of planning, zoning, community housing, shopping centers, and urban renewal.

GEO 325. Environment Land Use Planning. (3 Credits)

A. Prerequisites: Prerequisites: GEO 100, 110, or 210; ENG 102 or ENG 105 (B) or HON 102; ENG 102 or ENG 105 (B) or HON 102, and MAT 105. Examines how principles of landscape ecology, resource conservation, and environmental impact analysis are incorporated into land use decisions and public policy. Emphasizes practical application at the site and regional scales. Credit will not be awarded for both GEO 325 and GEO 325S, ENV 325 or ENV 325S.

GEO 325S. Environmental Land Use Planning. (3 Credits)

(3) A. Course will be offered every even Spring semester. Prerequisite: GEO 100, 110, or 210; ENG 102, 105(B), or HON 102; MAT 105 or higher, or departmental approval. Examines how principles of landscape ecology, resource conservation, and environmental impact analysis are incorporated into land use decisions and public policy. emphasizes practical application at the site and regional scale. Credit will only be awarded for GEO 325S or GEO 325 or ENV 325 or ENV 325S.

GEO 351. Geoscience Data and Techniques. (3 Credits)

Prerequisites: GEO 100, 110, 210, GLY 104, 107, 108 or 109; MAT 105 and above, STA 215 or 217. Introduction to geoscience data, quantitative and qualitative analysis, hypothesis testing, and appropriate representations of specific data types. Includes exposure to techniques used in geoscience research and applications, including mapping, GIS, GPS, field work, remote sensing, library and Internet research, and others. Practical experience focus. 2 Lec/2 Lab.

GEO 353. Geographic Information Systems. (3 Credits)

(3) I, II. Prerequisite: (One of the following): AGR 216, CSC 315, GEO 100, 110, 210, GLY 102, 107, or 108. Introduction to GIS principles, methods, operations, mapping, and applications. Topics include spatial data, databases, GIS analysis, models, site suitability, environmental and social applications, and more. Hands-on emphasis using ArcGIS. 2 Lec/2 Lab.

GEO 450. Field Studies. (3 Credits)

(3) A. Prerequisite: GEO 100, 110, or 210. Field techniques and applied case studies of geographic topics in local and regional environs.

GEO 453. Advanced GIS. (3 Credits)

I, II. Prerequisite: GEO 353 or departmental approval. Advanced concepts, operations, and applications of raster and vector GIS. Spatial analysis using scanning, imagery, GPS, global data sets, and derived data for natural and social applications. Use of standards, megadata, openGIS, and other advances. 2 Lec/2 Lab.

GEO 455. GIS Cartography. (3 Credits)

I. Prerequisite: (One of the following): GEO 100, 110, 210, GLY 102, 107, or 108. Principles of cartographic design for GIS applications. Hands-on emphasis using ArcGIS. 2 Lec/2 Lab.

GEO 456. Remote Sensing. (3 Credits)

A. Prerequisite: GEO 100, 110, 210, GLY 102, 107, or 108. Principles, data sources, acquisition, interpretation, analysis, and application of geographic imagery, including maps, air photos, shuttle photography, and satellite digital data. Hands-on computer GIS techniques. 2 Lec/2 Lab.

GEO 458. Advanced Geographic Imagery. (3 Credits)

II. Prerequisite: GEO 353 and GEO 456. Characteristics, interpretation, integration and applications of advanced geographic imagery, including remote sensing and GIS digital data. Attention on satellite and multispectral imagery, including image processing. Hands on emphasis. 2 Lec/2 Lab.

GEO 501. Advanced Geography:____. (3 Credits)

A. Prerequisite: departmental approval. In-depth study of geoscience themes using geospatial techniques. May be retaken to a maximum of nine hours if subject matter differs each time.

Geology**GLY 102. Earth Science for Elementary Teachers. (3 Credits)**

I, II. Prerequisite: Elementary, special education elementary, and elementary DHH education majors only or departmental approval. This inquiry-based course for elementary teachers integrates content, pedagogy and technology to explore Earth as an integrated set of systems and as part of the Solar System. 1 Lec/4 Lab. Gen. Ed. IVB or VII (NS).

GLY 103. Earth Science for Middle Grades Teachers. (3 Credits)

II. Prerequisite: Middle grades, special education middle grades, and DHH middle grade education majors only or Earth Science Teaching minors or departmental approval. This inquiry-based course for middle grades teachers integrates content, pedagogy, and technology to explore earth science content aligned with relevant standards in the Next Generation Science Standards and the Praxis Middle School Science exam. 1 Lec/ 4 Lab.

GLY 104. The Ocean World. (3 Credits)

(3) Formerly GLY 304. I, II. Investigation of the geologic, physical, biogeochemical, and biologic processes that occur within the oceans of the world. The course emphasizes connections between these processes, and how those connections interact with our planet's life. 2 Lec/2 Lab. Gen Ed E-4. Credit will not be awarded to students who have credit for GLY 304.

GLY 107. Gold and Diamonds. (3 Credits)

A. The geology of gold and diamonds, including mineralogy, natural occurrence, exploration, and mining. The impact of gold, diamonds, and other important earth materials on the environment, history, and society will also be discussed. 2 Lec/2 Lab. Gen. Ed. IVB or VII (NS).

GLY 108. Earthquakes and Volcanoes. (3 Credits)

I, II. Investigation of the Earth as it exists and functions today, the materials that compose the Earth, the processes that act upon and within the Earth, and the interrelationship of both materials and processes with human activity. 2 Lec/2 Lab. Gen. Ed. IVB or VII (NS).

GLY 109. Great Moments in Earth History. (3 Credits)

I, II. Investigation of the origin of the Earth as a planet and its evolutionary development of physical and biological systems through time. Important turning points in the Earth's history will be emphasized. 2 Lec/2 Lab. Gen. Ed. IVB or VII (NS).

GLY 210. Introduction to Geochemistry. (3 Credits)

I. Prerequisite or Corequisite: ACT math score of 22, or SAT math score of 530, or passing algebra placement test scores (KYOTE algebra domain KAD score of 14 or higher). or MAT 112, 114, or departmental approval. An introduction to the application of fundamental concepts and skills in chemistry (nomenclature, stoichiometry, bonding, chemical change) to geology, including the distribution of the elements, mineral chemistry, and radiometric dating.

GLY 302. Earth Science. (3 Credits)

(3) A. Prerequisite: GLY 102, 104, 107, 108, or 109. Study of the universe and our solar system, the Earth's atmospheric and climatic elements, its physical processes and features, organic development, and natural resources.

GLY 303. Environmental Geoscience. (3 Credits)

A. Prerequisite: GLY 103, 104, 107, 108, or 109; or GEO 100, 110, or 210; or departmental approval. Investigation of the Earth as a complex set of interconnected systems that cycle elements, water, and earth materials over geologic and human times scales. The course emphasizes global environmental changes that occur on the planet because of human actions. Credit will not be awarded for both GLY 303 or ENV 303.

GLY 305. Dinosaurs. (3 Credits)

(3) A. Prerequisites: GLY 102, 104, 107, 108, 109; ENG 102, ENG 105(B) or HON 102; or departmental approval. The rise, diversification, and extinction of this prominent group of organisms. This course attempts to explore how scientists make inferences about the past, including the use and limitations of physical evidence and the nature of science.

GLY 307. Exploring the Dynamic Earth. (3 Credits)

Formerly GLY 107. Planet Earth: origin, composition, and evidence of activity and energetic recycling of Earth materials via plate tectonics.

GLY 309. Mineralogy. (4 Credits)

A. Course will be offered every even Fall semester. Prerequisites: GLY 104, 107, 108, or 109; MAT 112 (A and B) or higher; or departmental approval. Study of minerals commonly encountered in rocks and soils with minor emphasis on ore deposits: mineral geochemistry, crystal structure, classification, physical properties, optical properties, and geologic environment. Laboratory develops the ability to identify minerals in hand specimens and thin sections. 3 Lec/2 Lab.

GLY 315. Hydrology. (3 Credits)

A. Course will be offered every even Fall semester. Prerequisites: One from GLY 104, 107, 108, or 109; and MAT 114 or both MAT 112A and MAT 112B or ACT 23 and above or SAT 550; or departmental approval. Interrelationships between Earth's systems and the occurrence and character of water in streams, lakes, and groundwater. Focuses on fundamental understanding of hydrologic processes and reservoirs, interaction between surface waters and groundwater and relationships between human activity and these reservoirs. 2 Lec/ 2 Lab.

GLY 349. Applied Learning in Geology. (0.5-8 Credits)

I, II. Work in placements related to academic studies. Total hours for baccalaureate, sixteen. A minimum of 80 hours of employment required for each semester hour of academic credit. May not be used to satisfy area, major, or minor requirements.

GLY 349A. Cooperative Study: Geology. (0.5-8 Credits)

I, II. Work in placements related to academic studies. Total hours for baccalaureate, sixteen. A minimum of 80 hours of employment required for each semester hour of academic credit. May not be used to satisfy area, major, or minor requirements.

GLY 349B. Cooperative Study: Geology. (0.5-8 Credits)

I, II. Work in placements related to academic studies. Total hours for baccalaureate, sixteen. A minimum of 80 hours of employment required for each semester hour of academic credit. May not be used to satisfy area, major, or minor requirements.

GLY 351. Field Methods. (3 Credits)

A. Prerequisites: GLY 104, 107, 108, or 109; or departmental approval. Methods of field geology including description and measurement of rock sequences, introduction to geological mapping and writing geological reports. 1 Lec/4 Field.

GLY 398. Independent Studies in Geology. (1-6 Credits)

A. Prerequisite: departmental approval. Topic determined by student and instructor. Student must have the independent study proposal form approved by faculty supervisor and department chair prior to enrollment. May be retaken to a maximum of six hours provided topic is different each time.

GLY 408. Process Geomorphology. (3 Credits)

A. Prerequisite: GEO 110 or 210, 104, 107, 108, 109; or departmental approval. An in-depth study of the geologic processes involved in landform development.

GLY 409. Igneous & Metamorphic Petrology. (4 Credits)

A. Course will be offered every odd Fall semester. Prerequisites: GLY 309 and MAT 112 or higher. Nature and origin of common igneous and metamorphic rocks, with emphasis on crystalline rocks. Lab develops the ability to analyze and classify rocks in hand sample and in thin section using a petrographic microscope. 3 Lec/2 Lab.

GLY 410. Structural Geology. (4 Credits)

A. Course will be offered every odd Fall semester. Prerequisites: GLY 104, 107, 108, or 109; and MAT 112 (A and B) or higher. Deformation of Earth's crust across a wide range of scale with emphasis on plate tectonics and its consequences. Lab develops the ability to analyze the geometry of deformed rock bodies and solve common structural problems. Course includes a MANDATORY field trip during Fall Break. 3 Lec/2 Lab.

GLY 415. Sedimentary Geology. (4 Credits)

A. Course will be offered every odd Fall semester. Prerequisite: GLY 104, 107, 108, 109; MAT 112 (A and B) or higher; or departmental approval. Examination of sedimentary processes and products, the characteristics and origins of sedimentary rocks and their related depositional environments, and application of these principles to solving geological problems. Laboratory develops techniques for describing and interpreting sedimentary rocks, structures, and stratigraphy. Course includes a MANDATORY field trip during Fall Break. 2 Lec/4 Lab.

GLY 420. Stratigraphy. (4 Credits)

A. Course will be offered every even Spring semester. Prerequisites: GLY 415 and MAT 112B or higher with a grade of C or better. Description, correlation, and interpretation of stratified sedimentary sequences; basic identification and interpretation of the fossils they contain. Emphases: rock-vs. time-stratigraphy, facies relationships, sequence stratigraphy, event stratigraphy, biostratigraphy, well log correlation. Course includes a mandatory, overnight, weekend field trip. 2 Lec/4 Lab.

GLY 450. Evolution of the Earth. (3 Credits)

A. Course will be offered every odd Spring semester. Prerequisite: ENG 102 or 102R or 105 or HON 102 and GLY 309, 409, 410, 415, or 420, or departmental approval. Overview of geological principles from the perspective of the Earth's history, physical and biological. Emphasis on critical thinking and expressive writing. Credit will not be awarded to students who have credit for GLY 450W or 550.

GLY 450W. Evolution of the Earth. (3 Credits)

A. Course will be offered every odd Spring semester. Prerequisite: ENG 102 or 102R or 105 or HON 102 and GLY 309, 409, 410, 415, or 420, or departmental approval. Overview of geological principles from the perspective of the Earth's history, physical and biological. Emphasis on critical thinking and expressive writing. Credit will not be awarded to students who have credit for GLY 550.

GLY 451. Field Camp. (6 Credits)

SUMMER ONLY. Prerequisites: GLY 409 and 410. Field-training course in the northern and central Rocky Mountains (6 weeks). Analysis of rock sequences; geologic mapping of sedimentary, metamorphic, and igneous terrains; interpretation of complex rock deformation; regional geological synthesis with emphasis on tectonics; and visits to many instructive geologic localities, including national parks and monuments.

GLY 460. Aqueous Geochemistry. (3 Credits)

A. Prerequisite: GLY 210 or CHE 111 and 111L. Reactions between natural waters, atmospheric gases and earth materials in surface and near surface environments. Emphasis is placed on consequences of chemical weathering, composition of surface and near surface water, geochemical cycles, and natural and anthropogenic geochemical events. 2 Lec/2 Lab.

GLY 480. Petroleum Geology. (3 Credits)

A. Pre/Corequisites: GLY 410 and GLY 420. Use of the petroleum systems paradigm to explore characteristics of economically-viable petroleum accumulations. Examines fundamental activities such as electric logging, mudlogging, and drilling. Exercises and projects model industry practices in recognizing and understanding petroleum accumulations. 2 Lec/ 2 Lab.

GLY 482. Paleoclimate. (3 Credits)

A. Prerequisite: GLY 104, 109, 415, GEO 115, 210, or 315; or departmental approval. How the interaction of ocean and atmosphere creates climate in the planet today and leaves its record in geologically accessible Earth materials, with an emphasis on the interpretation of the geological record and how we learn how the Earth's climate has changed in the past.

GLY 498. Capstone Project in Geology. (3 Credits)

A. Prerequisite: senior standing and departmental approval. A capstone experience for geology majors that integrates a research experience with the students' professional development and the production of a substantive deliverable product (e.g. poster, conference presentation, geologic map.) Student must have the independent study form approved by faculty supervisor and department chair prior to enrollment.

GLY 499. Senior Thesis. (3 Credits)

A. Prerequisites: senior standing and department approval. Supervised, independent thesis project for majors in geology. Thesis project must be approved by faculty supervisor and department committee prior to enrollment in the course. Student must have the independent study form approved by faculty supervisor and department chair prior to enrollment.

GLY 535. Hydrogeology. (3 Credits)

A. Course will be offered every odd Spring semester. Prerequisite: GLY 104, 107, 108, or 109; and MAT 112 or higher. Origin, occurrence, movement, utilization, and conservation of groundwater. Qualitative and quantitative presentation of geological, physical, and geochemical aspects of groundwater hydrology. 2 Lec/2 Lab.

GLY 580. Selected Topics:____. (1-3 Credits)

A. Prerequisite: senior standing or departmental approval. Designed to explore specific aspects of geology. May be retaken to a maximum of six hours provided topic is different each time.

Physics**PHY 101. Conceptual Physics. (3 Credits)**

I, II. Prerequisite: MAT 105 or higher or departmental approval. Conceptual approach to topics such as kinematics, Newtonian mechanics, electricity, magnetism, and optics. Not intended for science majors. Credit will not be awarded to students who have credit for PHY 102. 4 Lec/Lab. Gen. Ed. E-4.

PHY 102. Inquiry Physics for MS Teachers. (3 Credits)

I, II. Prerequisite: MAT 105 or higher and pre-teaching or teaching middle school education, special education middle grades, or DHH middle grade education majors or departmental approval. An inquiry-based, conceptual approach physical science course for middle school teaching majors. Topics include kinematics, matter and heat, optics, electricity, and magnetism. Credit will not be awarded for both PHY 101 and 102. 4 Lec/Lab. Gen. Ed. E-4 [NS].

PHY 104. Inquiry Physical Science for Elementary Teachers. (3 Credits)

I, II. Cross-Listed with CHE 104. Prerequisite: Elementary, special education elementary, and DHH elementary education majors only, sophomore standing, and MAT 112 or higher. An activity-oriented conceptual course in the physical sciences. Topics include the structure and properties of matter, heat and temperature, forces, motion, magnets, energy, and sound waves. Credit will not be awarded for students who have credit for CHE 104. 2 Lec/2 Lab.

PHY 131. College Physics I. (5 Credits)

I, II. Prerequisite: MAT 112 or higher or departmental approval. MAT 120 or higher is recommended. Algebra and trigonometry based approach to Newtonian mechanics, including Kinematics, Newton's laws, momentum, energy, and rotation. Credit will not be awarded to students who have credit for PHY 201. 6 Lec/Lab. Gen. Ed. IVB or VII (NS).

PHY 132. College Physics II. (5 Credits)

I, II. Prerequisite: PHY 131 with a grade of "C" or better or departmental approval. Algebra and trigonometry based approach to electromagnetic phenomena, including electric forces and fields, simple DC circuits, magnetic forces and fields, magnetic induction, and optics. Credit will not be awarded to students who have credit for PHY 202. 6 Lec/Lab.

PHY 200. Volunteering in Physics and Astronomy. (0 Credits)

A. An exposure to physics and astronomy activities, including, but not limited to, exploring physical and astronomical research projects, organizing physics and astronomy community service, and assisting at other physics and astronomy departmental events. Students can choose the focus of the volunteering in each semester. Passing grade achieved for attending 80% of the designated activities in each semester.

PHY 201. University Physics I. (5 Credits)

I. Prerequisite: MAT 211, 234 or 234H or departmental approval. Composition and resolution of forces, laws of equilibrium, Newton's laws of motion, work and energy, momentum, simple harmonic motion, hydrodynamics, heat phenomena. Credit will not be awarded to students who have credit for PHY 131 and PHY 201. 6 Lec/Lab. Gen. Ed. IVB or VII (NS).

PHY 202. University Physics II. (5 Credits)

II. Prerequisite: PHY 201 with a grade of "C" or better. Prerequisite or Corequisite: MAT 244 or 244H or departmental approval. Electrostatics, electric potential, dielectrics, A.C. and D.C. circuits, magnetic fields, Faraday's Law, sound, wave motion, geometrical and physical optics. Credit will not be awarded to students who have credit for PHY 132. 6 Lec/Lab.

PHY 211. Intermediate Physics. (4 Credits)

A. Prerequisites: PHY 201 with a grade of "C" or better or PHY 131 with a minimum grade of "B" or better; MAT 234 or 234H; or departmental approval. Applications of calculus to physical principles. Topics include fluid mechanics, thermodynamics, and wave optics.

PHY 221. Statics. (3 Credits)

A. Prerequisite: PHY 201. Prerequisite/Corequisite: MAT 244 or 244H or departmental approval. Study of force systems on bodies at rest, descriptions of force systems, distributed and internal forces, frames and trusses, beams.

PHY 302. Modern Physics. (4 Credits)

(4) A. Prerequisites: PHY 132 or PHY 202; MAT 211 or MAT 234 or MAT 234H or departmental approval. Physics of the 20th century. Topics include special relativity, quantum effects, wave theory, Bohr theory, nuclear structure, nuclear reactions, and other topics related to 20th century modern physics. Credit will not be awarded to students who have credit for PHY 302W.

PHY 302W. Modern Physics. (4 Credits)

(4) A. Prerequisites: ENG 102, 105(B) or HON 102; PHY 132 or PHY 202; MAT 211, MAT 234 or MAT 234H or departmental approval. Physics of the 20th century. Topics include special relativity, quantum effects, wave theory, Bohr theory, nuclear reactions, and other topics related to 20th century modern physics. Credit will not be awarded to students who have credit for PHY 302.

PHY 303. Introduction to Laser Physics. (3 Credits)

A. Prerequisite: PHY 132 or PHY 202 and instructor approval. An introduction to the theory and application of different types of lasers such as dye, nitrogen, He/Ne, diode, and mercury vapor; the characteristics of laser light, and optical measuring devices. 2 Lec/2 lab.

PHY 306. Classical Physics Laboratory. (2 Credits)

I. Prerequisite: PHY 132 or 202. Experiments in mechanics, optics, and electricity. Simulation of physical situations using a spreadsheet. Techniques of interfacing scientific equipment to microcomputers. 4 Lab.

PHY 307. Electronics. (4 Credits)

A. Prerequisite: PHY 132 or 202. Theory of solid state devices, power supplies, transducers, operational amplifiers, solid state switches, flip-flops, counters, digital devices, logic families. 3 Lec/3 Lab.

PHY 310. Theoretical Methods in Physics. (3 Credits)

(3) A. Prerequisites: MAT 254 with a grade of "C" or better; CSC 174, or departmental approval. Analytical methods for characterizing physics models and solving physics problems in advanced topics are discussed, including vector analysis, linear algebra, complex analysis, infinite series, waves and Fourier series, differential equations and other techniques.

PHY 315. Electrical Circuits. (4 Credits)

A. Prerequisite: PHY 202. Prerequisite or Corequisite: MAT 244 or 244H. Fundamental laws and principles for linear circuits whose elements consist of passive and active components used in present day practice. Determination of the sinusoidal steady state responses using the algebra of complex numbers.

PHY 349. Applied Learning in Physics. (0.5-8 Credits)

A. Work in placements related to academic studies. A minimum of 80 hours employment is required for each semester hour of academic credit. Total hours: eight, associate; sixteen, baccalaureate. Hours earned in PHY 349 will not apply toward a physics major or minor.

PHY 349A. Cooperative Study: Physics. (0.5-8 Credits)

A. Work in placements related to academic studies. A minimum of 80 hours employment is required for each semester hour of academic credit. Total hours: eight, associate; sixteen, baccalaureate. Hours earned in PHY 349 will not apply toward a physics major or minor.

PHY 349B. Cooperative Study: Physics. (0.5-8 Credits)

Work in placements related to academic studies. Hours earned in PHY 349 will not apply toward a physics major or minor.

PHY 349C. Cooperative Study: Physics. (0.5-8 Credits)

Work in placements related to academic studies. Hours earned in PHY 349 will not apply toward a physics major or minor.

PHY 349D. Cooperative Study: Physics. (0.5-8 Credits)

Work in placements related to academic studies. Hours earned in PHY 349 will not apply toward a physics major or minor.

PHY 360. Engineering Dynamics. (3 Credits)

A. Prerequisite: PHY 221 and MAT 244. Newtonian dynamics of particles and rigid bodies. Engineering applications of equations of motion, work and energy, conservative forces, acceleration, relative motion, and plane motion, including solving systems in multiple coordinate systems.

PHY 375. Engineering Thermodynamics. (3 Credits)

A. Prerequisite: PHY 202. Prerequisite or Corequisite: MAT 244 or 244H. Study of temperature, thermodynamic systems, ideal gases, first and second law of thermodynamics, Carnot cycle, Kelvin temperature scale, entropy, including thermodynamic analysis of engineering devices.

PHY 380. Fluid Mechanics. (3 Credits)

A. Prerequisite: PHY 360, PHY 375, and MAT 353. Properties of fluids, fluid statics, inviscid fluid dynamics, fluid kinematics, thermodynamic principles, mass momentum and energy principles, and viscous effects. Flow through pipes and around bodies.

PHY 402. Modern Optics. (3 Credits)

A. Prerequisite: PHY 211 or departmental approval. Prerequisite or Corequisite: MAT 244. Wave motion, interference, diffraction, electromagnetic radiation, dispersion, polarization, and lasers.

PHY 406W. Advanced Physics Laboratory. (3 Credits)

Prerequisite: ENG 102, 105(B), or HON 102; PHY 302 or 302W, or departmental approval. Experiments in mechanics, optics, electricity, and nuclear physics, computer simulations of physical situations. Measurement and data analysis techniques, including error analysis. May be repeated up to a maximum of six hours provided content different each time. 5 Lec/Lab.

PHY 410. Independent Study in Physics:____. (1-6 Credits)

(1-6) A. Prerequisite: PHY202 or departmental approval. May be retaken to a maximum of six hours provided subject matter is different each time. Student must have the independent study form approved by faculty supervisor and department chair prior to enrollment.

PHY 411. Special Topics in Physics. (1-6 Credits)

(1-6) A. Prerequisite: PHY 202 or departmental approval. Special topics in physics of current interest to faculty and students will be presented through lecture, discussion, and reports. May be retaken to a maximum of six hours provided subject matter is different each time.

PHY 412. Directed Research in Physics. (1-6 Credits)

A. Prerequisite: PHY 302 and departmental approval. A directed research experience for physics majors that may include laboratory experiments, development of new equipment, physics education research, or computational solutions of special problems related to physics. May be retaken to a maximum of six hours. Student must have the independent study form approved by faculty supervisor and department chair prior to enrollment.

PHY 421. Electricity and Magnetism I. (3 Credits)

(3) I. Prerequisites: PHY 310 with a grade of "C" or better or departmental approval. Electrostatics in vacuum and dielectrics, solutions of Laplace's and Poisson's equations, magnetic fields, induced EMF's, magnetic materials, and Maxwell's equations.

PHY 422. Electricity and Magnetism II. (3 Credits)

(3) II. Prerequisites: PHY 421 or departmental approval. Maxwell's equations, electromagnetic waves in insulators and conductors, energy and momentum, electromagnetic radiation, dipole radiation, special relativity, special applications.

PHY 456. Statistical and Thermal Physics. (3 Credits)

A. Prerequisites: PHY 302; PHY 310 with a grade of "C" or better; or departmental approval. Microscopic approach to thermal processes. Topics include probability, entropy, the canonical ensemble, blackbody radiation, and quantum statistics including Bose-Einstein and Fermi-Dirac statistics.

PHY 460. Classical Mechanics. (4 Credits)

(4) A. Prerequisite: PHY 310 with a grade of "C" or better or departmental approval. Prerequisite/Corequisite: MAT 353. Applications of calculus to the principles of classical mechanics. Topics include rectilinear motion in 1-D, motion in 3-D, non-inertial frames, central forces, many-bodied systems, rigid bodies, Lagrangian mechanics, and other topics related to classical mechanics.

PHY 470. Quantum Mechanics. (3 Credits)

A. Prerequisites: PHY 310 and PHY 460, or departmental approval. Basic principles of wave mechanics, solutions of Schrodinger wave equation for simple systems, interpretation of solutions and application to atomic and molecular problems.

PHY 506. Physics for High School Teachers. (3 Credits)

A. Credit given toward major or minor only in teaching programs. Topics from general and modern physics to prepare teachers to teach high school physics and give classroom demonstrations. 2 Lec/3 Lab.