THE DEPARTMENT OF BIOLOGICAL AND PHYSICAL SCIENCES

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Sciences at MSU Billings

Biology, Chemistry, Physics and Earth Science are core programs in the sciences at MSU Billings. Biology is the study of living organisms. Biologists study interactions among and within organisms in order to understand processes characteristic of life. Chemistry, Physics and Earth Science are physical sciences exploring the composition, structure, properties and interactions of matter. Chemistry is the study of differences and similarities of elements in order to understand how they interact to produce diverse molecules. Physics examines the properties of atoms and laws governing the makeup of matter. Earth Science is the study of minerals and soils, their origin, change, and distribution.

Research

Science faculty at MSU Billings encourage undergraduate students to participate in research. Every student is given the opportunity to explore a research problem in the sciences under the guidance of a faculty sponsor. Faculty conduct research in molecular genetics, microbiology, animal physiology, organic chemistry, analytical chemistry, topics in laser spectroscopy, plant physiology, plant systematics, geology, and ecology and evolution. Active involvement in research with faculty is an important part of student success in the sciences at MSU Billings.

Program Outcomes

Programs offered through the Department of Biological and Physical Sciences share many outcomes. Upon program completion students will:

- Understand the basic principles and laws governing our world and have a global awareness of their discipline.
- Demonstrate basic competency in laboratory, field and computer skills related to the sciences.
- Be familiar with accessing and interpreting the scientific literature.
- Be proficient in written and oral communication in the sciences.
- Understand scientific methodology, and conduct scientific investigations using it.
- Be prepared to participate in professional activities.

Career Opportunities

Most students who graduate from MSU Billings in the sciences typically receive a Bachelor's degree in Biology or Chemistry. In some instances our graduates directly enter the job market. Our program in Medical Laboratory Science allows students to achieve national certification for a career in clinical/medical laboratory science. Students seeking jobs with private industry, state (e.g. Fish, Wildlife & Parks) or federal (e.g. FBI) agencies have also been successful. Alternatively, many of our graduates choose to continue their training beyond a four year undergraduate program. They have been accepted in professional programs in the health sciences (medical, dental, pharmacy & veterinary medicine) and major university graduate programs leading to a master's degree or Ph.D. in Biology, Chemistry and Physics.

Advising Information

Academic advising for all freshmen Arts and Sciences majors is initially provided through Advising & Career Services on campus. Science majors are then assigned a faculty advisor in the Sciences with expertise matched to their interest. Students meet with their faculty advisor each semester to review their progress and make any changes required for a complete and accurate plan of study to satisfy program requirements in a timely manner. Faculty advisors also work with students to explore internships, cooperative education placements and opportunities in research to enhance the student's academic program. In addition, faculty advisors provide assistance in selecting elective courses which support the student's interests, career plans and plan of study. Students are ultimately responsible for meeting degree requirements, and science faculty at MSU Billings believe very strongly that academic advising is a vital component to ensuring student success.

Biology

Biology programs available at MSU Billings include the Biology Major and the Biology Minor.

The biology major also has several options and plans of study to allow students to specialize in an area of interest. The biology curriculum is designed to provide biology students with the opportunity for the best possible undergraduate education in biology. In addition to the transmission of factual information, the biology curriculum places emphasis on the development of critical thinking skills in contemporary areas of biology. This is accomplished through a combination of lecturing, experimental laboratory exercises, independent learning by data analysis, research and field projects, seminars, incorporation of extensive writing, library research, and use of computers in data analysis.

MSU Billings' program in biology begins with a two-year core curriculum emphasizing the broad scope of biology through coursework in biological principles, biological diversity, cell biology and genetics. Other required advanced courses and electives are taken in the junior and senior year. While building a solid foundation in biology, the program allows students to match their interests with professional requirements.

Students in biology at MSU Billings have an opportunity to focus on specific areas in biology through a variety of options and plans of study. Specialization in biology is possible with the choice of an appropriate plan of study and in consultation with the faculty advisors who can provide students with the best educational experience at MSU Billings.

All students in the Biology program also take a Capstone seminar course in their senior year. This course is designed to ensure a standard of excellence in knowledge of basic biological concepts, and integration of those concepts with other areas in Science.

A maximum of five semester credits of BIOB 490 BIOB 492, BIOB 494, BIOB 495, and BIOB 498 can be applied to the BA or BS degree as unrestricted biology electives. Excess credits earned in these courses may still be applied to graduation as unrestricted electives.

Chemistry

Chemistry programs at MSU Billings include the Chemistry Major and the Chemistry Minor.

Students taking the first two years in a chemistry program will have a well-rounded background in organic and inorganic chemistry. Students majoring in chemistry will receive additional training in physical chemistry, quantitative chemistry, instrumentation, biochemistry and advanced organic or inorganic chemistry.

The chemistry program is designed to be flexible enough to meet individual interests of students and comprehensive enough to be competitive nationally. A chemistry major can expect to find employment in private, state, or federal laboratories ranging

from research and development to quality control. Course selection and/or selection of a minor can open additional choices in other fields such as biology, geology, business, or health sciences. Graduate education is encouraged as an avenue to expand career opportunities.

Earth Science

Earth Science programs available at MSU Billings include the earth science minor with an emphasis in Geology.

The Earth Science Minor with a geology emphasis provides opportunities for study in the areas of: landform development, igneous, sedimentary and metamorphic rocks, crystallography, earth history, earth structures, and independent research. Students completing this program may find employment in the geological, engineering and environmental areas as well as employment as interpreters with park systems, nature centers and museums.

Broadfield Science

The Broadfield Science program offers students a broad-based foundation in the sciences through coursework in Biology, Chemistry, Earth Science and Physics. The program provides graduates with the knowledge and skills necessary to qualify for positions requiring a broad-based foundation in all sciences.

The Broadfield Science Degree with Teaching Endorsement is especially attractive to students interested in teaching science because they will have a strong foundation in biology, chemistry, earth science, and physics. With additional Professional Core requirements met for teacher licensure, students entering this program would be regarded as "highly qualified" according to national standards, and thus qualify for K-12 teaching opportunities in broadfield science.

Physics

Physics programs available at MSU Billings include the Pre-Engineering program.

Physics is the study of matter, energy, and their interactions; this includes all physical structures and phenomena. Experiments and observations in physics have shown that the operation of the universe at all levels is based on a few fundamental laws. The study of physics is the study of these laws and their applications.

Medical Laboratory Science Program

Students wishing to become medical/clinical lab scientists may choose the Medical Laboratory Science option in the Biology Program.

Additional credits are required because a fifth year of clinical experience is required in this program. Professional training programs approved by the National Accrediting Agency for Clinical Laboratory Science (NAACLS, www.naacls.org (http://www.naacls.org)) are 12 months in duration. In the fourth year, students apply for an internship consisting of 37 credits of clinical experience during the summer, fall, and winter semesters in an approved training program at one of the following institutions: MSU Bozeman; University of North Dakota, Grand Forks; Sacred Heart School of Medical Technology, Spokane, Washington; The Colorado Center for Medical Laboratory Sciences, Aurora. Upon completion of the internship, students will be qualified to take a national registry examination administered by the American Society for Clinical Pathologists or the National Certification Agency.

For additional information, contact Dr. Rhonda Dillman at (406) 657-2031 or rdillman@msubillings.edu

Pre-Medical Sciences

Students interested in professional programs in medical sciences such as medicine, dentistry, veterinary medicine, physician assistant, physical therapy and pharmacy must obtain a Bachelor's degree in preparation for most of these professional programs. No specific undergraduate major is required for most of these health professions, but a strong academic background in biology and chemistry is expected for admission to these programs.

Medical science programs look for students who are well-rounded. Individual plans of study can be designed in consultation with a faculty advisor to provide the student with the maximum opportunity for pursuing goals. Students seeking admission to a medical science program apply to an appropriate professional school before graduation from MSU Billings. Biology and Chemistry faculty assist and advise the student in arranging these applications.

Pre-Engineering

Students interested in a career in Engineering may pursue a two-year course of study at MSU Billings, culminating in an Associate of Science Degree (A.S.) with a Program of Study in Pre-Engineering. This two-year course of study allows students to complete their general education requirements as well as the prerequisites for further engineering study including introductory engineering courses in statics, dynamics, and strength of materials. Students are also required to participate in a two-credit introduction to general engineering course during their first year to help them refine their career goals through the exploration of a variety of engineering disciplines. This program can be tailored for specific engineering disciplines or can be pursued as a general course of study in pre-engineering. Ultimately, students wishing to further their engineering education will transfer into an engineering bachelor's program in the discipline of their choosing at an accredited university.

In order to complete the requirements for an A.S. Program of Study in Pre-Engineering in two years, it is generally necessary to carry 16-18 credit hours per semester.

- Biology Bachelor of Arts Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/ba-biology)
- Biology Bachelor of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-biology)
  - Environmental Sciences Option *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-biology-environmental-sciences-option)
  - Medical Laboratory Science Option (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-biology-medical-laboratory-science-option)
  - Teaching Licensure Option *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-biology-teaching-licensure-option)
- Chemistry Bachelor of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-chemistry)
  - Teaching Licensure Option *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-chemistry-teaching-licensure-option)
- Broadfield Science Bachelor of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-broadfield-science)
  - Teaching Licensure Option (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/bs-broadfield-science-teaching-licensure-option)
- Biology Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/minor-biology)
- Biology Teaching Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/teaching-minor-biology)

- Chemistry Minor (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/minor-chemistry)
- Chemistry Teaching Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/teaching-minor-chemistry)
- Earth Science Minor (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/minor-earth-science)
- Earth Science Teaching Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/teaching-minor-earth-science)
- Physics Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/minor-physics)
- Physics Teaching Minor *Program placed on moratorium* (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/teaching-minor-physics)

- Allied Health Program of Study Associate of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/as-allied-health)
- Environmental Science Program of Study Associate of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/as-environmental-science)
- Pre-Engineering Program of Study Associate of Science Degree (https://catalog.msubillings.edu/undergraduate/college-arts-sciences/department-biological-physical-sciences/as-pre-engineering)

Astronomy

ASTR 110 Introduction to Astronomy. 3 Credits
Term Typically Offered: Spring
Surveys the historical highlights and traditional topics in classical and modern astronomy, such as the solar system, sun, planets, galaxies, and the universe. Examines exotic objects such as quasars, pulsars, and black holes. Presents discussion of recent discoveries, modern cosmological theories, and current unsolved problems. Background in high school algebra is strongly advised.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

ASTR 111 Introduction to Astronomy Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): ASTR 110.
Introduces students to the night sky. Illustrates the difference between real and apparent motions in the heavens. Develops useful observational techniques and an appreciation by the student of the broad range of phenomena in the Universe.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

ASTR 191 Special Topics. 3 Credits
Prerequisite(s): ASTR 110.
Provides the opportunity for students who have completed the survey course to explore a number of special topics in depth. These may include the Big Bang and alternate cosmologies, the dark matter problem, the galaxy formation problem, the dark sky paradox, supernovae, black holes, and/or other topics of current interest.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

Biochemistry

BCH 380 Biochemistry. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): BIOB 160, CHMY 211 or CHMY 323.
Corequisite(s): BCH 381.
Covers structure and function of biomolecules, biocatalysis, bioenergetics, as well as metabolism and its control.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BCH 381 Biochemistry Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): BCH 380.
Complements the lecture material presented in the corequisite.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BCH 480 Advanced Biochemistry I. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): BCH 380.
Corequisite(s): BCH 481.
Provides students with an opportunity to study advanced topics in biochemistry. Serves as an extension of BCH 380 exposing students to advanced aspects of biomolecular structure and function as well as metabolism and its regulation.
Department: Sciences - Biology & Phys Sci

BCH 481 Advanced Biochemistry I Lab. 1 Credit
Term Typically Offered: Spring
Prerequisite(s): BCH 380.
Corequisite(s): BCH 480.
Exposes students to advanced research methodologies in biochemistry. Utilizes project-based labs to complement the lecture material in the corequisite.
Department: Sciences - Biology & Phys Sci

BCH 491 Special Topics. 1-12 Credits
Prerequisite(s): determined as needed.
Provides students with an opportunity to take courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Department: Sciences - Biology & Phys Sci

Biology: General

BIOB 101 Discover Biology. 3 Credits
Term Typically Offered: Fall, Spring, Summer
Includes discussion of the most important concepts in biology. Lectures cover cells (structure and physiology), genetics (cellular reproduction, genes, the nature of heredity and evolution), and the diversity of life (plants, animals, microorganisms and their ecological relationships). General Education course for non-science majors.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 102 Discover Biology Lab. 1 Credit
Term Typically Offered: Fall, Spring, Summer
Corequisite(s): BIOB 101.
Includes laboratory exercises from different areas of Biology. Introduces students to experiments designed to examine major conceptual ideas in Biology such as cells, cell reproduction, metabolism, molecular genetics, evolution, and diversity. Students currently enrolled in an online section of BIOB 101 will be given preferential access to an online section of BIOB 102.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 121 Fund of Bio for Allied Health. 3 Credits
Term Typically Offered: Fall, Spring
Includes discussion of basic biological principles, beginning with the molecules of life and ending with the evolution of the major human organ systems. Emphasizes the fields of biochemistry, cell biology, genetics, and evolution, focusing specifically on the roles they play in current human form and function. Recommended General Education course for non-science majors pursuing a career in health care.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 122 Fund Bio: Evltn/Eclgy/Biodvsty. 3 Credits
Term Typically Offered: Fall
Includes discussion of basic biological principles, beginning with the molecules of life and ending with ecosystem processes. Emphasizes the fields of evolution and ecology, focusing specifically on the roles they play in generating and maintaining biological diversity. Recommended General Education course for non-science majors pursuing careers other than in health care fields.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 123 Fund Bio: Nature of Nutrition. 3 Credits
Term Typically Offered: Fall, Spring
Addresses the core principles of biology from the perspective of nutrition science. Focuses on the roles of biological molecules in animal and plant organisms, cellular function and energy metabolism, genetic expression and mutations, evolution of mechanisms for nutrient procurement and utilization, and the human role in the food chain and its impact on the biosphere. Introduces contemporary issues such as genetically-modified organisms, microbiota and food-borne illness, and sustainability of food supplies. Recommended General Education course for non-science majors pursuing a career in education, social or health sciences, or human services.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 160 Principles of Living Systems. 3 Credits
Term Typically Offered: Fall, Spring
Corequisite(s): BIOB 161 and CHMY 141 or CHMY 104.
Emphasizes principles of biology related to the unity of life. Covers cell structure and function, cellular metabolism and mechanisms of energy trapping, cellular reproduction, genetics, evolution, and a brief introduction to ecology, classification and biological diversity.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 161 Principles Living Systems Lab. 1 Credit
Term Typically Offered: Fall, Spring
Corequisite(s): BIOB 160.
Includes laboratory exercises related to topics discussed in BIOB 160.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 170 Principles of Bio Diversity. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): BIOB 160.
Corequisite(s): BIOB 171.
Emphasizes the diversity of life. Covers viruses, bacteria, protists, fungi, plants and animals. Focuses on eukaryotes.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 171 Principles Bio Diversity Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): BIOB 170.
Includes laboratory exercises related to topics discussed in BIOB 170.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 260 Cellular & Molecular Biology. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): BIOB 160, BIOB 161.
Corequisite(s): BIOB 261.
Covers the molecular basis of eukaryotic cell structure and function. Topics include nuclear structure and function, intracellular compartmentalization and protein storing, membrane structure and function, signal transduction pathways, mechanisms and regulation of the mitotic and meiotic cell cycles, and tissue formation and maintenance.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 261 Cellular & Molecular Biol Lab. 1 Credit
Term Typically Offered: Fall
Prerequisite(s): BIOB 160, BIOB 161.
Corequisite(s): BIOB 260.
Complements the lecture material presented in the corequisite.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 294 Seminar/Workshop. 1-6 Credits
Provides students with specific deficiencies the opportunity to take selected portions of the required Biology sequence. Lectures and laboratories to be attended, and credits to be earned are determined by biology faculty.
Lecture Hours 1-6
Department: Sciences - Biology & Phys Sci

BIOB 298 Internship/Cooperative Educ. 1-9 Credits
Provides university credit for a sophomore work experience in the area of Biology, supervised by faculty. Learning agreement must be completed prior to registration (restricted).
Department: Sciences - Biology & Phys Sci

BIOB 315 Animal Development. 3 Credits
Term Typically Offered: Fall (even years)
Prerequisite(s): BIOB 260.
Introduces the reproductive and developmental patterns in animals. Covers the embryonic and postembryonic developmental processes emphasizing cellular differentiation, the generation of form and shape, growth regulation, and developmental control mechanisms. The second half of the course emphasizes the genetic and molecular control of development, organized around our current understanding of commonly studied model organisms.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 375 General Genetics. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): BIOB 260, BIOB 261.
Corequisite(s): BIOB 376.
Covers the basic principles of genetics from both the classical and molecular point of view. Topics include Mendelian and non-Mendelian concepts, chromosome theory of inheritance, linkage and gene mapping, structure and function of DNA, regulation of gene expression, mutations and fundamentals of population genetics.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 376 General Genetics Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): BIOB 375.
Includes laboratory exercises related to topics in BIOB 375.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 410 Immunology. 3 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): BIOB 260, BIOB 375, BIOB 425 is recommended.
Includes fundamentals of immuno-chemistry, cellular immunology, immunogenetics and clinical immunology. Lab required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 425 Adv Cell & Molecular Biology. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): BIOB 375, BIOB 376, BCH 380, BCH 381 and CHMY 323.
Corequisite(s): BIOB 426.
Covers the molecular basis of gene expression and inheritance in prokaryotic and eukaryotic cells. Topics include transcription, RNA processing, translation, regulation of gene expression and DNA replication. Emphasis is placed on understanding the experimental underpinnings of molecular biology.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 426 Adv Cell & Molecular Biol Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): BIOB 425.
This laboratory complements the lecture material presented in the corequisite.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOB 487 Bioinformatics. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): BIOB 375.
Corequisite(s): BCH 380.
Introduces the field of bioinformatics through a combined lecture-computer laboratory format. Provides students with an overall view of genomics and proteomics through hands-on experience with biologically relevant databases, DNA sequence comparisons, structure analysis of macromolecules, phylogenetics, microarrays and proteomics.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOB 490 Undergraduate Research. 1-6 Credits
Prerequisite(s): Junior standing in Biology or consent of advisor.
Involves intensive study of a specific problem related to biology. A contract describing the study must be completed at the time of enrollment.
Department: Sciences - Biology & Phys Sci

BIOB 491 Special Topics. 1-12 Credits
Prerequisite(s): determined as needed.
Provides students with an opportunity to take courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Department: Sciences - Biology & Phys Sci

BIOB 492 Independent Study. 1-3 Credits
Prerequisite(s): Junior standing in Biology or consent of instructor.
Provides advanced students an opportunity to explore material not covered by regular Biology courses. A contract describing the study must be completed at the time of enrollment.
Lecture Hours 1-3
Department: Sciences - Biology & Phys Sci

BIOB 494 Seminar/Workshop. 1-3 Credits
Prerequisite(s): Junior standing in Biology or consent of instructor.
Provides advanced students an opportunity to investigate intensively topics pertinent to the field of Biology.
Department: Sciences - Biology & Phys Sci

BIOB 495 Fieldwork. 1-3 Credits
Prerequisite(s): BIOB 170 and BIOB 171 or consent of instructor.
Provides an opportunity through summer field experience at the MSU Billings Biological Field Station or tour courses to study quantitatively and/or qualitatively the fauna and flora of ecosystems.
Department: Sciences - Biology & Phys Sci

BIOB 498 Internship/Cooperative Educ. 1-9 Credits
Prerequisite(s): A grade of "A" or "B" in the course in which the internship will be done.
Allows the student to earn credit for assisting in teaching biology laboratory classes.
Department: Sciences - Biology & Phys Sci

BIOB 499 Senior Thesis/Capstone. 1 Credit
Term Typically Offered: Fall, Spring
Prerequisite(s): Senior standing in Biology.
Exit course that integrates and synthesizes knowledge and experience developed through the various courses in the biology program. Provides students opportunities to learn about current research in various scientific fields by attendance at seminars presented by science faculty and other guest speakers. Also provides a forum for students to present results of independent research projects and topics as assigned.
Department: Sciences - Biology & Phys Sci

Biology: Ecology

BIOE 202 Intro to Environmental Ecology. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): BIOB 101 or BIOB 160.
Introduces interactions of organisms with each other and with their physical surroundings in the context of populations, communities, ecosystems, and landscapes. Emphasizes major global problems, energy resources, pollution, and sustaining biodiversity and ecological integrity.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOE 370 General Ecology. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): BIOB 160, BIOB 161.
Corequisite(s): BIOE 371.
Covers the concepts of evolution and ecology. Includes speciation, physiological, behavioral, population and community ecology as well as energetics and nutrient cycling.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOE 371 General Ecology Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): BIOE 370.
Includes laboratory exercises related to topics in BIOE 370.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOE 483 Evolution & Ecology. 3 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): BIOE 370 and BIOE 371.
Corequisite(s): BIOE 484.
Examines advanced topics in evolutionary biology and ecology, focusing on critical discussion of theory and the literature. Content varies but topics may include mechanisms of evolutionary change, evolutionary genetics, sexual selection, evolutionary biogeography, coevolution, and evolutionary developmental biology among others.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOE 484 Evolution & Ecology Lab. 1 Credit
Term Typically Offered: Spring (odd years)
Corequisite(s): BIOE 483.
Includes discussion of primary literature and computer simulations related to topics in BIOE 483.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

Biology: Human

BIOH 301 Human Anatomy & Physiology I. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): CHMY 121 or CHMY 141 and one General Education course chosen from the Life Sciences category (BIOB 121 is preferred).
Recommended: CHMY 123. Includes detailed study of the physiology of cells, tissues, bone, muscle, and the nervous system. This is primarily a course for pre-professional students and those with a major in the health sciences.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOH 302 Human Anatomy & Phys I Lab. 1 Credit
Term Typically Offered: Fall
Prerequisite(s): One General Education course chosen from the Life Sciences category or concurrent enrollment in BIOH 301.
Includes detailed study of the anatomy of skeletal, integumentary, muscle, and nervous systems. Involves examination of body parts at both the gross and microscopic levels.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOH 311 Human Anatomy & Physiology II. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): A grade of "C-" or better in BIOH 301, or consent of instructor.
Corequisite(s): BIOH 312.
Includes detailed study of sensory physiology, cardiovascular system, respiratory physiology, gastrointestinal system, renal physiology, endocrinology, and reproduction. Lab required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOH 312 Human Anatomy & Phys II Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): BIOH 311.
Includes a study of physiology of the nervous, cardiovascular, endocrine, respiratory, renal, gastrointestinal, and reproductive systems using the laboratory approach.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOH 382 Fundmntls of Medical Histology. 2 Credits
Prerequisite(s): BIOH 301 or consent of instructor.
(Odd Sp) Provides a focused study of microscopic structure and function of human cells, tissues, and organs. The course integrates both lecture and laboratory experiences. Laboratory experience will emphasize identification of specimens via light microscopy.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

BIOH 383 Biology of Human Reproduction. 2 Credits
Prerequisite(s): BIOH 301 or consent of instructor.
(Even Sp) Provides a focused study of the structure and function of the various human reproductive organs. Emphasis will be placed on the roles of the endocrine and nervous systems in influencing virtually all aspects of human reproduction. Clinical correlations involving typical pathologies will be included.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

BIOH 405 Hematology. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): BIOH 301, BIOH 302, BIOH 311, BIOH 312.
Corequisite(s): BIOH 406.
Studies the function, biochemistry, cell biology, and pathology of blood and its constituents.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOH 406 Hematology Lab. 1 Credit
Term Typically Offered: Fall (odd years)
Prerequisite(s): BIOH 301, BIOH 302, BIOH 311, BIOH 312.
Corequisite(s): BIOH 405.
Covers methods for examining white blood cells, red blood cells, and platelets. Includes the examination of abnormal blood cells, hemostasis, and fluorescent antibody cell sorting analysis.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOH 470 Summer Clinical Lab. 12-15 Credits
Prerequisite(s): Consent of instructor.
Studies clinical immunohematology, clinical chemistry theory, theory and practice of phlebotomy, clinical hemostasis, clinical microscopy and urinalysis, clinical body fluids, theory of modern transfusion techniques, and theory of clinical microbiology. This is the first part of the year-long professional training core. Clinical lab science fee applies.
Lab Hours 12-15
Department: Sciences - Biology & Phys Sci

BIOH 471 Professional Training I. 12-15 Credits
Prerequisite(s): Consent of Instructor.
Provides training at a clinical laboratory affiliate. Reviews clinical immunohematology, clinical chemistry theory, theory and practice of phlebotomy, clinical hemostasis, clinical microscopy and urinalysis, clinical body fluids, theory of modern transfusion techniques, and theory of clinical microbiology. Performs actual patient laboratory testing under the guidance of trained professionals. This is the second part of the year-long professional training core. Clinical lab science fee applies.
Lab Hours 12-15
Department: Sciences - Biology & Phys Sci

BIOH 472 Professional Training II. 12-15 Credits
Prerequisite(s): Consent of Instructor.
Provides training at a clinical laboratory affiliate. Covers financial and quality management information for the clinical laboratory, advanced immunohematology, clinical chemistry, clinical microbiology, and clinical hematology. This is the third part of the year-long professional training core. Clinical lab science fee applies.
Lecture Hours 12-15
Department: Sciences - Biology & Phys Sci

BIOH 491 Special Topics: Human Biology. 1-2 Credits
Term Typically Offered: Spring
Prerequisite(s): BIOH 301 and consent of instructor.
R-3 Provides advanced study of selected topics in human biology. Course content will vary and may include explorations of human reproductive biology, neurobiology, or microscopic anatomy.
Lecture Hours 1-2
Department: Sciences - Biology & Phys Sci

Biology: Micro

BIOM 208 Applied Brewing Microbiology. 3 Credits
Term Typically Offered: Fall
Introduces the fundamental aspects of yeast fermentation and microbiology relevant to brewing. Some basic microbiological principles will be presented, followed by explanations of the various brewing/quality-impacting processes brought about by biological activity, as well as means of monitoring the brewing process. This course includes laboratory exercises.
Department: Sciences - Biology & Phys Sci

BIOM 250 Microbiology for Hlth Sciences. 3 Credits
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): One General Education course chosen from the Life Sciences category or BIOH 201.
Recommended: CHMY 123 and BIOH 301. Surveys the fundamental principles of microbiology, while emphasizing the relationship of microorganisms to infectious disease. Designed as an introductory course in microbiology for nurses and health-related majors. Lab optional.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOM 251 Microbiology Hlth Sciences Lab. 1 Credit
Term Typically Offered: Fall, Spring
Corequisite(s): BIOM 250.
Emphasizes techniques for the isolation, identification and control of microorganisms. The lab is intended for allied health science students requiring an introductory microbiology laboratory.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOM 360 General Microbiology. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): BIOB 260, BIOB 261, two years of Chemistry.
Corequisite(s): BIOM 361.
Introduces the anatomy, physiology, metabolism and genetics of bacteria and viruses. Surveys the roles of microorganisms in industrial and environmental microbiology as well as infectious disease.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOM 361 General Microbiology Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): BIOM 360.
Emphasizes fundamental techniques for the isolation, manipulation and identification of bacteria. An experimental approach is used to solving problems in microbiology.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOM 400 Medical Microbiology. 3 Credits
Term Typically Offered: Spring (even years)
Prerequisite(s): BIOM 250 or BIOM 360.
Includes a study of pathogenic microorganisms and the diseases they cause. Pathogenic mechanisms, host resistance, control and epidemiology of the major bacterial, viral, fungal and protozoan diseases are discussed. Lab optional.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOM 401 Medical Microbiology Lab. 1 Credit
Term Typically Offered: Spring (even years)
Prerequisite(s): BIOM 251 or BIOM 361.
The laboratory emphasizes diagnostic methods and culturing techniques.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOM 427 General Parasitology. 2 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): BIOB 260, BIOB 375.
Studies the life cycles, biochemistry, molecular parasitology, pathogenesis, identification and treatment of the major parasitic groups, including parasitic protozoa, monogeneans, digeneneans, cestodes, nematodes, acanthocephalans, and parasitic arthropods.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

BIOM 491 Special Topics. 1-12 Credits
Prerequisite(s): determined as needed.
Provides students with an opportunity to take courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Department: Sciences - Biology & Phys Sci

Biology: Organismal

BIOO 412 Animal Physiology. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): BIOB 260.
Includes a description of physiological processes in the major animal phyla. This course considers nervous and endocrine integration, electrolyte and fluid balance, gas exchange, movement, and energetics.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOO 433 Plant Physiology. 3 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): BIOB 376, BIOE 370.
Examines the physiological basis of plant survival, including water movement, mineral nutrition, gas exchange, solute transport, photosynthesis and environmental plant physiology. Includes physiological aspects of plant growth and development, including hormones, morphogenesis, biological clocks and plant responses to temperature. Integrates plant physiology from biochemical and physiological perspectives.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOO 434 Plant Physiology Lab. 1 Credit
Term Typically Offered: Spring (odd years)
Corequisite(s): BIOO 433.
Includes exercises related to lecture topics in BIOO 433, with emphasis on the physiology of selected plants in Montana. Examines physiological aspects of plant growth, development and survival by acquainting students with a variety of methods used to investigate physiological processes in plants.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOO 435 Plant Systematics. 2 Credits
Term Typically Offered: Fall (even years)
Prerequisite(s): BIOB 170 and BIOB 171.
Corequisite(s): BIOO 436.
Includes systems and methods of plant classifications as well as collection, identification and preservation of the local flora.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

BIOO 436 Plant Systematics Lab. 2 Credits
Term Typically Offered: Fall (even years)
Corequisite(s): BIOO 435.
This laboratory complements the lecture material presented in the corequisite.
Lab Hours 2
Department: Sciences - Biology & Phys Sci

BIOO 437 Plant Development. 3 Credits
Term Typically Offered: Spring (even years)
Prerequisite(s): BIOB 260.
Provides an in-depth exploration of reproductive and developmental patterns in plants. Covers embryonic and postembryonic developmental processes, emphasizing cellular differentiation, generation of form and shape, growth regulation, developmental control mechanisms, genetic and molecular control of development.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOO 438 Plant Development Lab. 1 Credit
Term Typically Offered: Spring (even years)
Prerequisite(s): BIOB 260.
Corequisite(s): BIOO 437.
Complements the lecture material presented in the corequisite with laboratory exercises emphasizing angiosperm development. Includes exercises on gametophyte development, embryology, and development of roots, leaves and stems.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

BIOO 450 Vertebrate Zoology. 3 Credits
Term Typically Offered: Spring (even years)
Prerequisite(s): BIOB 170 and BIOB 171.
Surveys the vertebrate classes, focusing on classification, morphology, physiology, ecology, behavior, and evolutionary history of each group.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

BIOO 451 Vertebrate Zoology Lab. 1 Credit
Term Typically Offered: Spring (even years)
Corequisite(s): BIOO 450.
Complements the lecture material presented in the corequisite, with an emphasis on identification of Montana vertebrates.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

Chemistry

CHMY 104 Preparation for Chemistry. 3 Credits
(F and/or Sp) Prepares students to succeed in the one-semester CHMY 121 or two-semester CHMY 141/CHMY 143 College Chemistry series by developing necessary mathematical and scientific problem-solving skills. This course focuses on developing the knowledge and skills required to look at the world on the atomic scale. Students will solidify thinking patterns used to solve chemical problems, such as recognizing mathematical relationships in data and manipulating mental models to explain macroscopic phenomena. The course will demystify the theories and concepts for incoming students. The course will focus on the following topics: scientific method and measurement, the periodic table, chemical formulas and equations, stoichiometry, and gas laws. Each topic will include a special focus on the procedural math associated with related problem-solving tasks.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 121 Intro to General Chemistry. 3 Credits
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): M 095 or equivalent.
Covers the fundamental definitions of chemistry, structure, chemical equations, solutions, equilibrium, oxidation-reduction, and acid/base chemistry. This is primarily a course for pre-nursing and allied health students.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 122 Intro to Gen Chem Lab. 1 Credit
Term Typically Offered: Fall, Spring, Summer
Corequisite(s): CHMY 121.
Provides laboratory experiences that complement and extend the lecture materials.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 123 Intro to Organic & Biochem. 3 Credits
Term Typically Offered: Spring, Summer
Prerequisite(s): CHMY 121 and CHMY 122.
Covers the basic functional groups, nomenclature and reactions of organic chemistry and provides an overview of biomolecules, biocatalysis and metabolism with clinically relevant correlations.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 141 College Chemistry I. 3 Credits
Term Typically Offered: Fall, Summer
Prerequisite(s): M 095 or satisfactory math placement score.
Corequisite(s): CHMY 142.
Introduces the student to the fundamental concepts of chemistry, including: elements and compounds, the periodic table, atomic structure, chemical equations, stoichiometry, solution concentrations, gas laws, heat and energy, quantum theory, and chemical boding. Primarily intended for science majors/minors, pre-engineering, and allied health students.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 142 College Chemistry I Lab. 1 Credit
Term Typically Offered: Fall, Summer
Corequisite(s): CHMY 141.
Lab to accompany CHMY 141. Introduces the tools and techniques of experimental chemistry such as weighing, solution preparation, titration and standardization.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 143 College Chemistry II. 3 Credits
Term Typically Offered: Spring, Summer
Prerequisite(s): CHMY 141 and CHMY 142.
Corequisite(s): CHMY 144.
Introduces the student to the additional fundamental concepts of chemistry, including: molecular geometry, solutions and condensed phases, chemical and phase equilibria, kinetics, thermodynamics, and electrochemistry.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 144 College Chemistry II Lab. 1 Credit
Term Typically Offered: Spring, Summer
Prerequisite(s): CHMY 142.
Corequisite(s): CHMY 143.
Lab to accompany CHMY 143. Introduces qualitative analysis and other topics to complement the lecture material.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 145 College Chemistry Recitation. 1 Credit
Term Typically Offered: Fall, Spring
Corequisite(s): CHMY 141 or CHMY 143.
Provides a small class environment where students can ask questions that require answers too extensive or too specific for the lecture setting. The course is designed to enhance the CHMY 104/CHMY 141/CHMY 143 lecture experience by actively engaging students in real life chemical problem solving. Students will use their newly acquired chemistry skill sets to solve multi-faceted chemical problems in small group settings. Students can ask questions about lecture material or homework assignments and receive more individual attention.
Lecture Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 170 Applied Brewing Chemistry. 3 Credits
Term Typically Offered: Fall
Introduces the fundamental aspects of malting and fermentation chemistry. Some basic chemical principles will be presented, followed by explanations of the underlying chemistry of steps in the brewing process and quality control monitoring. This course includes laboratory exercises.
Department: Sciences - Biology & Phys Sci

CHMY 211 Elements of Organic Chemistry. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): CHMY 143, CHMY 144.
Covers the unique characteristics of carbon, bonding, structure, reactions, nomenclature, and a look into the major organic functional groups. This is a one-semester introduction to organic chemistry.
Department: Sciences - Biology & Phys Sci

CHMY 212 Elements of Organic Chem Lab. 1 Credit
Term Typically Offered: Spring
Prerequisite(s): CHMY 143, CHMY 144.
Corequisite(s): CHMY 211.
Introduces the basic techniques used in an organic chemistry lab including crystallization, extraction, distillation, chromatography, and synthesis.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 291 Special Topics. 1-12 Credits
Prerequisite(s): determined as needed.
Provides students with an opportunity to take courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Department: Sciences - Biology & Phys Sci

CHMY 292 Independent Study. 1-4 Credits
Prerequisite(s): Consent of instructor and department chairperson.
Provides an opportunity for freshman and sophomore students to explore material not covered by regular Chemistry courses. A contract describing this study must be completed at the time of enrollment.
Department: Sciences - Biology & Phys Sci

CHMY 294 Seminar/Workshop. 1-8 Credits
Department: Sciences - Biology & Phys Sci

CHMY 298 Internship/Cooperative Educ. 1-9 Credits
Provides university credit for a sophomore work experience in the area of Chemistry, supervised by faculty. Learning agreement must be completed prior to registration (restricted).
Department: Sciences - Biology & Phys Sci

CHMY 311 Analytical Chem-Quant Analysis. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): CHMY 143 and CHMY 144.
Corequisite(s): CHMY 312.
Covers the theoretical foundations of quantitative chemical analysis, as well as an introduction to fundamental instrumental techniques.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 312 Analyticl Chm Lab-Quant Anlsys. 1 Credit
Term Typically Offered: Fall
Prerequisite(s): CHMY 144.
Corequisite(s): CHMY 311.
Lab to accompany CHMY 311 covering gravimetric, titrimetric, electrochemical and spectrometric analysis techniques.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 321 Organic Chemistry I. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): CHMY 143 and CHMY 144.
Corequisite(s): CHMY 322.
Covers the nomenclature, structure, reactions and reaction mechanisms of organic functional groups - alkanes through alcohols.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 322 Organic Chemistry Lab I. 1 Credit
Term Typically Offered: Fall
Corequisite(s): CHMY 321.
Introduces the common techniques used in an organic chemistry lab, including crystallization, extractions, distillations, chromatography, and synthesis.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 323 Organic Chemistry II. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): CHMY 321 and CHMY 322.
Corequisite(s): CHMY 324.
Continuation of CHMY 321. Covers the functional groups: aromatics, aldehydes, ketones, acids, acid derivatives, and amines. Also introduces organic spectroscopy.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 324 Organic Chemistry Lab II. 1 Credit
Term Typically Offered: Spring
Corequisite(s): CHMY 323.
Continuation of CHMY 322. Provides additional techniques and skills common in an organic chemistry lab, including synthesis and spectroscopic techniques.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 361 Elements of Physical Chemistry. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): M 161 or M 172, PHSX 207 or PHSX 232, and CHMY 211 or CHMY 323.
Corequisite(s): CHMY 362.
Introduces the fundamental concepts of physical chemistry, including thermodynamics, chemical and physical equilibria, molecular motion and transport, kinetics, molecular structure, and spectroscopy.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 362 Elements of Phys Chemistry Lab. 1 Credit
Term Typically Offered: Fall (odd years)
Corequisite(s): CHMY 361.
Demonstrates and amplifies concepts presented in CHMY 361.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 371 Phys Chem-Qntm Chm & Spctrscpy. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): CHMY 323, M 171, M 172 and PHSX 232.
Corequisite(s): CHMY 372.
Introduces the fundamental concepts of quantum mechanics, atomic and molecular structure, chemical bonding, and the theoretical basis of experimental spectroscopy.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 372 Physical Chemistry Lab I. 1 Credit
Term Typically Offered: Fall (odd years)
Corequisite(s): CHMY 371.
Demonstrates and amplifies concepts presented in CHMY 371.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 373 Phys Chem-Kntcs & Thrmdynmcs. 3 Credits
Term Typically Offered: Spring (even years)
Prerequisite(s): M 171, M 172, PHSX 232, CHMY 143.
Corequisite(s): CHMY 374.
Introduces the fundamental concepts of equilibrium, thermodynamics equilibria, and phenomenological kinetics.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 374 Physical Chemistry Lab II. 1 Credit
Term Typically Offered: Spring (even years)
Corequisite(s): CHMY 373.
Demonstrates and amplifies concepts presented in CHMY 373.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 401 Advanced Inorganic Chemistry. 3 Credits
Term Typically Offered: Spring (even years)
Prerequisite(s): CHMY 143 and CHMY 144.
Corequisite(s): CHMY 402.
Covers the chemistry of the main group and transition elements. The course includes group theory and its application to modern bonding theories. These bonding theories will be used to explore topics in coordination, organometallic, and bioinorganic chemistries.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 402 Advanced Inorganic Chem Lab. 1 Credit
Term Typically Offered: Spring (even years)
Prerequisite(s): CHMY 143 and CHMY 144.
Corequisite(s): CHMY 401.
Includes advanced techniques in inorganic synthesis, spectroscopy, and computational chemistry.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 411 Advanced Organic Chemistry. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): CHMY 323 and CHMY 324.
Corequisite(s): CHMY 412.
Covers additional and more advanced topics in organic synthesis, reaction mechanisms, and spectroscopy.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 412 Advanced Organic Chemistry Lab. 1 Credit
Term Typically Offered: Fall (odd years)
Corequisite(s): CHMY 411.
Provides exposure to more advanced techniques used in organic synthesis and the spectroscopy used for structure determination.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

CHMY 421 Advanced Instrument Analysis. 3 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): CHMY 311 and CHMY 371.
Corequisite(s): CHMY 422.
Covers the foundations of modern instrumental analysis theory and techniques. Techniques studied include instrumental design, atomic and molecular spectroscopy, electrochemistry and chromatography. Lab required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

CHMY 422 Adv Instrument Analysis Lab. 2 Credits
Term Typically Offered: Spring (odd years)
Prerequisite(s): CHMY 312.
Corequisite(s): CHMY 421.
Lab to accompany and demonstrate the techniques covered in CHMY 421.
Lab Hours 2
Department: Sciences - Biology & Phys Sci

CHMY 490 Undergraduate Research. 1-3 Credits
Prerequisite(s): consent of instructor.
Students will carry out a contained research project under the supervision of a faculty member, including library and experimental research as appropriate, analysis of the results and the submission of a formal research report upon completion of the project.
Department: Sciences - Biology & Phys Sci

CHMY 491 Special Topics. 1-12 Credits
Prerequisite(s): determined as needed.
Provides students with an opportunity to take courses not required in any curriculum for which there is a particular need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.
Department: Sciences - Biology & Phys Sci

CHMY 492 Independent Study. 1-3 Credits
Prerequisite(s): Consent of instructor and department chairperson.
Provides outstanding students an opportunity for research in chemistry. A contract describing the study must be completed at the time of enrollment.
Department: Sciences - Biology & Phys Sci

CHMY 494 Seminar/Workshop. 1-8 Credits
Prerequisite(s): senior standing in a science major or consent of the instructor.
Students are expected to research and give an hour seminar on a topic from chemistry or a closely related field, and write a paper on the topic as if for publication.
Department: Sciences - Biology & Phys Sci

CHMY 498 Internship/Cooperative Educ. 1-9 Credits
Provides university credit for a work experience in the area of Chemistry, supervised by faculty. Learning agreement must be completed prior to registration (restricted).
Department: Sciences - Biology & Phys Sci

CHMY 499 Senior Thesis/Capstone. 1 Credit
Prerequisite(s): Junior or Senior standing in Chemistry and/or concurrent enrollment in CHMY 490.
Involves an intensive study of a specific problem related to chemistry requiring the writing and submission of a thesis to graduate with departmental honors. To graduate with honors, it is also necessary to have an overall GPA of 3.25 or better and a GPA of 3.5 or better in the major. A thesis proposal describing the study and a thesis review committee must be completed at the time of enrollment.
Department: Sciences - Biology & Phys Sci

Engineering: General

EGEN 105 Intro to General Engineering. 2 Credits
Term Typically Offered: Fall, Spring
Provides students an opportunity to explore the fields of engineering, engineering technology, and computer science. Other topics include engineering design, career opportunities, professionalism, and ethics.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

EGEN 201 Engineering Mechanics-Statics. 3 Credits
Term Typically Offered: Fall, Spring
Prerequisite(s): PHSX 220 & PHSX 221.
Corequisite(s): M 273.
Covers the equilibrium of particles and rigid bodies; static analysis of structures including trusses, beams, frames, and machines; coulomb friction, area and mass centroids; and moments and products of inertia.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

EGEN 202 Engineering Mechanics-Dynamics. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): EGEN 201.
Covers kinematics, kinetics, work-energy, and impulse-momentum for particles and rigid bodies.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

EGEN 205 Mechanics of Materials. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): EGEN 201.
Covers stress and strain, Hooke's Law, thermal strain, torsion, bending of beams, combined stress, limit analysis, energy methods, virtual work, and column theory.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

EGEN 298 Cooperative Educ/Internship. 1-9 Credits
Department: Sciences - Biology & Phys Sci

Geoscience: Earth Systems

ERTH 303 Weather and Climate. 4 Credits
Term Typically Offered: Fall (even years)
Presents a semi-technical approach to the elements and controls of weather. Lab required.
Lecture Hours 3, Lab Hours 1
Department: Sciences - Biology & Phys Sci

ERTH 401 Geologic Field Methods. 4 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): GEO 309.
Presents the techniques used by the geologist to conduct field surveys. Standard geologic surveying equipment will be utilized by the student to conduct an investigation and prepare a geological map of an area of moderately complex structure. Extensive field work required.
Lecture Hours 4
Department: Sciences - Biology & Phys Sci

ERTH 491 Special Topics. 1-12 Credits
Lecture Hours 1-12
Department: Sciences - Biology & Phys Sci

ERTH 494 Seminar/Workshop. 1-4 Credits
Prerequisite(s): consent of instructor.
Provides advanced students an opportunity to intensively investigate topics pertinent to the field of Earth Sciences.
Department: Sciences - Biology & Phys Sci

ERTH 498 Internship/Cooperative Educ. 1-8 Credits
Prerequisite(s): Consent of instructor.
Provides instructional experience in the Earth Sciences program with an opportunity for early exploration of teaching interests.
Department: Sciences - Biology & Phys Sci

Geoscience: Geology

GEO 101 Intro to Physical Geology. 3 Credits
Term Typically Offered: Fall
Corequisite: GEO 102. Presents an introduction to the study of the earth through a study of its materials and composition, structure, geologic processes, surface and ground waters, physical, chemical and biological oceanography.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

GEO 102 Intro to Physical Geology Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): GEO 101.
Enhances the lecture material of GEO 101 through the usage of experiential activities.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

GEO 205 Mineralogy. 4 Credits
Prerequisite(s): GEO 101.
Surveys crystallography, chemistry and physics of minerals, and mineral field occurrences and associations. Studies will also include identification, classification, and interpretation of origin, chemistry, and mineralogical compositions of igneous, sedimentary, and metamorphic rocks. Lab included. Field trips required.
Lecture Hours 3, Lab Hours 1
Department: Sciences - Biology & Phys Sci

GEO 211 Earth History & Evolution. 3 Credits
Corequisite(s): GEO 212.
Presents a systematic study of the earth through geologic time by analysis of the geological evolution of earth and its sequence of life forms reconstructed from the paleontological record. Lab required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

GEO 212 Earth History & Evolution Lab. 1 Credit
Corequisite(s): GEO 211.
Enhances the lecture material of GEO 211 through the usage of experiential activities.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

GEO 309 Sedimentation and Stratigraphy. 3 Credits
Term Typically Offered: Fall (odd years)
Prerequisite(s): GEO 101.
Introduces and studies the processes of sedimentation, mechanical analysis sediments, environments of deposition, origin and classification of sedimentary rocks, principles and techniques utilized in measuring sedimentary rock strata, facies changes, tectonic framework, biostratigraphic units and paleo-environments. Extensive field and lab work required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

GEO 490 Undergraduate Research. 1-6 Credits
Prerequisite(s): Junior standing or consent of instructor.
Provides students the opportunity to conduct a research project under the supervision of a faculty member, including library and experimental research as appropriate, analysis of the results, and the submission of a formal research report upon completion of the project.
Department: Sciences - Biology & Phys Sci

GEO 491 Special Topics. 1-12 Credits
Department: Sciences - Biology & Phys Sci

GEO 492 Independent Study. 1-3 Credits
Prerequisite(s): consent of instructor.
Provides advanced students an opportunity to explore material not covered by regular Earth Science courses. A contract describing the study must be completed at the time of enrollment.
Department: Sciences - Biology & Phys Sci

GEO 498 Cooperative Educ/Internship. 1-9 Credits
Department: Sciences - Biology & Phys Sci

Nutrition

NUTR 121 Clinical Human Nutrition. 2 Credits
Term Typically Offered: Fall, Spring, Summer
Introduces the importance of a nutritious diet in the maintenance and promotion of health. Emphasizes clinical aspects of human nutrition and appropriate uses of diet therapy in the clinical setting. Designed for students in health care pathways. Restricted to ASN/PN majors at MSUB City College.
Lecture Hours 2
Department: Sciences - Biology & Phys Sci

NUTR 221 Basic Human Nutrition. 3 Credits
Term Typically Offered: Fall, Spring
Prerequisite(s): CHMY 121 and one General Education course chosen from the Life Sciences category (BIOB 121 or BIOB 123 are preferable).
Recommended: CHMY 123. Includes the principles of adequate diets in human nutrition, which involves carbohydrates, lipids, proteins, vitamins, minerals, absorption, digestion, metabolism, and energy utilization as they relate to health and food consumption at different stages of the life cycle. This is primarily a course for health science majors.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

NUTR 411 Nutrition for Sprts & Exercise. 3 Credits
Term Typically Offered: Fall, Spring
Prerequisite(s): KIN 105, KIN 106, NUTR 221.
Emphasizes nutrition as it applies to fitness, training, and athletic performance. Topics include macro- and micronutrient requirements and dietary recommendations, energy metabolism, anthropometry, body weight issues, increased nutrient needs during training and competition, and nutritional ergogenics. Application of concepts is reinforced in a nutritional assessment of a volunteer student athlete and educational video project.
Lecture Hours 3
Department: Health & Human Performance

Physics

PHSX 103 Our Physical World. 3 Credits
Term Typically Offered: Fall, Spring, Summer
Prerequisite(s): M 095.
Corequisite(s): PHSX 104.
Concentrates on fundamental ideas of physics: energy, forces, and conservation laws. Helps students understand basic principles which underlie and explain all diverse phenomena and structures of the physical world. Emphasizes conceptual rather than mathematical treatment; however, basic algebra skills are required.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 104 Our Physical World Lab. 1 Credit
Term Typically Offered: Fall, Summer
Corequisite(s): PHSX 103.
Examines and analyzes the immediate physical environment in terms of fundamental principles through data collection, analysis and the formation of scientifically valid conclusions. Develops an appreciation for the simplicity of basic physical laws and the broad range of phenomena that can be explained by them.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 205 College Physics I. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): M 122.
Corequisite(s): PHSX 206.
Presents an algebra-based treatment of introductory physics covering vector Analysis, Newton's Laws of Motion, conservation laws, bulk properties of matter, fluid mechanics and wave motion. This is the first semester of a two semester sequence. Students may receive credit for only one introductory sequence: PHSX 205-206 or PHSX 220-232.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 206 College Physics I Lab. 1 Credit
Term Typically Offered: Fall
Prerequisite(s): M 151.
Corequisite(s): PHSX 205.
Laboratory to complement the lecture in PHSX 205.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 207 College Physics II. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): PHSX 205 and PHSX 206.
Presents a continuation of PHSX 205 with a discussion of thermodynamics, electricity and magnetism, electric circuits, and the behavior and properties of light (with an emphasis on optical applications). This is the second semester of a two semester sequence. Students may receive credit for only one introductory sequence: PHSX 205-207 or PHSX 220-232.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 208 College Physics II Lab. 1 Credit
Term Typically Offered: Spring
Prerequisite(s): PHSX 205 and PHSX 206.
Complements the lecture in PHSX 207 with emphasis on electricity, magnetism, and thermodynamics.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 220 Physics I. 3 Credits
Term Typically Offered: Fall
Prerequisite(s): M 171 or concurrent enrollment in M 171.
Corequisite(s): PHSX 221.
Presents calculus-based treatment of introductory physics covering vector analysis, Newton's Laws of Motion, conservation laws, bulk properties of matter, fluid dynamics, and wave motion. This is the first semester of a two-semester sequence. Students may receive credit for only one introductory sequence: PHSX 205-207 or PHSX 220-232.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 221 Physics I Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): PHSX 220.
Laboratory to complement the lecture in PHSX 220.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 232 Physics II & Thermo. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): M 171, PHSX 220, PHSX 221.
Corequisite(s): PHSX 233.
Presents a continuation of the calculus-based treatment of physics with a discussion of thermodynamics, electricity and magnetism, electric circuits, and the behavior and properties of light. Students may receive credit for only one introductory sequence: PHSX 205-207 or PHSX 220-232.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 233 Physics II & Thermo Lab. 1 Credit
Term Typically Offered: Spring
Corequisite(s): PHSX 232.
Laboratory to complement the lecture in PHSX 232.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 294 Seminar/Workshop. 1-4 Credits
Department: Sciences - Biology & Phys Sci

PHSX 343 Modern Physics. 3 Credits
Term Typically Offered: Fall (even years)
Prerequisite(s): PHSX 232.
Presents the fundamentals of relativity and quantum mechanics with an emphasis on developing the mathematical tools necessary for coordinate transformations, 2nd order partial differential equations, matrices, eigenvalues and eigenvectors.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 344 Modern Physics Lab. 1 Credit
Term Typically Offered: Fall (even years)
Prerequisite(s): PHSX 232.
Corequisite(s): PHSX 343.
Presents laboratory exercises to complement the lecture in PHSX 343.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

PHSX 391 Special Topics. 3 Credits
Prerequisite(s): PHSX 343.
Designed to serve the needs of students who are interested in continued study in physics beyond the introductory level. The course will be devoted to an in-depth study of one of the following topics: electricity and magnetism, classical mechanics, or quantum mechanics.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 490 UG Research. 1-6 Credits
Prerequisite(s): Junior standing or consent of instructor.
Provides students the opportunity to conduct a research project under the supervision of a faculty member, including library and experimental research as appropriate, analysis of the results, and the submission of a formal research report upon completion of the project.
Department: Sciences - Biology & Phys Sci

PHSX 491 Special Topics. 3 Credits
Prerequisite(s): PHSX 391 in the area to be continued.
Continues a topic covered in PHSX 391. The follow-up for electricity and magnetism will be electromagnetic wave theory; for classical mechanics will be fluid dynamics; for quantum mechanics will be further analysis of more complicated atomic systems and a study of Dirac's matrix representation of the Schrodinger equation.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

PHSX 492 Independent Study. 1-4 Credits
Prerequisite(s): consent of instructor and department chairperson.
Designed to provide the student with the opportunity to study any special aspect of physics which is not offered directly as a course.
Department: Sciences - Biology & Phys Sci

PHSX 494 Seminar/Workshop. 1-4 Credits
Department: Sciences - Biology & Phys Sci

PHSX 498 Internship/Cooperative Educ. 1-9 Credits
Department: Sciences - Biology & Phys Sci

Integrated Sciences

SCIN 101 Integrated Sciences I. 1-3 Credits
Term Typically Offered: Fall
Prerequisite(s): M 095.
Corequisite(s): SCIN 102.
Introduces the concepts and methodology of science by integrating biology, chemistry, physics and geology to investigate specific relevant topics. In particular, the themes of organization, energy, transformation, and diversity are explored in relation to each scientific discipline. Emphasizes conceptual rather than mathematical treatment; however, basic algebra skills are required. Lab required.
Lecture Hours 1-3
Department: Sciences - Biology & Phys Sci

SCIN 102 Integrated Sciences Lab. 1 Credit
Term Typically Offered: Fall
Corequisite(s): SCIN 101.
Enhances the lecture material of SCIN 101 through experimental activities.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

SCIN 103 Integrated Sciences II. 3 Credits
Term Typically Offered: Spring
Prerequisite(s): SCIN 101.
Corequisite(s): SCIN 104.
Continues to apply the concepts and methodology biology, chemistry, geology, and physics to additional topics. Further details of the application of organization, energy, transformation, and diversity are explored.
Lecture Hours 3
Department: Sciences - Biology & Phys Sci

SCIN 104 Integrated Science Lab II. 1 Credit
Term Typically Offered: Spring
Prerequisite(s): SCIN 102.
Corequisite(s): SCIN 103.
Enhances lecture material of SCIN 103 through experimental activities.
Lab Hours 1
Department: Sciences - Biology & Phys Sci

SCIN 291 Independent Study. 6 Credits
Department: Sciences - Biology & Phys Sci

SCIN 490 Internship. 1-3 Credits
Prerequisite(s): Elementary Education major or Special Education major; completion of PHSX 105, BIOB 101 or equivalents with grade B or higher and consent of instructor.
Provides opportunity of direct use of teaching skills in science areas under a supervised setting in college laboratories and lectures.
Department: Sciences - Biology & Phys Sci

SCIN 491 Independent Study. 1-4 Credits
Prerequisite(s): Completion of PHSX 105, BIOB 101 or equivalents, consent of instructor and consent of department chairperson.
Designed to provide the student with the opportunity to study any aspect of integrated sciences which is not offered directly as a course.
Department: Sciences - Biology & Phys Sci

SCIN 492 Seminar. 1-3 Credits
Prerequisite: Completion of PHSX 105 or equivalent with a grade B or higher.
Provides students in elementary education and/or special education an opportunity to investigate science topics pertinent to the teaching of science at the elementary school level.
Department: Sciences - Biology & Phys Sci

SCIN 493 Workshop. 1-4 Credits
Prerequisite(s): Completion of PHSX 105, BIOB 101, or equivalents, and consent of instructor.
Provides opportunity for experimental and/or library research study in integrated areas of the sciences.
Department: Sciences - Biology & Phys Sci