

NATURAL SCIENCES

Mission Statement

Our mission is to foster intellectual growth and career preparation (graduate programs, professional programs, or work in natural sciences) in accordance with the liberal arts tradition at UW-Superior. As a science department, we focus on giving students a solid knowledge base and the skills in their respective subjects. Science students will know, understand, apply, and communicate the principles and facts related to their particular disciplines.

Contact Information

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Majors

- Biology Major (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/biology/biology-major/>)
- Broad Field Science Major (Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/broad-field-science/broad-field-science-teaching-grades-4-12-major-comprehensive/>)
- Cell/Molecular Biology Focus (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/biology/cellmolecular-biology-focus/>)
- Chemistry Major (Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/chemistry/chemistry-major-comprehensive/>)
- Chemistry Major (Non-Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/chemistry/chemistry-major-non-comprehensive/>)
- Chemistry Major - Pre-Medicine/Pre-Pharmacy (Biochemistry) Concentration (Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/chemistry/chemistry-major-premedicine-prepharmacy-biochemistry-concentration-comprehensive/>)
- Chemistry Major and Chemical Engineering Dual Degree (Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/chemistry/chemistry-major-chemical-engineering-dual-degree-comprehensive/>)
- Ecology or Aquatic Biology Focus (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/biology/ecology-aquatic-biology-focus/>)
- Environmental Science Major (Comprehensive) (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/environmental-science/environmental-science-major-comprehensive/>)
- Pre-Medicine and Health Professions Concentration (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/biology/pre-medicine-health-professions-concentration/>)

Minors

- Aerospace Studies, Minor (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/aerospace-studies/aerospace-studies-minor/>)
- Biology Minor (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/biology/biology-minor/>)
- Chemistry Minor (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/chemistry/chemistry-minor/>)
- Geographic Information Systems (GIS) Minor (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/geography/applied-gis-minor/>)

Certificates

- Geographic Information Systems (GIS) Certificate (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/geography/gis-certificate/>)
- Science of Brewing Certificate (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/science-of-brewing-certificate/>)

Associate Degrees

- Associate of Science - Engineering (<http://catalog.uwsuper.edu/undergraduate/academic-departments/natural-sciences/associate-of-science-engineering/>)

Course Descriptions

Aerospace Studies

AIRS 101 Heritage and Values 1.00

Part one of a two-part survey course of the United States Air Force as a public-service organization and as an introductory course to the Air Force ROTC program. Air Force heritage, core values, human relations, the oath of office and interpersonal communication skills are also examined. Open to all university students interested in military topics. Enrollment in course does not designate students as an ROTC cadets. Students who want to enroll in the ROTC program and become cadets must be enrolled in AFROTC GMC Lead Lab.

Prerequisites:

Corequisite for taking this course is AIRS 111.

Typically Offered:

- Fall Term Only

AIRS 102 Heritage and Values 1.00

Part two of a two-part survey course of the United States Air Force as a public-service organization and as an introductory course to the Air Force ROTC program. Air Force heritage, core values, human relations, the oath of office and interpersonal communication skills are also examined. Open to all university students interested in military topics. Enrollment in course does not designate students as an ROTC cadets. Students who want to enroll in the ROTC program and become cadets must also enroll in AFROTC GMC Lead Lab.

Prerequisites:

AIRS 112 is corequisite for taking this course.

Typically Offered:

- Spring Term Only

AIRS 111 AFROTC GMC Leadership Laboratory 1.00

Practical environment giving leadership training while being instructed on military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Pass-Fail only.

Prerequisites:

AIRS 101 is co-requisite for taking this course.

Typically Offered:

- Fall Term Only

AIRS 112 AFROTC GMC Leadership Laboratory 1.00

Practical environment giving leadership training while being instructed on military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Pass-Fail only.

Prerequisites:

Prerequisite for this course is AIRS 111 or Instructor consent .

Typically Offered:

- Spring Term Only

AIRS 189 Aerospace Studies Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

AIRS 201 Team and Leadership Fundamentals 1.00

Part one of a two part course that examines Air Force leadership, ethics and values. Students will develop leadership skills based on student participation, group problem solving and oral/written communication. Students will apply these leadership perspectives when completing team building activities and discussing leadership challenges within group dynamics. Students will also demonstrate basic verbal and written communication skills. Open to all university students interested in military topics. Enrollment in course does not designate students as an ROTC cadets. Students who want to enroll in the ROTC program and become cadets must also enroll in AFROTC GMC Lead Lab.

Prerequisites:

AIRS 211 is corequisite for taking this course.

Typically Offered:

- Fall Term Only

AIRS 202 Team and Leadership Fundamentals 1.00

Part two of a two part course that examines Air Force leadership, ethics and values. Students will develop leadership skills based on student participation, group problem solving and oral/written communication. Students will apply these leadership perspectives when completing team building activities and discussing leadership challenges within group dynamics. Students will also demonstrate basic verbal and written communication skills. Open to all university students interested in military topics. Enrollment in course does not designate students as an ROTC cadets. Students who want to enroll in the ROTC program and become cadets must also enroll in AFROTC GMC Lead Lab.

Prerequisites:

AIRS 212 is corequisite for taking this course.

Typically Offered:

- Spring Term Only

AIRS 211 AFROTC GMC Leadership Laboratory 1.00

Practical environment giving leadership training while being instructed on military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Pass-Fail only.

Prerequisites:

AIRS 201 is corequisite for taking this course.

Typically Offered:

- Fall Term Only

AIRS 212 AFROTC GMC Leadership Laboratory 1.00

Practical environment giving leadership training while being instructed on military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Pass-Fail only.

Prerequisites:

AIRS 202 and AIRS 211 are corequisite for taking this course.

Typically Offered:

- Spring Term Only

AIRS 289 Aerospace Studies Elective 0.60

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

AIRS 301 Leading People and Effective Communication/Air Force Leadership Studies 3.00

Part one of a two part course where students will develop an in-depth understanding of how to effectively lead people and provide people with the tools to use in current and future leadership roles. Students will develop and refine their leadership philosophy through topics that include power and influence, counseling, mentoring, effective supervision, accountability, core values, ethical decision making. Students will also hone their writing and briefing skills. Open to all university students interested in military topics. Enrollment in course does not designate students as ROTC cadets.

Prerequisites:

AIRS 311 is corequisite for taking this course.

Typically Offered:

- Fall Term Only

AIRS 302 Leading People and Effective Communication/Air Force Leadership Studies 3.00

Part two of a two part course where students will develop an in-depth understanding of how to effectively lead people and provide people with the tools to use in current and future leadership roles. Students will develop and refine their leadership philosophy through topics that include power and influence, counseling, mentoring, effective supervision, accountability, core values, ethical decision making. Students will also hone their writing and briefing skills. Open to all university students interested in military topics. Enrollment in course does not designate students as ROTC cadets.

Prerequisites:

AIRS 312 and consent of instructor are prerequisite for taking this course.

Typically Offered:

- Spring Term Only

AIRS 311 AFROTC POC Leadership Laboratory 1.00-2.00

Practical environment giving leadership training through teaching freshmen and sophomores military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Pass-Fail only.

Prerequisites:

AIRS 301 is corequisite for taking this course.

Typically Offered:

- Fall Term Only

AIRS 312 AFROTC POC Leadership Laboratory 1.00-2.00

Practical environment giving leadership training through teaching freshmen and sophomores military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required.

Prerequisites:

AIRS 302 and AIRS 311 are corequisites for this course.

Typically Offered:

- Spring Term Only

AIRS 389 Aerospace Studies Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

AIRS 401 National Security Studies/Leadership Responsibilities/Commissioning Preparation 3.00

Part one of a two part course where students will learn the basic elements of national security policy and military processes. The student will understand the air force domain operations as well as learn about the selected roles of the military in society and current domestic and international issues. The final portion of the course is designed to prepare students for life as a second lieutenant in the United States Air Force. Open to all university students interested in military topics. Enrollment in course does not designate students as ROTC cadets.

Typically Offered:

- Fall Term Only

AIRS 402 Leadership Responsibilities 3.00

Part two of a two part course where students will learn the basic elements of national security policy and military processes. The student will understand the air force domain operations as well as learn about the selected roles of the military in society and current domestic and international issues. The final portion of the course is designed to prepare students for life as a second lieutenant in the United States Air Force. Open to all university students interested in military topics. Enrollment in course does not designate students as ROTC cadets.

Typically Offered:

- Spring Term Only

AIRS 411 AFROTC POC Leadership Laboratory 1.00-2.00

Practical environment giving leadership training through teaching freshmen and sophomores military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Taken concurrently with AIRS 401.

Typically Offered:

- Fall Term Only

AIRS 412 AFROTC POC Leadership Laboratory 1.00

Practical environment giving leadership training through teaching freshmen and sophomores military customs and courtesies, physical fitness, military drill and the general Air Force environment. Two physical fitness attendances each week; a physical fitness diagnostics test and a physical fitness test are all required. Taken concurrently with AIRS 402.

Typically Offered:

- Spring Term Only

AIRS 420 Leadership Practicum 1.00-4.00

Practical application of leadership and management in structured realistic situations.

Typically Offered:

- Fall and Spring Terms

AIRS 421 Leadership Practicum 1.00-4.00

Practical application of leadership and management in structured realistic situations.

Typically Offered:

- Fall and Spring Terms

AIRS 489 Aerospace Studies Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

Biology**BIOL 115 Human Biology 4.00**

University Studies course investigating the structure and function of the human body as related to areas of health and disease. Designed to meet the University Studies requirement for laboratory science. Does not count toward the Biology major. Not open to those having taken BIOL 270, or 280. (Lecture three hours, laboratory two hours).

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Spring
- Online: Fall & Summer

BIOL 123 Concepts In Biology 4.00

Introduction for non-Biology majors to important biological concepts including chemistry, cell biology, genetics, evolution, plant and animal form and function, and ecology. Laboratory exercises are integrated with lectures and designed to be experimental and inquiry driven. Fulfills the University Studies requirement for laboratory science. Does not count toward the Biology major. (Lecture three hours, laboratory two hours.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Spring
- Online: Summer

BIOL 130 Principles of Biology I 4.00

Introduction to important principles of chemistry, cellular, molecular, and evolutionary biology, and the diversity of life. Laboratory experiments are inquiry driven. Intended as the first of a two-course sequence for biology majors, and students with a strong interest in the life sciences. Fulfills the University Studies laboratory science requirement. (Lecture three hours, laboratory two hours.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Fall & Spring;

BIOL 132 Principles of Biology II 4.00

The second course in a two-course sequence intended for Biology majors or minors, and other students with a strong interest in the life sciences. Introduces students to the development, structure and function of both plants and animals and the basic principles of ecology. Laboratory exercises are integrated with lectures and designed to be experimental and inquiry driven. (Lecture three hours, laboratory two hours, recitation 1 hour).

Prerequisites:

BIOL 130 or permission of instructor.

Typically Offered:

- On-campus: Fall & Spring;

BIOL 170 Biological Inquiry for Teachers 2.00

This course uses inquiry-based science methods to answer open-ended biological questions that have environmental connections. This course is required of Elementary Education majors and satisfies environmental science requirements for the Wisconsin Teaching Licensure and the UW-Superior University Studies program. Lecture one hour, laboratory two hours.

University Studies Requirements:

- Natural Sciences - Environmental

Typically Offered:

- On-campus: Fall & Spring
- Online: Fall, Spring, & Summer

BIOL 189 Biology Elective 1.00-99.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 189ES Biology Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 189LS Biology Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 270 Human Anatomy & Physiology I 4.00

First semester of a two-semester sequence investigating the structure and function of human body systems and mechanisms for maintaining homeostasis within and across each system. Examination of tissues and the integumentary, skeletal, muscular, nervous, and sensory systems. . (Lecture three hours, laboratory two hours.)

Prerequisites:

BIOL 130 or permission of instructor.

Typically Offered:

- On-Campus: Fall;

BIOL 280 Human Anatomy & Physiology II 4.00

Continuation of a two-semester sequence investigating the structure and function of human body systems and mechanisms for maintaining homeostasis within and across each system. Examination of the endocrine, digestive, cardiovascular, respiratory, urinary, and reproductive systems. (Lecture three hours, laboratory two hours.)

Prerequisites:

BIOL 270 or instructor consent.

Typically Offered:

- On-campus: Spring;

BIOL 289 Biology Elective 1.00-50.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 289ES Biology Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

University Studies Requirements:

- Natural Sciences - Environmental

BIOL 289LS Biology Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 312 Biogeography and Conservation 3.00

Study of geographical distributions of plants and animals in the context of spatial and temporal factors influencing species distributions, patterns of species richness, and endemism. Themes related to the conservation of biodiversity will be emphasized including island biogeography, landscape and metapopulation processes, phylogeography and conservation genetics. (Lecture three hours.) BIOL 340 and BIOL 305 recommended.

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Spring, Odd Years;

BIOL 316 Medical Terminology 2.00

Study of basic medical terminology. Prefixes, suffixes, word roots, combining forms, special endings, plural forms, abbreviations, and symbols are emphasized. A programmed learning, word-building systems approach is used to learn, construct, and analyze new terms as they relate to the function and location of body systems. No prerequisite.

Typically Offered:

- On-campus: Spring;

BIOL 325 Plant Taxonomy 4.00

Provides the skills and background to identify flowering plants of northern Wisconsin and Minnesota. Lecture topics focus on floral structure, classification, and distribution of plant families of regional importance, while labs focus on identification of living plant materials using dichotomous keys. Each student will prepare a plant collection. (Lecture three hours, laboratory two hours.)

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Spring, Odd Years;

BIOL 330 Genetics 4.00

Integrating the principles and techniques of Mendelian and molecular genetics to emphasize how biological information is inherited and expressed. Students will also investigate the primary research literature and receive instruction in scientific writing. (Lecture three hours, laboratory two hours.)

Prerequisites:

Successful completion of CHEM 105 and BIOL 130 and BIOL 132 or BIOL 270. (Note: pre-Health program students are not required to take BIOL 132)

Typically Offered:

- On-campus: Spring;

BIOL 340 Ecology and Evolutionary Biology 4.00

Introduction to foundational principles of ecology and evolutionary biology investigating adaptations of organisms to their environment, natural selection, population biology, life-history strategies and evolutions, ecological and evolutionary consequences of species interactions, and ecosystem processes. Lab activities emphasize using standard sampling methods to collect and analyze data from local ecosystems. Completion of CHEM 105 is recommended but not a prerequisite. (Lecture three hours, laboratory three hours.)

Prerequisites:

Successful completion of BIOL 132 or permission from the instructor

Typically Offered:

- On-Campus: Fall;

BIOL 350 Limnology 4.00

Study of freshwater biology including the physical and chemical attributes of the environment as well as plants and animals found in lakes and streams. CHEM 105 and BIOL 340 is recommended. (Lecture three hours, laboratory two hours.)

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Fall, Even Years;

BIOL 355 Microbiology 3.00

Exploring how the structure, function and genetics of microorganisms (bacteria, viruses, fungi and protozoa) influence our everyday world. This includes microbes relevant to human health and industry; and the biological and chemical defenses we use to regulate them. (Lecture three hours)

Prerequisites:

Prerequisite for enrolling in BIOL 355 is successful completion of BIOL 330 or BIOL 340

Typically Offered:

- On-campus: Spring;

BIOL 356 Microbiology Laboratory 1.00

Students learn aseptic techniques, culturing techniques, and basic microbial handling techniques useful in medical, ecological, and industrial fields. The laboratory involves the isolation and biochemical identification of soil bacteria and determination of antimicrobial properties. While it is recommended that students take the laboratory and lecture sections concurrently, it is not required. (Laboratory 2 hours).

Prerequisites:

Prerequisite for enrolling in BIOL 356 is successful completion of CHEM 105 and BIOL 330 OR BIOL 340

Typically Offered:

- On-campus: Spring;

BIOL 364 Invertebrate Biology 4.00

A survey of adaptations and classification of invertebrate animals. Characteristics of various taxonomic groups are emphasized within an ecological and evolutionary context. Laboratory activities focus on the functional morphology, comparative anatomy, and identification of representatives of major phyla and classes of invertebrates. field-based lab exercises emphasize sampling and identification of orders and families of arthropods and mollusks in local ecosystems. (lecture three hours, laboratory two hours)

Prerequisites:

Requirement: successful completion of BIOL 330 or BIOL 340, or consent of instructor.

Typically Offered:

- On-campus: Fall, Even Years;

BIOL 380 Vertebrate Biology 4.00

Life histories, habits, habitats, distribution, classification, and recognition of common vertebrates of the north central United States. (Lecture three hours, laboratory two hours.)

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Fall, Even Years;

BIOL 382 Ichthyology 4.00

An introduction to the classification, structure, physiology, distribution, and life histories of fishes. (Lecture three hours, laboratory two hours.)

Prerequisites:

BIOL 330 or 340 or Permission of Instructor

Typically Offered:

- On-campus: Fall, Odd Years;

BIOL 389 Biology Elective 1.00-12.00

Transfer Credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 399 Cancer Biology 3.00

Investigating the cellular, molecular and genetic origins of the human diseases classified together as cancer. Utilizing both scientific and popular literature, historical context will be provided and current research aimed at improving both diagnostic and therapeutic options will be explored. Topics include carcinogenesis, oncogenes, tumor suppressors, microenvironment influence, migration, invasion and metastasis.

Prerequisites:

BIOL 330 or permission of instructor

Typically Offered:

- On-campus: Fall, Even Years;

BIOL 405 Neurobiology 3.00

Introduction to the structure and function of the nervous system, including neuroanatomy, neurophysiology, and systems neurobiology. Topics include the properties of neurons, glia, and the mechanisms and organization underlying neural signaling; the reward pathway and addiction, sleep, memory; and diseases and disorders of the nervous system. Discussions of neurobiological methods and reading of current neurobiological literature will be included.

Prerequisites:

Successful completion of one course from each of the following bracketed groups: [PSYC 350 or BIOL 330] and [PSYC 275 or BIOL 330 or BIOL 340] or permission of instructor.

Typically Offered:

- On-campus: Spring, Even Years;

BIOL 411 Neurobiology Lab 1.00

This is a curricular undergraduate research experience (CURE) course where students will further their understanding of BIOL 405 course content through engagement with the scientific process. Students will develop a hypothesis, based on a literature review, conduct an experiment, conduct data analysis, and present their research project and findings to their peers. This is a companion course to BIOL 405 and requires concurrent enrollment. Students may sign up for BIOL 491 concurrently, increasing the research component of this course to satisfy the research requirements of the degree. Students interested in enrolling in BIOL 491 credit should work with the instructor to complete a research contract.

Prerequisites:

Prerequisite for BIOL 411 is completion of BIOL 330 or BIOL 340 and Co-requisite BIOL 405 or instructor consent.

Typically Offered:

- On-campus: Spring, Odd Years;

BIOL 412 Developmental Biology 4.00

A comparative analysis of animal embryonic development. Classical embryology will be integrated with genetic regulation of development. Lecture 3 hours, Laboratory 2 hours

Prerequisites:

Prerequisite for BIOL 412 is successful completion of BIOL 330 or consent of instructor

Typically Offered:

- On-Campus: Fall;

BIOL 414 Molecular Pharmacology 3.00

Exploring the scientific study of drug interactions on biological systems and the chemical properties, biological effects, and therapeutic uses of drugs. Includes the study of pharmacodynamics, pharmacokinetics, and pharmacogenomics, drug therapeutics, drug action, and bodily responses to drug events, through studies of specific drugs and drug interactions. This class is designed to meet the requirements for entry in to nursing, physician assistant, or other health related professional programs.

Prerequisites:

Prerequisite for BIOL 414 is completion of BIOL 330 or BIOL 340 or instructor consent.

Typically Offered:

- On-campus: Spring, Even Years;

BIOL 415 Ecology and Management of Forest Ecosystems 4.00

Overview of major factors affecting forest ecosystems including disturbance, species interactions, succession, climate change, timber harvesting/resource extraction practices, and ecosystem management strategies. Emphasis on forests of the western Great Lakes Region. Field activities develop identification and data collection skills and are integrated with a semester-long research project designed to evaluate predictions of a specific ecological hypothesis. The research project may be coupled with the BIOL 491 or ENSC 491 Senior Research course to fulfill the capstone experience requirement for Biology or Environmental Science majors, respectively. (Lecture three hours, laboratory three hours).

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Select Semesters;

BIOL 420 Field Biology 1.00

Study of plants and animals in nature through field trips and observation. Topics change each semester. (Laboratory two hours.)

Prerequisites:

Successful completion of BIOL 330 or BIOL 340, or permission of instructor.

Typically Offered:

- On-campus: Spring, Even Years;

BIOL 440 Cell Biology 4.00

Study of the subcellular structures, protein synthesis & processing, signal transduction, cell cycle, and cell death pathways. Emphasis is place on research techniques, data analysis and modern application of cellular and molecular biology. There is a heavy emphasis on critical thinking scientific literacy and writing of lab reports in this course. (Lecture three hours, laboratory two hours.)

Prerequisites:

Successful completion of BIOL 330 and CHEM 106 or permission instructor

Typically Offered:

- On-campus: Select Semesters;

BIOL 465 Laboratory Techniques in Biochemistry and Cell/Molecular Biology 1.00-2.00

Principles and practices of techniques used in biochemistry and in cell and molecular biology. Includes protein isolation and analysis, enzyme kinetics, carbohydrate analysis, immunological techniques for analysis, and techniques of gene cloning and manipulation. Recommended: CHEM 462, BIOL 355 AND BIOL 440 or concurrent enrollment. (Lecture one hour, laboratory three hours) Cross-listed as: BIOL/CHEM 465.

Prerequisites:

BIOL 330 and CHEM 360 or instructor consent are pre-requisites for this class

Typically Offered:

- On-campus: Spring, Even Years;

BIOL 181 Special Topics 1.00-4.00

In-depth study of specialized current topics in biology selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study, etc. Course may be repeated when topics are different. Instructor permission to enroll in this course.

Typically Offered:

- Occasional by Demand

BIOL 281 Special Topics 1.00-4.00

In-depth study of specialized current topics in biology selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study, etc. Course may be repeated when topics are different. Instructor permission to enroll in this course.

Typically Offered:

- Occasional by Demand

BIOL 481 Special Topics 1.00-4.00

In-depth study of specialized current topics in biology selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study, etc. Course may be repeated when topics are different. Instructor permission to enroll in this course.

Prerequisites:

Prerequisite for taking this course is Junior standing or Instructor consent.

Typically Offered:

- On-campus: Select Semesters;

BIOL 489 Biology Elective 9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 489ES Biology Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 489LS Biology Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

BIOL 491 Senior Research 1.00-4.00

A course developed in cooperation with faculty or area research laboratories designed to provide students with practical experience in experimental biology. Candidates for this course must outline a research problem and complete a Contract for Independent Learning prior to registration. (May be repeated for a total of four credits.) Instructor consent required. May be used to satisfy Senior Experience requirement for Biology major.

Typically Offered:

- On-campus: Fall & Summer;

BIOL 496 Internship 1.00-4.00

On-the-job experience with local agencies (e.g. Wisconsin DNR) that provides students with opportunities to apply their skills to practical problems. In collaboration with a faculty sponsor, students must complete a Contract for Independent Learning prior to registration. May be used to satisfy Senior Experience requirement.

Typically Offered:

- On-campus: Fall & Spring;

BIOL 497 Senior Year Experience 1.00

This course provides instruction to develop and deliver an oral presentation in a scientific conference format to serve as a culminating experience for the Biology major. Presentation topics are connected to a capstone project completed in BIOL 491 Research in Biology or BIOL 496 Internship, either of which must be taken as a pre-requisite or co-requisite course. Meets in face-to-face format 2 hours per week.

Typically Offered:

- On-campus: Fall & Spring;

Brewing**BREW 101 A Sampling of Beer Styles 1.00**

This course introduces the history, process, and the modern styles of beer. Topics covered include: history of beer making; basic brew ingredients; discussion of the brewing process; parameters that define differences in beer styles, such as aroma, flavor, color and mouthfeel. Students will be expected to purchase and sample specific beer styles throughout the course. Prerequisites: 21 years of age or older by course start date.

Prerequisites:

Student must be 21+ years of age by course start date to register for this course.

Typically Offered:

- On-Campus: Fall;

BREW 120 Beer, Cheese, and Kombucha for Beginners 3.00

Introduction to the science, production, and sampling of fermented beverages and foods. Projects and lessons for a general audience, designed to be completed in a non-laboratory environment at home.

Prerequisites:

Student must be 21+ years of age by course start date to register for this course.

BREW 301 Science of Brewing I 3.00

This course is the first of two required courses in the Science of Brewing Certificate and introduces the processes involved in brewing modern styles of beer as well as the chemical and biological phenomena associated with these processes. Topics covered include: Basic brew ingredients; Discussion of the brewing process; Chemical and biological aspects of brewing ingredients and the brewing processes; Brewing of a chosen beer style using malt extract. Prerequisites: 21 years of age or older by course start date.

Prerequisites:

Student must be 21+ years of age by course start date to register for this course.

Typically Offered:

- On-Campus: Fall;

BREW 302 Science of Brewing II 3.00

This course is the second of two required courses in the Science of Brewing Certificate and involves a more thorough examination of topics discussed in Science of Brewing I and will address more advanced aspects of brewing and brewing issues including: All-grain recipe development; Yeast culturing and characterization; All-grain brewing processes; Scientific techniques to characterize beer and brewing ingredients. Prerequisites: BREW 301; 21 years of age or older by course start date.

Prerequisites:

Prerequisite: Must complete BREW 301 and be 21+ years of age by course start date to register for this course

Typically Offered:

- On-campus: Spring;

BREW 381 Special Topics 1.00-4.00

In-depth study of specialized current topics in brewing science selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study, etc. Course may be repeated when topics are different. Must be 21 years of age by course start date.

Prerequisites:

Student must be 21+ years of age by course start date to register for this course.

Typically Offered:

- On-campus: Select Semesters;

BREW 496 Internship 1.00-4.00

On-the-job experience with local agencies (e.g. local breweries) that provides students with opportunities to apply their skills to practical problems. In collaboration with a faculty sponsor, students must complete a Contract for Independent Learning prior to registration. Prerequisite: must be 21+ years of age or older by course start date to register for this course.

Prerequisites:

Student must be 21+ years of age by course start date to register for this course.

Typically Offered:

- On-campus: Select Semesters;

Chemistry

CHEM 100 Our Chemical Environment 2.00

Introduces the concepts of chemistry into the interpretation of chemical effects on the environment. Prerequisite: None. Meets the University Studies requirement for Natural Science (environmental component). Credits cannot be counted toward a Chemistry major or minor. Offered both on campus and online.

University Studies Requirements:

- Natural Sciences - Environmental

Typically Offered:

- On-campus: Select Semesters;

CHEM 102 Chemistry of Everyday Phenomena 4.00

Explores the chemistry of foods, drugs, household chemicals, personal hygiene products, agricultural chemicals, materials and other types of chemistry relevant to the student. Current chemistry topics in the popular press will be critically examined. Topics not usually addressed in other science general education courses will be presented. A small part of the course will be devoted to elementary statistics (evaluation, not calculation) to enable students to understand science and medicine as it is commonly reported. An important but minor part of the course involves discussion of the role of research in technology development and standard of living, and the impact of the chemical industry on the national and world economies. Credits cannot be counted toward a Chemistry major or minor. Prerequisite: None. (Three lectures and one two-hour laboratory.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall;

CHEM 105 General Chemistry I 5.00

Introduction to physical and chemical properties of the elements, chemical reactions, gas laws, chemical nomenclature, structure of atoms, chemical bonding, and solutions. Intermediate algebra (MATH 113) or equivalent strongly recommended as prerequisite. (Four lectures and one three-hour laboratory.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall;

CHEM 106 General Chemistry II 4.00

Continuation of CHEM 105 studying chemical equilibria, kinetics, electrochemistry, chemical compounds and reactions, qualitative analysis of ions, organic chemistry and nuclear chemistry. Three lectures and one three-hour laboratory.

Prerequisites:

CHEM 105 and one of MATH 113, 115, 151 or 240.

Typically Offered:

- On-campus: Spring;

CHEM 107 Supplementary Problems in General Chemistry II 1.00

A course designed to expand and provide extra help on those topics in General Chemistry II which frequently cause difficulty for the less well prepared student. Can only be taken simultaneously with General Chemistry II (CHEM 106). Credits cannot be applied to Chemistry Major or Minor. One Lecture-recitation per week.

Prerequisites:

CHEM 106 is co-requisite.

Typically Offered:

- On-campus: Spring;

CHEM 181 Introductory Topics 1.00-2.00

Introductory studies of special interest selected by a student and/or faculty member. The course may be independent-study, and it may be either lecture, laboratory, or both. The study most commonly will be introductory laboratory research work by a student considering a chemistry major, but also may be used for other special studies by a highly prepared student in chemistry. Pre- or corequisite: varies with topic and permission of instructor. Individual sections of the course may be offered for a grade or may be offered pass-fail only. May be repeated for a maximum of two credits. Offered upon sufficient demand.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 189 Chemistry Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 281 Selected Topics 1.00

Individual studies of a special interest selected by a student and/or faculty member. The study may involve seminars, special laboratory study. Prerequisites: varies with topic and consent of instructor. (May be repeated for up to two credits.) Offered on sufficient demand.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 289 Chemistry Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 289ES Chemistry Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 289LS Chemistry Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 300 Chemistry of Natural Waters 3.00

Emphasizes experimental methods used in investigations of the chemistry of natural water systems and the interpretation of chemical parameters indicative of water quality. (Two lectures and one three-hour laboratory.)

Prerequisites:

CHEM 105 and either BIOL 330 or BIOL 340.

Typically Offered:

- On-campus: Fall, Odd Years;

CHEM 305 Quant Analysis Lecture 3.00

Introductory lecture course in quantitative chemical analysis with major emphasis on classical, wet chemical methods and chemical equilibria. Topics include: concentration calculations, chemical reaction stoichiometry, equivalent weights and normality, titrimetric and gravimetric determinations, acid-base theory, solubilities and precipitation separations, basic electrochemistry, potentiometry, introduction to uv-visible absorbance spectrophotometry. (Three lectures.)

Prerequisites:

Prerequisite for taking this course is completion of CHEM 106, and corequisite is CHEM 306.

Typically Offered:

- On-campus: Fall, Even Years;

CHEM 306 Quantitative Analysis Laboratory 2.00

Introductory laboratory course emphasizing wet chemical methods of quantitative analysis. Representative experiments include titrimetry and basic instrumental determinations. Applications of statistics to data analysis are discussed and applied. (One four-hour lecture/laboratory.)

Prerequisites:

CHEM 305 is corequisite for taking this course.

Typically Offered:

- On-campus: Fall, Even Years;

CHEM 312 Organic Chemistry--A Short Course 3.00

One-semester survey in organic chemistry covering material which describes the structure, properties, preparation and reactions of the major classes of organic compounds. Additional topics will be selected from chemical bonding, kinetics, mechanisms and spectroscopy. Does not count toward a chemistry liberal education major. Counts toward a chemistry secondary education major. (Three lectures.)

Prerequisites:

CHEM 106 is prerequisite and CHEM 313 is co-requisite.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 313 Intro Organic Chem Lab 2.00

One-semester laboratory designed to accompany CHEM 312. Work consists of laboratory preparation and study of the chemical and physical properties of compounds of the types covered in CHEM 312. Co-requisite: CHEM 312. Does not count toward chemistry liberal arts major. Counts toward a chemistry secondary education major. (One-hour lecture-demonstration and one three-hour laboratory.)

Prerequisites:

CHEM 312 is co-requisite.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 320 Organic Chemistry Lecture I 3.00

First of a two-semester sequence of courses which make up a standard one-year course in beginning organic chemistry. Study of the structures, properties, preparation and reactions of the major classes of organic compounds. Also includes basic principles of chemical bonding, kinetics, mechanisms and molecular spectroscopy. (Three lectures.)

Prerequisites:

CHEM 106 is prerequisite; CHEM 322 AND CHEM 327 are co-requisites.

Typically Offered:

- On-Campus: Fall;

CHEM 321 Organic Chem Lecture II 3.00

Second of a two-semester sequence of courses which make up a standard one-year course in beginning organic chemistry. Work is made up of the study of the structures, properties, preparation and reactions of the major classes of organic compounds. Also includes basic principles of chemical bonding, kinetics, mechanisms and molecular spectroscopy. (Three lectures.)

Prerequisites:

CHEM 320 is prerequisite; CHEM 323 is co-requisite.

Typically Offered:

- On-campus: Spring;

CHEM 322 Organic Chemistry Lab I 1.00

First of a two-semester sequence of laboratory courses which accompany CHEM 320 and 321. Consists of laboratory preparation and study of the chemical and physical properties of compounds of the types covered in CHEM 320-321. Some applications of molecular spectroscopy. (Three-hour laboratory)

Prerequisites:

CHEM 320 AND CHEM 327 are co-requisites.

Typically Offered:

- On-Campus: Fall;

CHEM 323 Organic Chemistry Lab II 1.00

Second of a two-semester sequence of laboratory courses which accompany CHEM 320 and 321. Consists of laboratory preparation and study of the chemical and physical properties of compounds of the types covered in CHEM 320-321. Some applications of molecular spectroscopy. (Three-hour laboratory.)

Prerequisites:

CHEM 321 is co-requisite.

Typically Offered:

- On-campus: Spring;

CHEM 327 Molecular Spectroscopy I 1.00

Elementary introduction to the spectroscopic techniques most frequently used by chemists. Brief summaries of the mechanics of the techniques will be given, but major focus is interpretation of spectra generated by the following techniques: mass spectroscopy, infrared spectroscopy, proton and carbon nuclear magnetic resonance spectroscopy, and ultraviolet spectroscopy. Students will be expected to identify and sketch structures of simple organic compounds based on spectral interpretation. (One lecture.)

Prerequisites:

CHEM 320 is a corequisite for this class

Typically Offered:

- On-Campus: Fall;

CHEM 341 Introductory Physical Chemistry 3.00

Provides foundations for major area of Physical Chemistry including thermodynamics, chemical kinetics quantum theory, chemical bonding, molecular rotations and vibrations, electronic transitions, photochemistry, and molecular interactions.

Prerequisites:

MATH 115 and PHYSICS 108 or 202, or consent of instructor

Typically Offered:

- On-campus: Spring;

CHEM 345 Physical Chemistry Lect I 4.00

Exposes students to the main principles of modern thermodynamics and chemical kinetics and their applications. Key points of both areas will be illustrated with the examples of thermodynamics of polymer blends and the effect of formation of meta-stable states in polymer thin films. (Four lectures.)

Prerequisites:

CHEM 106, MATH 241, PHYS 202 or PHYS 206, OR permission of instructor are prerequisites.

Typically Offered:

- On-campus: Spring;

CHEM 346 Physical Chemistry Lecture II 3.00

Continuation of CHEM 345 emphasizing quantum theory, lasers, spectroscopy, molecular transport, and molecular reaction dynamics. Key points of many of these areas will be illustrated with the phenomenon of surface light-induced drift. (Three lectures.)

Prerequisites:

CHEM 345 or permission of instructor. CHEM 348 is co-requisite.

Typically Offered:

- On-campus: Select Semesters;

CHEM 347 Physical Chemistry Lab I 1.00

Laboratory work studies laser photochemistry and other applications of lasers in chemistry, as well as thermodynamical properties of gases and liquids, and calorimetry. (One four-hour laboratory meeting during the last eight weeks of the semester.)

Prerequisites:

CHEM 345 is co-requisite.

Typically Offered:

- On-campus: Select Semesters;

CHEM 348 Physical Chemistry Lab II 2.00

Continuation of CHEM 347 consisting of laboratory studies of the applications of lasers in chemistry, including kinetic measurements, thermodynamical properties of liquids and macromolecules, electrochemistry, and spectroscopy. (One four-hour laboratory.)

Prerequisites:

CHEM 346 is a co-requisite.

Typically Offered:

- On-campus: Select Semesters;

CHEM 360 Introduction to Biochemistry 3.00

One-semester survey of principles of biological chemistry. Study of the principal compounds of biochemical importance: proteins, lipids, carbohydrates, their chemistry, metabolic breakdown and biosynthesis, enzymes, co-factors, nucleic acids, regulation of cellular systems. Three lectures.

Prerequisites:

CHEM 312 or CHEM 321 are prerequisite.

Typically Offered:

- On-Campus: Fall;

CHEM 365 Descriptive Inorganic Chemistry 3.00

Survey of the basic chemistry of most elements of the periodic table, including natural abundances, typical compounds in the natural state, purification techniques, and modern uses. Periodic trends will be explored and used as an organizing tool in understanding this chemistry. Includes topics such as crystal packing and ionic structures of solids, acid-base theory, and redox reactions.

Prerequisites:

CHEM 106 and CHEM 312 or CHEM 320.

Typically Offered:

- On-Campus: Fall;

CHEM 375 Instrumental Analysis Lecture 3.00

Survey of chemical instrumentation and instrumental methods of analysis. Instrumental methods discussed include: atomic and molecular spectroscopy and spectrometry, chromatography, potentiometry, and voltammetry. Discussion also includes: detection limits and detectability, sensitivity, and methods of data analysis. (Three lectures.)

Prerequisites:

CHEM 305 is prerequisite. CHEM 376 is co-requisite.

Typically Offered:

- On-campus: Select Semesters;

CHEM 376 Instrumental Analysis Lab 2.00

Representative experiments in many of the analytical methods discussed in CHEM 375. Some experiments involve digital data acquisition. Computerized methods of data analysis are employed. (One four-hour laboratory.)

Prerequisites:

CHEM 375 is co-requisite.

Typically Offered:

- On-campus: Select Semesters;

CHEM 381 Intermediate Topics 1.00-3.00

May be offered for individualized or multiple-student instruction on a particular topic. May be independent study, lecture or laboratory. Topic(s) selected based upon student interest with approval of instructor. Prerequisites: varies with topic. Introductory Physical Chemistry is currently offered as an Intermediate Topic on a regular basis.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 389 Chemistry Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 462 Advanced Biochemistry 3.00

Second semester of a year sequence involving a study of the chemistry of living systems. Takes a more in-depth look at principles covered in the first semester: structure and properties of amino acids and proteins, enzymes, carbohydrate and lipid metabolism and nucleic acids, and covers additional topics including enzyme mechanisms, vitamins and co-factors, protein metabolism and bioenergetics.

Prerequisites:

CHEM 321 and CHEM 360 are prerequisite.

Typically Offered:

- On-campus: Spring, Even Years;

CHEM 465 Laboratory Techniques in Biochemistry and Cell/Molecular Biology 1.00-2.00

Principles and practices of techniques used in biochemistry and in cell and molecular biology. Includes protein isolation and analysis, enzyme kinetics, carbohydrate analysis, immunological techniques for analysis, and techniques of gene cloning and manipulation. Recommended: CHEM 462, BIOL 355 AND BIOL 440 or concurrent enrollment. (Lecture one hour, laboratory three hours) Cross-listed as: BIOL/CHEM 465.

Typically Offered:

- Spring Term Even Years Only

CHEM 481 Special Topics 1.00-6.00

In-depth study of specialized current topics in chemistry selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study. May be repeated when topics are different. Prerequisite: varies with topic.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

CHEM 489 Chemistry Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 489ES Chemistry Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 489LS Chemistry Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

CHEM 491 Senior Research 1.00-4.00

Individual laboratory investigation of a selected problem to include a study of the related literature and formal reports. Prerequisites: CHEM 346 and approval of instructor. (May be repeated for up to four credits.)

Typically Offered:

- On-campus: Fall & Spring;

CHEM 496 Senior Paper 1.00

Preparation of a formal paper on an advanced chemistry topic. Topic must be approved by instructor. Instructor consent required. Topic chosen for CHEM 496 may not be appropriate for CHEM 497. Consult instructor of CHEM 497. Prerequisite or corequisite: CHEM 345.

Typically Offered:

- On-campus: Fall & Spring;

CHEM 497 Senior Seminar In Chemistry 1.00

Each student prepares and gives one or more oral reports on a chemical topic of interest to the student and approved by instructor. Prerequisites: CHEM 345 or senior standing in Chemistry. One lecture-discussion. Does not count toward 400-level credits for ACS certification.

Typically Offered:

- On-campus: Fall & Spring;

CHEM 498 Internship 1.00-4.00

A chemistry-related work experience with an industry, business or other organization (e.g. LSRI, LSNERR) that provides students with opportunities to apply their learned skills to practical problems. In collaboration with a faculty sponsor, students must complete a Contract for Independent Learning prior to registration. May be used to satisfy Senior Year Experience requirements.

Prerequisites:

Pre-requisite: CHEM 305 and CHEM 321

Typically Offered:

- On-campus: Fall, Spring, & Sum;

Environmental Science

ENSC 100 Environmental Science 2.00

Basic course in human-environment interactions for all students at UW Superior. Students will gain an awareness of the importance of Earth's systems in sustaining our daily lives, and develop the scientific foundation needed to understand contemporary environmental issues. Meets the University Studies environmental science requirement. No prerequisite. (Lecture two hours.)

University Studies Requirements:

- Natural Sciences - Environmental

Typically Offered:

- On-campus: Fall, Spring, & Sum
- Online: Fall & Spring

ENSC 189 Environmental Science Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

ENSC 189ES Environmental Science Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

University Studies Requirements:

- Natural Sciences - Environmental

ENSC 189LS Environmental Science Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

University Studies Requirements:

- UST: Natural Sciences - Lab

ENSC 200 People and the Environment: Challenges & Actions 3.00

This course builds on knowledge of physical processes of human-environment interactions, such as climate change and freshwater depletion, to learn about the social and cultural processes that are crucial for understanding the environmental challenges that human beings face and our best means of dealing with them. The course includes lecture, discussion, experiential learning, and student research.

Typically Offered:

- On-campus: Spring;

ENSC 350 Environmental Science Research Methods 2.00

This is a field-based environmental science research methods class that will: 1) provide students with hands-on experience with a suite of research methods, 2) provide examples of real-world science-based problem-solving, 3) demonstrate how environmental research can provide needed information for natural resource managers to make management decisions, and 4) learn how to prepare a scientific report.

Prerequisites:

Successful completion of BIOL 340 or instructor consent

Typically Offered:

- On-Campus: Fall;

ENSC 381 Environmental Science Special Topics 1.00-4.00

This course is a specialized topic in environmental science and may include workshops, seminars, field trips, lectures, focused projects, and independent study. Course may be repeated when topics are different. Instructor permission required to enroll in the course.

Typically Offered:

- Occasional by Demand

ENSC 489 Environmental Science Elective 99.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

ENSC 491 Research in Environmental Science 1.00-4.00

An independent study developed in cooperation with faculty or area research laboratories designed to provide students with practical experience in environmental science. With assistance from a faculty member, students must outline a research problem and complete a Contract for Independent Learning proposal form prior to registration. In order to fulfill the Senior Experience requirement for all Environmental Science graduates, students must present their experience at a scientific conference or at a Department of Natural Science symposium. Students should plan to register for ENSC 497 during the semester they plan to present their research. Instructor consent required. May be repeated for a total of four (4) credits.

Typically Offered:

- On-campus: Fall & Spring;

ENSC 496 Internship in Environmental Science 1.00-4.00

On-the-job experience with local agencies (e.g. Wisconsin DNR) that provides students with opportunities to apply their skills to practical problems. In collaboration with a faculty sponsor, students must complete a Contract for Independent Learning proposal form prior to registration. In order to fulfill the Senior Experience requirement for all Environmental Science graduates, students must present their experience. Internships experiences can be presented at a Department of Natural Science symposium. Students should plan to register for ENSC 497 during the semester they plan to present their internship. Instructor consent is required. May be repeated for a total of four credits.

Typically Offered:

- On-campus: Fall & Spring;

ENSC 497 Environmental Science Senior Experience Seminar 1.00

This course prepares students to develop and deliver a scientific presentation that serves a culminating experience for Environmental Science majors. The presentation topic is connected to the experience completed in ENSC 491 (Research in ENSC) or ENSC 496 (ENSC Internship), either of which must be taken as a pre-requisite or a co-requisite course. Students should register for this course during the semester they plan to present their senior experience. Meets on campus 1 hour per week.

Prerequisites:

Pre-requisite ENSC 491 or ENSC 496 OR Co-requisite ENSC 491 or 496

Typically Offered:

- Fall and Spring Terms

Geography**GEOG 100 World Regional Geography 3.00**

Develops basic factual knowledge and awareness of the physical and cultural features of the world environment. Explores regional and world scale patterns of resources, climate, applied technology and trade, political alignments, and other aspects of the current world. All world political units are analyzed from a regional perspective. Students gain significant knowledge of world spatial relationships.

University Studies Requirements:

- UST: Diversity
- UST: Global Awareness
- UST: Social Science

Typically Offered:

- On-campus: Fall & Spring
- Online: Spring & Summer

GEOG 102 Cultural Geography 3.00

Explores the influence of culture on perceptions, decisions, and interpersonal relations on both planetary and local scales of life. A broad range of cultural topics are considered, including the origins of culture, human development, political and social organization, religions and languages, and evolving human landscapes. Prepares students to be well-informed citizens of our increasingly interconnected global community.

University Studies Requirements:

- UST: Diversity
- UST: Global Awareness
- UST: Social Science

Typically Offered:

- On-campus: Spring
- Online: Fall

GEOG 189 Geography Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOG 241 Fundamentals of GIS I 4.00

Broad introduction to cartography and Geographic Information Systems with emphases on theory and practice. Fundamental principles of numerical data entry, digitizing, data manipulation and analysis, and interpretation of spatially referenced data will be explored. Additional topics include cartographic basics such as mapping, coordinate systems, projections and remote sensing. Students are introduced to the skills necessary to run a vector-based GIS. The GIS lab offers students an opportunity to use GPS systems and ArcGIS to improve their conceptual and technical GIS skills while working one-on-one with the instructor. Lab will cover map design, geodatabase creation, spatial data download, examining metadata, geoprocessing, digitizing, geocoding, spatial analysis, and 3D-analysis. In the lab each student will carry a real-world project using ArcGIS software. (Lecture three hours, laboratory two hours.) ITS 108 or basic computer skills recommended.

Typically Offered:

- On-Campus: Fall;

GEOG 281 Special Topics 1.00-6.00

In-depth study of specialized topics in geography selected by the faculty on the basis of student interests/needs. May include workshops, seminars, special issues, etc. This course may be repeated when topics are different. Offered on demand.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

GEOG 289 Geography Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOG 289DV Geography Elective Diversity 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOG 289ES Geography Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOG 289GA Geography Elective Global Awareness 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

University Studies Requirements:

- UST: Global Awareness

GEOG 289LS Geography Elective with lab 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOG 289SS Geography Elective Social Sciences 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOG 298 Independent Study 1.00-4.00

Advanced study for students who have shown themselves capable of independent work, carried out under the direction of a faculty member chosen by the student. Offered on demand. Instructor consent required.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

GEOG 302 Economic Geography 3.00

Study of how spatial organization of economic activities affects such issues as economic growth, employment, investment patterns, mobility, and the prices paid for goods. Industrial economic activities are examined by addressing issues such as why some areas are more suitable than others for economic activities and how markets function in the real world. Transportation networks that connect areas and issues of global interdependence are central themes in this course. This course has been approved as Writing Certificate Eligible (WCE)—see section of catalog for WCE Description/details. (lecture two hours, laboratory two hours)

Prerequisites:

Prerequisite for taking this course for TRSP majors is completion of ECON 250 and ECON 251. Non-TRSP majors are required to take a GEOG course or consent of instructor.

Typically Offered:

- On-Campus: Fall
- Online: Spring

GEOG 343 Fundamentals of GIS II 4.00

Introduction to GIS-specific content, including database, advance editing using topology, geocoding, and some advanced analysis operations. It covers geo-statistical analysis, site suitability and modeling, raster analysis, and ArcScan tool. Introduces students to some advance functionalities of ArcGIS Desktop, ArcGIS Pro, and introduction to ArcGIS online. Laboratory activities include mapping density, mapping change, finding what's inside, finding what's nearby, measuring geographic distribution, analyzing pattern, and identifying clusters, best suitable sites, and modeling. Students examine a wide range of GIS functions using the diverse analysis and data management tools. Each student is required to complete a real world project using GIS software

Prerequisites:

Prerequisite for taking this course is completion of GEOG 241.

Typically Offered:

- On-campus: Spring;

GEOG 350 Geography of Wisconsin 3.00

A spatial examination of the state of Wisconsin utilizing both physical and human considerations. It synthesizes and emphasizes the 20th and 21st century environmental issues that are related to physical characteristics such as geologic history, hydrologic, and climatic forces as well as how these physical factors have impacted the human development of the state. Examples of human issues include indigenous and immigrant settlement, economic, and political patterns.

Typically Offered:

- Fall Term Only

GEOG 357 Advanced Topics in Human/Environment Interaction 3.00

Advanced Topics in Human/Environment Interaction is a study of the effects of the physical and biological factors affecting human population growth, evolution, development, and settlement as well as how our behavior impacts the physical world. The influence of environment on human development, and the schools of thought that develop, crosses many disciplinary areas of study. The basic theories integral to biology and geography, often studied separately as part of discipline-specific courses, will be integrated into the study of humans and their physical environment. The emphasis of the course is to offer topics from a variety of diverse perspectives, with both a reading/lecture and lab component.

Prerequisites:

USP BIOL 170 or CHM 100 or ENSC 100 OR GEOL 120 or Instructor Consent

Typically Offered:

- Online: Spring

GEOG 389 Geography Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOG 402 Urban Planning and Transportation Systems 3.00

Comparative examinations of planning theories and practices that shaped the geography of 19th and 20th century urban and suburban areas. Introduction to the interurban and interurban influences of transportation systems on land use and planning will be explored. Stresses the ways in which planners and planning ideologies have responded to different social, economic, political and technological (transportation and communication) innovations and pressures. The class includes an examination of 21st Century problems, pressures and solutions to urban and transportation needs. Qualifies as an Academic-Service Learning course (see Academic Service-Learning for more details). A significant semester-long group AS-L project, which connects the student with the Twin Ports community, is a substantial learning goal in the face-to-face section of this course. Cross-listed as GEOG/TRSP 402.

Prerequisites:

For non-SBE majors, completion of GEOG 302 or consent of Instructor. For SBE majors, completion of GEOG 302 and admission to the SBE program.

Typically Offered:

- Spring Term Only

GEOG 442 Advanced Principles of GIS 4.00

Students learn how to develop and implement various GIS application projects. The course covers spatial data conversion, spatial database management and advance spatial analysis. Introduces image analysis and spatial analysis utilizing the extensions of ArcGIS Desktop and ArcGIS Pro (geostatistical analyst, spatial analyst, network analyst, 3-D analyst) and remote sensing raster analysis). Each student designs a project based on their specialty (biology, environmental science, land use, transportation, hydrogeology, demographics, economic analysis, etc.). Course builds on the principles introduced in GEOG 343 and gives a more in-depth understanding of the technical aspects involved in spatial data handling, analysis, and modeling. Very advanced principles of ArcGIS will be used as theoretical and applied aspects are examined through a series of practical exercises and assignments culminating in the development of a prototype GIS.

Prerequisites:

Prerequisite for taking this course is completion of GEOG 343

Typically Offered:

- On-Campus: Fall;

GEOG 450 Capstone in Geography 3.00

This course integrates and extends classroom learning through guided research on student-selected interdisciplinary geography and geography-related topics. After an introduction to geographic research methods and theory, students will conduct an investigation of a spatial question. Students work individually, in consultation with faculty and interaction with peers in class, to produce a final product that is pertinent to the major/minor. Examples of final product are: a formal written research paper, classroom-ready teaching unit, workshop materials for presentation.

Typically Offered:

- On-campus: Select Semesters;

GEOG 452 GIS Special Project 2.00

This course is an undergraduate level course planned at developing more advanced GIS skills. The course is a project-based course (2 credits) targeted students who have taken the first 2 courses in the GIS minor (GEOG241 and GEOG 343). The class is not introductory and students will begin using more advanced analysis tools in ESRI GIS software (ArcGIS Desktop, ArcGIS Pro, and ArcGIS Online). In this course students will propose, design, and implement a real-world project. Students will identify a concept, a problem or a concern they wish to address or solve, and execute the project to final data products. Student completed the project will demonstrate their proficiency of the subject matter of the GIS applications.

Prerequisites:

Prerequisite for taking this course is completion of GEOG 241 and GEOG 343

Typically Offered:

- On-campus: Select Semesters;

GEOG 481 Special Topics 1.00-6.00

In-depth study of specialized topics in geography selected by the faculty on the basis of student interest/need. May include workshops, seminars, special issues, etc. Course may be repeated when topics are different. Offered on demand.

GEOG 489 Geography Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOG 489DV Geography Elective Diversity 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOG 489GA Geography Elective Global Awareness 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

University Studies Requirements:

- UST: Global Awareness

GEOG 489SS Geography Elective Social Sciences 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOG 491 Undergraduate Research 1.00-4.00

A course developed in cooperation with faculty or area geography specialists to provide practical experience in experimental geography. Candidates for this course must outline a research problem or focus of study. Registration for credit can only be made after all supervisory and support requirements have been assured and the formal research plan is approved. May be repeated for a total of four credits.

Prerequisites:

Prerequisite for taking this course is completion of two GEOG courses and consent of instructor.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

GEOG 492 Geography Seminar 1.00

Study of a topic through literature research. Each student studies a topic and effectively summarizes the available information in written and oral form. Prerequisite: Two prior geography courses and consent of instructor.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

GEOG 496 Internship 1.00-4.00

On-the-job experience with local agencies such as the Department of Transportation, urban and/or regional planning agencies, historical societies, or other approved geography-related organization designed to provide students with realistic opportunities to apply their skills to practical problems. Registration for credit can only be made after all supervisory and support requirements have been assured. Prerequisite: Two prior geography courses and consent of instructor. Offered on demand.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

GEOG 498 Independent Study 1.00-4.00

Advanced study for students who have shown themselves capable of independent work, carried out under the direction of a faculty member chosen by the student. Offered on demand. Instructor consent required.

Typically Offered:

- On-campus: Select Semesters
- Online: Select Semesters

Geology

GEOL 110 The Dynamic Earth 4.00

An introductory science class that emphasizes the foundational principles and concepts of geology. Topics include: minerals, rocks, Earth's internal structure, plate tectonics, geologic structures, the rock cycle, climate change, glaciers, groundwater, geologic structures, the rock cycle, climate change, glaciers, groundwater, geologic resources and earthquakes. One weekend field trip. (lecture 3 hours, laboratory 2 hours).

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall;

GEOL 120 Our Water Resources 4.00

The Water & Environment course is designed for all students and aim to train students broadly in water resources. The course will be emphasizing on surface water, groundwater, water use, water quality, dams, water allocation, water use conflict, and emerging water issues. Water resources will be linked to the environmental issues that facing our globe. Problem in global change related to the land surface and water through hydrological cycle, contamination, recharge-discharge, and water scarcity will be addressed. Students will work with various software (Aquachem, GIS, Excel) and learn through the lab and assignments problem solving skills.

University Studies Requirements:

- Natural Sciences - Environmental
- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Spring;

GEOL 170 Earth Science for Teachers 2.00

Broad survey of basic concepts and principles of astronomy, geology, oceanography and meteorology. Emphasizes the relationship between Earth processes and the fundamentals of chemistry, physics, and biology. Designed especially for elementary education majors in order to fulfill an earth science requirement. This class does not meet the University Studies requirement for a laboratory science. (Lecture one hour, laboratory two hours.)

Typically Offered:

- On-campus: Select Semesters;

GEOL 189 Geology Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 289 Geology Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 289ES Geology Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 289GA Geology Elective Global Awareness 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

University Studies Requirements:

- UST: Global Awareness

GEOL 289LS Geology Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 315 Climatology 3.00

Exploration of the processes that control Earth's climate and influence climate change affect the environment on timescales of hundreds of millions to tens of years. The first half of the course focuses on understanding the various components of the Earth system that affect climate. The second half emphasizes case studies and techniques useful for understanding climate change.

Prerequisites:

Prerequisite for taking this course is completion of BIOL 130, CHEM 105, or GEOL 110.

Typically Offered:

- On-campus: Spring, Even Years;

GEOL 360 Geomorphology 4.00

Geomorphology is the study of landscapes and landforms. Geomorphology entails the systematic description of landforms, analysis of the processes that form them, and understanding their response to changes in climate, tectonics, human disturbance, and the progression of time. Includes field trips. (Lecture 3 hours, laboratory 2 hours)

Prerequisites:

Prerequisite for taking this course is completion of GEOL 110 and completion or co-enrolled in GEOG 241 or instructor permission.

Typically Offered:

- On-campus: Spring, Odd Years;

GEOL 389 Geology Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 400 Watershed Hydrology 4.00

A study of water properties, occurrence, distribution, and movement and their relationship with the environment within each phase of the hydrological cycle. Examines water quantity and quality issues, and water management policies. Uses mix of lecture- and problem-based approaches. Students will be introduced to techniques used in addressing environmental problems such as flooding, water supplies, and groundwater contamination and evaluation. Recommended for science students interested in the environmental sciences and/or securing a position in the environmental field. (Lecture three hours, laboratory two hours.)

Prerequisites:

Prerequisite for taking this course is successful completion of CHEM 105 and either GEOL 110 or GEOL 120 or instructor consent. MATH 113 is recommended.

Typically Offered:

- On-campus: Select Semesters;

GEOL 481 Special Topics 1.00-4.00

In-depth study of specialized current topics in geology selected by the faculty on the basis of student/community interest. May include workshops, seminars, field trips, special problems, independent study, etc. May be repeated when topics are different. Offered on demand. Instructor consent required.

Typically Offered:

- On-campus: Select Semesters;

GEOL 489 Geology Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

GEOL 489ES Geology Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

GEOL 489GA Geology Elective Global Awareness 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

University Studies Requirements:

- UST: Global Awareness

GEOL 489LS Geology Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-S course.

Natural Sciences Education**NSED 189 Natural Science Education Elective 12.00**

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

NSED 289 Natural Science Education Elective 12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

NSED 321 Teaching Elementary/Middle School Science 3.00

Students will develop science teaching practices for grades K-9, including investigation-based science lessons that support elementary and middle school students as they engage with, explore, and explain science phenomena. Peer-to-Peer teaching required. A minimum grade of C in this course is required for all education majors. This course meets one requirement for undergraduate education majors which leads to the EA or A licensure OR 4-12 licensure in Wisconsin and for undergraduate elementary education majors seeking a K-9 license.

Prerequisites:

Admission to the Teacher Education Program and Completion of T ED 300 or ECED 252 with a C or better

Typically Offered:

- On-campus: Fall & Spring
- Online: Fall & Spring

NSED 339 Secondary Methods in Science Education 3.00

General principles and problems of teaching science in the secondary schools. Emphasis on organizing teaching activities, teaching materials, resources, and current methodology. This course includes a required pre-student teaching clinical in grades 9-12. A minimum grade of C in this course is required for all education majors. On-Campus/Hybrid

Prerequisites:

Admission to the Teacher Education Program and Completion of T ED 300 (C or Better). Teacher Education Non-Academic Test (Criminal Background Check)

Typically Offered:

- On-campus: Select Semesters;

NSED 389 Natural Science Education Elective 12.00

Transfer credit ONLY from another accredited institution not equivalent to a UW-Superior course.

Physics**PHYS 100 Astronomy 4.00**

Includes a brief history of astronomy, the study of the motions and structures of the Earth, the moon, the sun, planets, stars and galaxies and consideration of cosmological theories. (Lecture three hours, laboratory two hours.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall
- Online: Spring

PHYS 105 Light and Sound - Physics in the Arts 4.00

Many of the Fine Arts (music, painting, dance, photography, etc) depend on our human perception of light and sound. While our experience of light and sound are wildly different, the underlying physics is the same - they are both waves. This is a laboratory and experience-based course with applications such as cameras, color mixing, musical instruments, and musical scales. The goal is to gain a greater understanding of light and sound to appreciate how they influence and enrich our Art and our lives. (Lecture three hours, Laboratory two hours).

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Select Semesters;

PHYS 107 Algebra-Based Physics I 4.00

Newtonian mechanics and waves. Designed for students majoring in the humanities, education, medical sciences, or biological sciences. (Lecture three hours, laboratory two hours.)

Prerequisites:

MATH 102, 113 or 115 with grade of C-or better or instructor consent

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall;

PHYS 108 Algebra-Based Physics II 4.00

Continuation of PHYS 107 covering electricity, magnetism, and light. (Lecture three hours, laboratory two hours.)

Prerequisites:

PHYS 107 or 201 with a grade of C- or better.

Typically Offered:

- On-campus: Spring;

PHYS 160 Physical Science 4.00

Laboratory-oriented course covering the basic concepts of physics and chemistry. (Lecture three hours, laboratory two hours.)

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-campus: Spring
- Online: Fall & Summer

PHYS 189 Physics Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 201 Calculus-Based Physics I 5.00

Newtonian mechanics, waves and thermodynamics. (Lecture four hours, laboratory two hours.)

Prerequisites:

Prerequisite for this course is MATH 151 OR MATH 240

University Studies Requirements:

- UST: Natural Sciences - Lab

Typically Offered:

- On-Campus: Fall;

PHYS 202 Calculus-Based Physics II 5.00

Electricity, magnetism, and light. (Lecture four hours, laboratory two hours.)

Prerequisites:

Prerequisite for this course is MATH 241, PHYS 201 or 205

Typically Offered:

- On-campus: Spring;

PHYS 205 Calculus Applications in Introductory Physics I 1.00

Supplemental to introductory non-calculus-based PHYS 107 course. Covers the calculus applications which are normally covered in the calculus-based course PHYS 201. Students who have taken PHYS 107 may decide to supplement their physics background with this course to gain access to higher level courses which have calculus-based physics as a pre-requisite.

Prerequisites:

Prerequisites: PHYS 107, Math 240 and instructor consent.

Typically Offered:

- On-campus: Select Semesters;

PHYS 206 Calculus Applications in Introductory Physics II 1.00

Supplemental to introductory non-calculus based PHYS 108. Covers the calculus applications which are normally covered in the calculus-based course PHYS 202. Students who have taken PHYS 108 may decide to supplement their physics background with this course to gain access to higher-level courses which have calculus-based physics as a pre-requisite.

Prerequisites:

Prerequisites: PHYS 108, MATH 241 and instructor consent.

Typically Offered:

- On-campus: Select Semesters;

PHYS 281 Selected Topics 1.00-6.00

May be offered for individualized or multiple-student instruction on a particular topic. May be independent study, lecture or laboratory. Topics(s) selected based on student interest with approval of instructor.

Typically Offered:

- Occasional by Demand

PHYS 289 Physics Elective 1.00-99.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 289ES Physics Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 289LS Physics Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 300 History and Philosophy of Science 3.00

Examines the nature of science, the history of science, and the nature and history of the impact of science on human life and thought. Provides some understanding of the methods of science, the difference between science and pseudo science, the political and ideological uses of science, and the moral responsibilities of scientists and science educators.

Typically Offered:

- Spring Term Even Years Only

PHYS 311 Mechanics 4.00

Classical mechanics, mathematical techniques using vector calculus, conservation laws and their relation to symmetry principles, rigid body dynamics, accelerated coordinate systems, and introduction to the generalized coordinate formalisms of LaGrange and Hamilton. (Lecture four hours.)

Prerequisites:

Prerequisite for this course is MATH 241, PHYS 201 or 205

Typically Offered:

- On-campus: Select Semesters;

PHYS 321 Electrical Circuits and Electronics 2.00-4.00

Laboratory based course in analog and digital circuits, AC and DC circuits, resonance, filters, transistors, operational amplifiers, logic, memory, microprocessors and computer architecture.

Prerequisites:

Prerequisite: PHYS 202 or PHYS 206

Typically Offered:

- On-campus: Select Semesters;

PHYS 325 Wave Motion and Optics 3.00

Wave phenomena with specific applications to plane electromagnetic waves, reflection, refraction, guided waves and the process of radiation.

Prerequisites:

Prerequisite: PHYS 202 or PHYS 206

Typically Offered:

- On-campus: Select Semesters;

PHYS 375 Physics Laboratory 1.00-3.00

Extended laboratory experiments selected to give experiences in advanced physics concepts and techniques. Experiments are agreed upon between the instructor and student. (Laboratory two-six hours.) May be repeated when topics are different. Instructor consent required for taking this course.

Typically Offered:

- On-campus: Select Semesters;

PHYS 381 Intermediate Topics 1.00-6.00

May be offered for individualized or multiple-student instruction on a particular topic. May be independent study, lecture or laboratory. Topic(s) selected based on student interest with approval of instructor. May be repeated when topics are different.

Typically Offered:

- On-campus: Select Semesters;

PHYS 389 Physics Elective 1.00-9.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 398 Physics Tutorial Project 1.00-4.00

Tutoring students in 100-level physics courses under supervision of a physics staff member. (Three hours per week per credit.)

Prerequisites:

Prerequisite: PHYS 108 or PHYS 202 and instructor consent

Typically Offered:

- On-campus: Select Semesters;

PHYS 401 Modern Physics 3.00

Non-classical phenomena and their explanation in relativity and quantum mechanics. Topics include Special Relativity, relativistic transformations, $E=mc^2$ spacetime, wave-particle duality of matter and light, the Heisenberg uncertainty principle, Schrodinger's equation, atomic physics, quantum numbers, spin, nuclear physics, radioactivity, nuclear forces, and the Standard Model. (Lecture three hours.)

Prerequisites:

Prerequisite: PHYS 202 or PHYS 206.

Typically Offered:

- On-campus: Select Semesters;

PHYS 448 Atomic And Quantum Physics 4.00

Introduction to the philosophy and mathematics of quantum mechanics, including uncertainty, wave-particle duality, problem solving in tunneling and boundary conditions, time-dependent wave functions, the quantum mechanics of hydrogen, alkali metals, and chemical bonding. (Lecture four hours.)

Prerequisites:

Prerequisite: PHYS 202 or PHYS 206

Typically Offered:

- On-campus: Select Semesters;

PHYS 481 Special Topics 1.00-6.00

In-depth study of specialized current topics in physics selected by the faculty on the basis of community interest. May include workshops, seminars, field trips, special problems, independent study. May be repeated when topics are different.

Typically Offered:

- On-campus: Select Semesters;

PHYS 489 Physics Elective 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 489ES Physics Elective Environmental Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 489LS Physics Elective Lab Science 1.00-12.00

Transfer credits ONLY from another accredited institution not equivalent to a UW-Superior course.

PHYS 491 Physics Research 1.00-4.00

Individual laboratory and/or theoretical investigation of a problem selected by the student and faculty or other skilled supervisor. The project will include study of related literature and formal reporting. Designed to give junior/senior level students practical experience in physics research. May be repeated for a total of four credits.

Typically Offered:

- On-campus: Fall & Spring;

Faculty and Staff

Dr. Andy Breckenridge - Professor, Geology/ENSC, Department Chair

Dr. Peter Cook - Professor, Physics

Dr. Nick Danz - Professor, Biology, Dean of Academic Affairs
Dr. Mark Grover - Assistant Teaching Professor, Biology
Dr. James W. Lane, Professor, Chemistry
Dr. Raymond Lee, Assistant Professor, GIS/ENSC
Dr. Kristopher McConnell, Associate Professor, Biology
Dr. Shanna Nifoussi - Assistant Professor, Biology
Dr. Lorena Rios Mendoza - Professor, Chemistry
Dr. Jeffrey Schuldt - Professor, Biology
Dr. Michael Waxman - Professor, Chemistry

Lecturers

Mr. Nathan Anderson, DL Physics
Mr. James Chamernick, Geography
Ms. Alexis Cook, Biology

Administrative Support

Ms. Sandra Orr, Administrative Assistant III