PHYSICAL SCIENCES

Mission

The physical sciences program at Chadron State College prepares students for careers as problem solvers, investigating the physical properties and processes of the natural world. By observing, building hypotheses and communicating results, students are engaged in the methods and culture of science. As part of the global scientific community, they learn firsthand the contributions of science to the values of leadership, lifelong learning, and maintaining a sustainable society.

Student Learning Outcomes

- 1. Students will have a strong knowledge base and the skills to be lifelong learners. Students will:
 - Have a strong foundational knowledge to be able to critically evaluate information.
 - Be able to recognize the limits of their knowledge and have the skills to seek and evaluate additional information.
 - Be able to apply logical reasoning and organizational skills to integrate new information into their functional knowledge base.
- 2. Students will be prepared for their profession in the science discipline. Students will:
 - Understand the interrelatedness of science and society and exhibit the professional skills appropriate for their chosen career path.
 - Be able to communicate scientific knowledge to a diverse audience using appropriate technology and media tools.
- Bachelor of Science Comprehensive Major in Physical Sciences (http://catalog.csc.edu/undergraduate/programs/physical-sciences/ bs-comprehensive-major-physical-sciences/)
- Bachelor of Science Education Subject Endorsement in Chemistry (Grades 7-12) (http://catalog.csc.edu/undergraduate/ programs/physical-sciences/bs-education-subject-endorsementchemistry-7-12/)
- Bachelor of Science Education Subject Endorsement in Earth and Space Science (Grades 7-12) (http://catalog.csc.edu/undergraduate/ programs/physical-sciences/bs-education-subject-endorsementearth-space-science-7-12/)
- Bachelor of Science Education Field Endorsement in Science (Grades 7-12) (http://catalog.csc.edu/undergraduate/programs/ physical-sciences/bs-education-field-endorsement-science-7-12/)
- Bachelor of Science Education Middle Level Education Academic Area in Sciences (Grades 5-9) (http://catalog.csc.edu/undergraduate/ programs/physical-sciences/bs-education-middle-level-educationacademic-area-sciences-grades-5-9/)
- Chemistry (http://catalog.csc.edu/undergraduate/programs/ physical-sciences/chemistry-minor/)
- Environmental Geoscience (http://catalog.csc.edu/undergraduate/ programs/physical-sciences/environmental-geoscience-minor/)
- Geoscience (http://catalog.csc.edu/undergraduate/programs/ physical-sciences/geoscience-minor/)
- Physics (http://catalog.csc.edu/undergraduate/programs/physicalsciences/physics-minor/)

 Water Resources Management (http://catalog.csc.edu/ undergraduate/programs/physical-sciences/water-resourcesmanagement-minor/)

Chemistry

CHEM 110 CAREERS IN SCIENCE1 Credit

Introduction for Physical Sciences majors to career options. Students will conduct independent research of selected firms or agencies. A required field trip to a major metropolitan area will provide knowledge of opportunities and challenges of the technical job market.

CHEM 121 INTRODUCTORY CHEMISTRY3 Credits

Fundamental principles of chemistry focusing on the topics of matter and measurement, structure of atoms and use of the periodic table, chemical bonding and molecules, reaction stoichiometry, and energy. **Requirements:** Required of students who have not taken high school chemistry who plan to enroll in CHEM 131 or CHEM 140.

CHEM 131 COLLEGE CHEMISTRY I3 Credits

First of a two semester sequence of courses in General Chemistry for science majors. Detailed study of matter and measurement, structure of atoms molecules and ions, stoichiometric relationships, electronic structure of atoms, chemical periodicity, chemical bonding, thermochemistry, and properties of gases, liquids and solids. **Prerequisites:** High school chemistry or CHEM 121 and high school algebra or MATH 142

Co-requisites: CHEM 131L

Notes: Enrollment in this course assumes competencies in math and chemistry equivalent to those accrued in high school algebra or MATH 142 and high school chemistry or CHEM 121.

CHEM 131L COLLEGE CHEMISTRY I LABORATORY1 Credit

Laboratory experience in basic chemical concepts, including concentrations, reaction mechanisms, stoichiometric relationships, molecular structure, properties of gases, liquids, and solids, and spectroscopy.

Co-requisites: CHEM 131

CHEM 132 COLLEGE CHEMISTRY II3 Credits

Second of a two semester sequence of courses in General Chemistry for science majors, with a focus on the topics of solution chemistry, chemical kinetics, principles and applications of equilibrium, chemical thermodynamics and electrochemistry.

Prerequisites: CHEM 131 and CHEM 131L

Co-requisites: CHEM 132L

CHEM 132L COLLEGE CHEMISTRY II LABORATORY1 Credit

Laboratory experience focusing on studies of principles and applications of chemical kinetics, equilibrium, acid-base chemistry, thermodynamics and electrochemistry.

Co-requisites: CHEM 132

CHEM 140 SURVEY OF CHEMISTRY3 Credits

Survey of chemistry principles and applications for science majors requiring a one semester freshman chemistry course. Topics covered include: matter and measurement, atoms ions and molecules, periodicity, chemical bonding, reaction stoichiometry, energy, phases of matter, solution chemistry, chemical kinetics, equilibrium, and electrochemistry. **Prerequisites:** High school chemistry or CHEM 121 and high school algebra or MATH 142

Co-requisites: CHEM 140L

Notes: Does not duplicate CHEM 131 and is not a prerequisite for CHEM 132.

CHEM 140L SURVEY OF CHEMISTRY LABORATORY1 Credit

Laboratory experiences in basic chemical processes and mechanisms. Basic chemistry laboratory operations.

Co-requisites: CHEM 140

CHEM 200 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest.

Add Consent: Department Consent

Notes: The number of credit hours is determined by the topic and the amount of work required.

Requirements: Approval of instructor, School Dean, and Academic Vice President.

CHEM 231 SURVEY OF ORGANIC CHEMISTRY3 Credits

Survey of organic chemistry principles and applications for students requiring one semester of Organic Chemistry. The nomenclature, structure, physical and chemical properties and reactions of the principle families of organic compounds are covered. Carbohydrates, lipids, enzymes, amino acids and protein synthesis are also covered at an introductory level.

Prerequisites: CHEM 132 and CHEM 132L or CHEM 140 and CHEM 140L Co-requisites: CHEM 231L

CHEM 231L SURVEY OF ORGANIC CHEMISTRY LABORATORY1 Credit

Principle laboratory operations of organic chemistry, organic synthesis, and spectroscopy.

Co-requisites: CHEM 231

CHEM 270 TOPICS (LD)1-3 Credits

Special topics in chemistry appropriate for lower division credit. Add Consent: Instructor Consent

Notes: May be repeated with different emphases for up to six hours credit.

CHEM 310 CAPSTONE I: RESEARCH SEMINAR1 Credit

The student will choose a topic for research and conduct a literature survey of that topic. Preliminary results and a plan for conducting further independent research on the topic will be presented in oral and written form during the semester.

Prerequisites: CHEM 132, 132L, and sophomore or above status **Notes:** Normally taken during the student's Junior year.

CHEM 313 QUANTITATIVE, ORGANIC, AND BIOLOGICAL CHEMISTRY FOR EDUCATORS3 Credits

This course will examine basic principles in quantitative, organic, and biochemistry with the aim of learning how to teach these subjects in a high school classroom. Lesson planning, activity development, scientific literacy, critical thinking skills, and active learning will be incorporated in the class.

Prerequisites: CHEM 131, 131L and CHEM 132, 132L Co-requisites: CHEM 313L

CHEM 313L QUANTITATIVE, ORGANIC, AND BIOLOGICAL CHEMISTRY FOR EDUCATORS LABORATORY1 Credit

The lab will be a mixture of inquiry-based lessons and direct instruction labs. Students will receive hands-on experience that guide them through concepts taught in lecture. Inquire-based learning labs will allow students to develop their own experiments that are safe to teach in a high school classroom.

Prerequisites: CHEM 131, 131L and 132, 132L Co-requisites: CHEM 313

CHEM 320 SUPERVISED STUDY IN LAB AND FIELD METHODS1-2 Credits

Students will prepare, supervise, and evaluate laboratory exercises under the direction of faculty members. Designed to give students practical experience teaching in the laboratory setting.

Cross-Listed: BIOL/CHEM/GEOS/PHYS320

Prerequisites: Sophomore or above status

CHEM 333 ORGANIC CHEMISTRY I3 Credits

An introduction to the structure, nomenclature, stereochemistry, properties, synthesis, and reactions of aliphatic and aromatic carbon compounds.

Prerequisites: CHEM 132, CHEM 132L, and Sophomore or above status Co-requisites: CHEM 333L

CHEM 333L ORGANIC CHEMISTRY I LABORATORY1 Credit

Principle laboratory operations of organic chemistry, organic synthesis, and spectroscopy.

Co-requisites: CHEM 333

CHEM 334 ORGANIC CHEMISTRY II3 Credits

A continuation of Organic Chemistry I. Topics will include a systematic study of organic reactions by functional group, reaction mechanisms, and organic synthetic methods.

Prerequisites: CHEM 333, 333L and sophomore or above status Co-requisites: CHEM 334L

CHEM 334L ORGANIC CHEMISTRY II LABORATORY1 Credit

An introduction to laboratory techniques and procedures of synthetic organic chemistry including analysis of organic compounds by infrared spectroscopy, mass spectrometry, and nuclear magnetic resonance spectroscopy.

Prerequisites: CHEM 333, 333L and sophomore or above status Co-requisites: CHEM 334

CHEM 335 BIOCHEMISTRY I3 Credits

Introductory course covering the components and reactions of living matter. Topics include structure and function of major macromolecules including carbohydrates, lipids, proteins, and nucleic acids. The basics of enzyme functions and regulation will be studied. A brief introduction to metabolic pathways will be included.

Prerequisites: CHEM 231 and CHEM 231L or CHEM 333 and CHEM 333L and Sophomore or above status

Notes: Concurrent enrollment in CHEM 335L is recommended.

CHEM 335L BIOCHEMISTRY LABORATORY1 Credit

Laboratory experience in purification, quantitation, and characterization of biological molecules.

Prerequisites: CHEM 335

Co-requisites: CHEM 335 (can be taken as either a pre-requisite or a co-requisite)

CHEM 336 BIOCHEMISTRY II3 Credits

Fundamental concepts of the chemistry of proteins, carbohydrates, lipids, and nucleic acids with emphasis on metabolic pathways of these compounds. The interrelationship of these compounds in living systems will be presented through bioenergetics, reaction pathways, regulatory pathways, and chemical mechanisms.

Prerequisites: CHEM 335 and Sophomore or above status

CHEM 341 QUANTITATIVE ANALYSIS3 Credits

Detailed study of classical analytical chemistry with topics to include; measurement and uncertainty, statistical analysis of data, basics of chemical equilibrium, activity and systematic treatment of complex equilibrium systems, acid-base equilibrium and buffers, EDTA titrations, gravimetric analysis, combustion analysis, and spectrophotometry. **Prerequisites:** CHEM 132 and CHEM 132L and Sophomore or above status

Co-requisites: CHEM 341L

CHEM 341L QUANTITATIVE ANALYSIS LABORATORY1 Credit

Laboratory experience designed to improve laboratory skills in the qualitative analysis of matter using gravimetric and volumetric techniques.

Prerequisites: Sophomore or above status Co-requisites: CHEM 341

CHEM 342 INSTRUMENTAL ANALYSIS3 Credits

Examination of the function and use of chemical instrumentation to analyze samples with emphasis on the use of spectrophotometers (UV/ vis, IR, AA, mass spec), chromatographs (HPLC, GC), electrodes and potentiometry, and electrophoretic systems.

Prerequisites: CHEM 132, 132L or consent of instructor Co-requisites: CHEM 342L

CHEM 342L INSTRUMENTAL ANALYSIS LABORATORY1 Credit

Laboratory experience involving the set-up and use of quantitative instrumentation in support of the topics covered in the lecture section of the course (spectrophotometry, chromatography, pH and Ion Specific electrodes, and electrophoresis).

Prerequisites: Sophomore or above status Co-requisites: CHEM 342

CHEM 390 INTERNSHIP IN CHEMISTRY1-12 Credits

Provides practical experience as a chemist in government, business or industry. Open to upper division students majoring in the area of chemistry.

Add Consent: Department Consent

Notes: Interested students should contact the Internship and Career Services office to secure application materials; application should be made prior to the semester the internship will be started; the amount of credit will be based on the availability of a suitable work position, the qualifications of the applicant, and the work hours.

CHEM 400 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest.

Add Consent: Instructor Consent

Notes: The number of credit hours is determined by the topic and the amount of work required.

Requirements: Approval of instructor, Dean of Curriculum and Academic Advancement, and Academic Vice President is required.

CHEM 401 CAPSTONE II: SENIOR RESEARCH1 Credit

Independent research projects based on the results presented in CHEM 310. Data collection, analysis, and presentation of scientific papers.

Prerequisites: CHEM 310 and Junior or above status **Notes:** May be repeated for a total of up to six hours of credit.

CHEM 410 CAPSTONE III: SENIOR RESEARCH/THESIS1 Credit

Research thesis is completed and presented at the Nebraska Academy of Sciences or other regional or national scientific forum approved by the faculty. Required field trip in late April.

Prerequisites: CHEM 401 and Junior or above status

CHEM 417 TOPICS IN CHEMISTRY1-3 Credits

Designed to meet the needs of students in a special area of interest. May be repeated for up to 6 hours.

Add Consent: Instructor Consent

CHEM 430 INORGANIC CHEMISTRY3 Credits

Advanced principles of inorganic chemistry. Structure, bonding, properties, and reactions of inorganic compounds with emphasis on the relationships and trends that are embodied in the periodic table of the elements.

Prerequisites: CHEM 132, CHEM 132L, and Junior or above status

CHEM 433 ENVIRONMENTAL CHEMISTRY3 Credits

Study of the chemical processes that influence the environment, including processes which affect the quality and use of land, water, and atmosphere, as well as influence of anthropogenic effects on them. Focuses on topics of current concern.

Prerequisites: CHEM 132 and CHEM 132L or CHEM 140 and CHEM 140L

CHEM 433L ENVIRONMENTAL CHEMISTRY LABORATORY1 Credit

Laboratory experience in environmental chemical analysis of environmental samples.

Prerequisites: CHEM 433 (can be taken as either a pre-requisite or a co-requisite)

CHEM 444 PHYSICAL CHEMISTRY3 Credits

Statistical principles, kinetics, thermodynamics, and advanced equilibria and solution dynamics for chemical systems. **Prereguisites:** CHEM 132 and CHEM 132L

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CHEM 444L PHYSICAL CHEMISTRY LABORATORY1 Credit

Laboratory experience in thermodynamics and kinetics. **Co-requisites:** CHEM 444

CHEM 464 PHYSICAL CHEMISTRY II3 Credits

Fundamental principles of kinetics, and quantum mechanics as related to chemical concepts.

Prerequisites: CHEM 444 and CHEM 444L

Geoscience

GEOS 110 CAREERS IN SCIENCE1 Credit

Introduction for Physical Sciences majors to career options. Students will conduct independent research of selected firms or agencies. A required field trip to a major metropolitan area will provide knowledge opportunities and challenges of the technical job market.

GEOS 129 PHYSICAL SCIENCE FOR ELEMENTARY AND MIDDLE GRADES TEACHER3 Credits

A laboratory oriented course intended to strengthen the physical science background of the elementary and middle grades teacher.

GEOS 130 EARTH SCIENCE3 Credits

Introductory survey of the four earth sciences; geology, oceanography, meteorology, and astronomy. Designed to help non-scientists gain a greater appreciation of the global physical environment, and to understand interactions of society with that environment. One or more field trips may be required.

Notes: Credit cannot be applied toward an earth science subject endorsement, physical science major, or any geoscience minor.

GEOS 132 NATURAL HAZARDS AND DISASTERS3 Credits

The cause and effects of natural disasters can be understood using an Earth system science approach. Science and technology are limited in their ability to predict disasters. Recognizing these limitations, students will explore the roles of individuals in broader societal issues relating to disaster preparedness, damage and cost mitigation as they relate to natural hazards.

GEOS 135 PHYSICAL SCIENCE3 Credits

An integrated course in physical sciences including astronomy, earth science, geology, physics and chemistry.

GEOS 137 ENVIRONMENTAL GEOLOGY3 Credits

Considers effects of human interaction with the physical environment, both in terms of natural phenomena such as earthquakes and floods, which effect human lives, and resource use, in which humans change their environment. One or more field trips will be required.

GEOS 138 ASTRONOMY2 Credits

A descriptive study of the solar system, stars, and galactic systems, including theories of the origin of the universe and the solar system. **Co-requisites:** GEOS 138L

GEOS 138L ASTRONOMY LABORATORY1 Credit

Laboratory experience in astronomy. Held in the evening either outdoors or in the planetarium.

Co-requisites: GEOS 138

GEOS 200 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest.

Add Consent: Department Consent

Notes: The number of credit hours is determined by the topic and the amount of work required.

Requirements: Approval of instructor, School Dean, and Academic Vice President.

GEOS 210 PLANETARY GEOLOGY3 Credits

Planetary Geology consists of three, (one) hour lectures per week. The course provides a process oriented examination of the geological features associated with the planets of the Solar System, their satellites, and the Sun. and an examination of "Earth-like" planets and moons.

GEOS 231 PHYSICAL GEOLOGY3 Credits

Introduction to the fundamentals and language of physical geology, to aid in understanding the solid Earth, its origin, constituents, and surficial features, and the appreciation of the dynamic nature of our planet. **Co-requisites:** GEOS 231L

GEOS 231L PHYSICAL GEOLOGY LABORATORY1 Credit

Laboratory exercises will introduce the tools geologists use to interpret Earth processes: minerals and rocks, maps, and aerial photographs. One or more field trips will be offered.

Co-requisites: GEOS 231

GEOS 234 EARTH SYSTEM HISTORY3 Credits

Highlights changes through time in the Earth system, including the solid Earth, the oceans and water on land, evolution of the atmosphere, and evolution of life as seen through the fossil record. The systems approach seeks out and analyzes interactions between these different components.

Co-requisites: GEOS 234L

GEOS 234L EARTH SYSTEM HISTORY LABORATORY1 Credit

Laboratory exercises will introduce the tools used to understand changes in the Earth system through time. Includes identification of the major fossil groups, and analysis of geologic, oceanographic, atmospheric and paleontologic data.

Co-requisites: GEOS 234

GEOS 245 FIELD SAMPLING TECHNIQUES3 Credits

Practical field skills applicable to geological and environmental studies developed through field exercises in the Pine Ridge Region or the home region of the student. Results presented in both oral and written formats. Students will learn to convey their knowledge to a variety of audiences, including professional colleagues, government agencies, and the general public.

Prerequisites: GEOS 137 or GEOS 234, GEOS 234L and GEOS 231, GEOS 231L

Co-requisites: GEOS 245L

GEOS 245L FIELD SAMPLING TECHNIQUES LABORATORY1 Credit During the laboratory, the practical field skills discussed in Field Sampling Techniques lecture will be applied to field exercises in the Pine Ridge Region or the home region of the student.

Co-requisites: GEOS 245

GEOS 246 GEOLOGY FIELD CAMP I3 Credits

The online part of this course introduces workplace health, safety, environmental impacts and regulations, professionalism and ethics, and quality assurance/quality control in data collection. The field portion will build observation and interpretation skills and introduce technical aspects of field mapping, stratigraphic interpretation and structural analysis. Students will prepare field notes, maps, stratigraphic charts, cross sections, and reports while interacting with geological problems in the Great Plains and Rocky Mountains.

Prerequisites: GEOS 231, GEOS 231L, GEOS 234, GEOS 234L Notes: Taught concurrently with GEOS 346.

Requirements: Additional course fee required.

GEOS 270 TOPICS IN GEOSCIENCE1-3 Credits

Special topics appropriate for lower division credit. **Notes:** May be repeated with different emphases for up to six hours of credit.

GEOS 310 CAPSTONE I: RESEARCH SEMINAR1 Credit

The student will choose a topic for research and conduct a literature survey of that topic. Preliminary results and a plan for conducting further independent research on the topic will be presented in oral and written form during the semester.

Prerequisites: Sophomore or above status **Notes:** Normally taken during the student's Junior year.

GEOS 312 PLANETARY GEOLOGY FOR EDUCATORS3 Credits

This course will provide an overview of planetary geology, which will include a discussion on the Solar System, our understanding of the physical compositions of other planetary bodies, a look at the Earth and its unique atmosphere, the atmospheres of other planets in our system, and small bodies present in the Solar System. Students will learn about the geological techniques employed to learn about other planets and moons as well as the technology used to investigate space. **Co-requisites:** GEOS 312L

GEOS 312L PLANETARY GEOLOGY FOR EDUCATORS LABORATORY1 Credit

This course will provide an overview of planetary geology, which will include a discussion on the Solar System, our understanding of the physical compositions of other planetary bodies, a look at the Earth and its unique atmosphere, the atmospheres of other planets in our system, and small bodies present in the Solar System. Students will learn about the geological techniques employed to learn about other planets and moons as well as the technology used to investigate space. **Co-requisites:** GEOS 312

GEOS 320 SUPERVISED STUDY IN LAB AND FIELD METHODS1-2 Credits

Students will prepare, supervise, and evaluate laboratory and field exercises under the direction of faculty members. Designed to give students practical experience teaching in the laboratory and field setting. **Cross-Listed:** BIOL/CHEM/GEOS/PHYS320

Prerequisites: Sophomore or above status

GEOS 321 INTRODUCTION TO GPS1 Credit

Principles and applications of global positioning system. Emphasis is on mapping and other uses applied to geoscience field problems. Field trips may be required.

Prerequisites: Sophomore or above status

GEOS 322 INTRODUCTION TO GIS3 Credits

Principles and applications of geographic information systems with emphasis on Arcview* software. Students will address solutions to realworld problems using Geographic Information Systems.

Prerequisites: Sophomore or above status

Notes: Field trips my be required; recommended prerequisite: GEOS 321.* Registered Trademark

GEOS 325 ENERGY AND THE ENVIRONMENT3 Credits

A deep survey of the science and technology behind fossil fuels, nuclear, and

renewable energy sources. Participants will research the origins of energy resources and the technologies that put them to use. The class will develop a code of energy ethics.

Prerequisites: Junior status and permission of instructor Add Consent: Instructor Consent

Notes: Students will produce a personal project documenting achievement of Essential Studies outcome 9. If that outcome is already satisfied, students may petition to get credit for Essential Studies outcome 6.

GEOS 334 METEOROLOGY3 Credits

The physical behavior of the atmosphere including the causes of weather and the elements of forecasting.

Prerequisites: Sophomore or above status

GEOS 337 PALEONTOLOGY3 Credits

A systematic survey of invertebrate phyla and vertebrate classes most important in the fossil record.

GEOS 337L PALEONTOLOGY LABORATORY1 Credit

Examination of fossil invertebrates and vertebrates in laboratory and field.

Prerequisites: Sophomore or above status Co-requisites: GEOS 337

GEOS 338 ROCKS AND MINERALS3 Credits

Introduction to mineralogy, and optical mineralogy in the context of rocks and interpretation of rock-forming environments. Possibly one or more field trips required.

Prerequisites: GEOS 231, GEOS 231L, CHEM 132 and CHEM 132L or CHEM 140 and CHEM 140L, and Sophomore or above status

GEOS 346 GEOLOGY FIELD CAMP II3 Credits

The online part of this course teaches mineral and energy exploration, and measuring quantity and quality of resources. The field portion will build observation and interpretation skills and reinforce technical aspects of field mapping, stratigraphic interpretation and structural analysis. Student will prepare field notes, maps, stratigraphic charts, cross sections, and reports while interacting with geological problems in the Great Plains and Rocky Mountains.

Prerequisites: GEOS 246 or GEOS 245 and GEOS 245L **Requirements:** Additional course fee required.

GEOS 390 INTERNSHIP IN GEOSCIENCE1-12 Credits

Provides practical experience as a geoscientist in government, business, or industry. Open to upper division students majoring in the area of geoscience.

Add Consent: Department Consent

Notes: Interested students should contact the Internship and Career Services Office to secure application materials.

Requirements: Application should be made prior to the semester the internship will be started; the amount of credit will be based on the availability of a suitable work position, the qualifications of the applicant, and the work hours.

GEOS 400 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in a geoscience area of special interest. Add Consent: Instructor Consent

Notes: The number of credit hours is determined by the topic and the amount of work required. Permission of instructor, School Dean, and Academic Vice President is required.

GEOS 401 CAPSTONE II: SENIOR RESEARCH1 Credit

Independent research projects based on the results presented in GEOS 310. Data collection, analysis, and presentation of scientific papers. **Prerequisites:** GEOS 310 and Junior or above status **Notes:** Normally taken during the student's Junior or Senior year; may be repeated for a total of up to six hours of credit.

GEOS 410 CAPSTONE III: SENIOR RESEARCH THESIS1 Credit

Research thesis is completed and presented at the Nebraska Academy of Sciences or other regional or national scientific forum approved by the faculty. Required field trip in late April. Normally taken during the student's Senior year.

Prerequisites: GEOS 401 and Junior or above status

GEOS 430 SPECIAL TOPICS IN GEOSCIENCE1-3 Credits

To meet special needs of Geoscience students.

Notes: May be repeated with different topics and approval of instructor for a total of six credit hours.

GEOS 431 HYDROGEOLOGY3 Credits

An introduction to the origin and nature of groundwater, its interaction with surface water, geological methods of groundwater exploration, and factors affecting water supply and quality. **Prerequisites:** Junior or above status

GEOS 432 STRUCTURAL GEOLOGY3 Credits

Description and analysis of geologic structures and the regional and global tectonic forces that produce them. Possibly one or more field trips required.

Prerequisites: GEOS 231, GEOS 231L, and Junior or above status

GEOS 434 INTRODUCTION TO OCEANOGRAPHY3 Credits

An earth-system approach to study of the oceans. Includes discussion of physical and biological phenomena in the oceans; analyzes interactions among the hydrosphere atmosphere and geosphere; and considers humans as stewards of ocean resources. Field trips may be required.

GEOS 435 FIELD EXPERIENCE IN GEOSCIENCE1-3 Credits

Typically a one to three week workshop. Field excursions to study major geologic features and provinces in North America or elsewhere. Add Consent: Instructor Consent

GEOS 436 FIELD EXCAVATION AND PROCEDURES1-3 Credits

A summer workshop designed to give the student field experience in the development of paleontological sites. **Prerequisites:** Junior or above status **Add Consent:** Instructor Consent

GEOS 437 WORLD ENVIRONMENTAL ISSUES3 Credits

Exploration of world environmental problems. Discussion participation setting emphasizes library research, accessing information, critical analysis of media news, and information and global perspective measures. The course culminates in student action plans that may affect environmental change.

Prerequisites: Junior or above status

GEOS 438 PETROLEUM GEOLOGY3 Credits

The origin, characteristics, occurrence, exploration, and development of/ for petroleum. Possibly one or more field trips.

GEOS 439 SEDIMENTOLOGY AND STRATIGRAPHY3 Credits

The origin and characteristics of sedimentary rocks. **Prerequisites:** GEOS 231, GEOS 231L, GEOS 234, GEOS 234L and Junior or above status

Co-requisites: GEOS 439L

GEOS 439L SEDIMENTOLOGY AND STRATIGRAPHY LABORATORY1 Credit

Laboratory and field studies of sediments and sedimentary rocks. **Prerequisites:** Junior or above status **Co-requisites:** GEOS 439

GEOS 471 ADVANCED ASTRONOMY1-3 Credits

A quantitative study of topics introduced in GEOS 233. Includes astrophotography, deep sky viewing, and planetarium. **Prerequisites:** GEOS 233/, GEOS 233L, and , GEOS 233L, and Junior or above status

PHYS 151 COLLEGE PHYSICS I3 Credits

Principles of mechanics, sound, thermodynamics, and fluid mechanics. **Prerequisites:** MATH 134, MATH 135, MATH 138, MATH 142, MATH 151, or MATH 232

Co-requisites: PHYS 151L

PHYS 151L COLLEGE PHYSICS I LABORATORY1 Credit

Laboratory exercises in College Physics I. **Co-requisites:** PHYS 151

PHYS 152 COLLEGE PHYSICS II3 Credits

Principles of electricity, magnetism, light, optics and modern physics. **Prerequisites:** MATH 134, MATH 135, MATH 138, MATH 142, MATH 151, or MATH 232

Co-requisites: PHYS 152L

PHYS 152L COLLEGE PHYS II LABORATORY1 Credit

Laboratory exercises in College Physics II. **Co-requisites:** PHYS 152

PHYS 200 INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest.

Add Consent: Department Consent

Notes: The number of credit hours is determined by the topic and the amount of work required.

Requirements: Approval of instructor, School Dean, and Academic Vice President.

PHYS 241 UNIVERSITY PHYSICS I4 Credits

The principles of mechanics, heat and sound. Differential and integral calculus applied. **Prerequisites:** MATH 252 **Co-requisites:** PHYS 241L

PHYS 241L UNIVERSITY PHYSICS I LABORATORY1 Credit

Laboratory exercises in University Physics I. **Co-requisites:** PHYS 241L

PHYS 242 UNIVERSITY PHYSICS II4 Credits

Principles of magnetism, electricity, and optics. Differential and integral calculus applied.

Prerequisites: PHYS 241 and PHYS 241L **Co-requisites:** PHYS 242L

PHYS 242L UNIVERSITY PHYS II LABORATORY1 Credit

Laboratory exercises in University Physics II. **Co-requisites:** PHYS 242

PHYS 320 SUPERVISED STUDY IN LAB AND FIELD METHODS1-2 Credits

Students will prepare, supervise, and evaluate laboratory exercises under the direction of faculty members. The course is designed to give students practical experience teaching in the laboratory setting. **Cross-Listed:** BIOL/CHEM/GEOS/PHYS320

Prerequisites: Sophomore or above status

PHYS 471J INDEPENDENT STUDY OR RESEARCH1-3 Credits

Study or research in an area of special interest. Prerequisites: Junior or above status

Add Consent: Instructor Consent

Notes: The number of credit hours is determined by the topic and the amount of work required.

Requirements: Permission of instructor and School Dean is required.