

Department of Geoscience

Purpose and Focus

The Department of Geoscience offers three degree programs for majors interested in the geological sciences. These programs are designed to prepare students for specific career paths in geoscience including the pursuit of graduate degrees. In addition, the department wishes to communicate the flavor and excitement of the geological sciences to all students at the university by offering a number of introductory courses that are directed toward students of all backgrounds and goals.

Degree Objectives/Learning Outcomes:

Geology — B.S.

To develop a level of geologic competency in our graduates so they are equipped to compete successfully for entry-level jobs in the geological job market and/or for admission to graduate programs offered by accredited universities and colleges. To accomplish the above:

1. The B.S. in Geology degree is intended to recognize, formulate, employ, and interpret the scientific methodology that is appropriate to geological research.
2. All students will graduate with competency in correctly identifying the properties, characteristics, and behavior of earth materials.
3. Graduating students will be proficient in the production and interpretation of geologic maps.
4. All graduates will have a working knowledge of those scientific disciplines ancillary to the science of geology: chemistry, physics, and mathematics.
5. All students will have the ability to function independently, collaboratively, and ethically with others in the profession.
6. Each graduate will demonstrate the written and verbal communications skills required to convey the results of scientific research.

Earth Science — B.S.

To develop a level of geologic competency in our graduates so they are equipped to enter the secondary education field equipped to qualify for state certification as a teacher of Earth Science in the public school systems of Nevada and other states requiring degree certification within a specialty field. To accomplish the above:

1. The B.S. in Earth Science degree is intended to recognize, formulate, employ, and interpret the scientific methodology that is appropriate to a broad, general understanding of science and how it operates.
2. All graduating students will have the knowledge of the educational resources that are available to teachers of earth science and how to obtain and successfully use those resources.
3. All students will graduate with competency in correctly identifying the properties, characteristics, and behavior of earth materials.
4. All graduates will have a working knowledge of those scientific disciplines ancillary to an appropriate level of the earth science curricula such as chemistry, physics, and mathematics.

5. Graduating students will have the written and verbal communication skills required to convey contemporary theories in geology and in how the Earth operates as a system.
6. All students will have the ability to function independently, collaboratively, and ethically with others in the profession as colleagues and supervisors.

Environmental Geology — B.S.

To develop a level of geologic competency in our graduates so they are equipped to compete successfully for entry-level positions in a growing national and international job market focused on environmentally sensitive activities, issues, and social programs and/or for admission to graduate programs offered by accredited universities and colleges. To accomplish the above:

1. The B.S. in Environmental Geology degree is intended to recognize, formulate, employ, and interpret the scientific methodology that is appropriate to geological research.
2. All students will graduate with competency in correctly identifying the properties, characteristics, and behavior of earth materials as critical components with Earth's environment.
3. Each student will be proficient in the production and interpretation of maps depicting geological and biological factors.
4. All graduates will have a working knowledge of those scientific disciplines ancillary to the environmental aspects of geology: biology, chemistry, physics, and mathematics.
5. All students will demonstrate the written and verbal communication skills required to convey the results of geologic research and synthesis of research arising within other disciplines.
6. All students will have the ability to function independently, collaboratively, and ethically with others in the profession as colleagues and supervisors.
7. All graduates will develop the skills necessary to predict and interpret the environmental, social, and economic impact of activities related to the exploration for, extraction of, use, and disposal of earth materials.
8. All students will learn the skills necessary to minimize, and/or remediate the geological, biological, and geographic environmental impact of activities related to the extraction and use of earth materials.

Accreditation

Northwest Commission on Colleges and Universities

Undergraduate Majors

Earth Science
Environmental Geology
Geology

Minors

Earth Science (23 credits)

The Earth Science Minor is tailored for students outside the College of Sciences. It provides a good background in the topics likely to be covered in an earth science teaching position in Clark County and other areas as well as a solid background to appreciate the natural landscapes and resources in Southern Nevada and the world. Consists of the following course work:

GEOL 101, GEOL 102, and one of the following: GEOG 101, GEOG 105, GEOL 120, GEOL 126, GEOL 140. Choose at least 12 credits from GEOL and GEOG courses numbered 300 or above. No more than 12 credits taken for the minor may be used to satisfy requirements in a student's major.

Earth Science Minors: The student and geoscience advisor must agree upon the courses chosen to satisfy the earth science minor. This list must be signed by the student and advisor and placed on permanent record in the student's file.

Geology (23 credits)

The Geology minor is tailored to students within the College of Science and Engineering or is for other majors with a scientific emphasis. Consists of required coursework including GEOL 101, GEOL 220, and one of the following: GEOL 221 or GEOL 102. Choose at least 12 credits from GEOL and GEOG courses numbered 300 or above. No more than 12 credits taken for the minor may be used to satisfy requirements in a major.

No course in which a grade of C or lower is earned may be applied to any minor in the College of Sciences.

Admission to the Major

Minimum GPA : 2.50

Transfer Policies: All transfer students should meet with an advisor without delay after admission in order to evaluate the applicability of previous course work to UNLV major and graduation requirements.

Department Policies

Graduation Requirements: For graduation with a major or minor in geology, a minimum final grade of C (2.00) is necessary in all required geology-related courses. In addition, before enrolling in any geology course, the student must have completed each geology prerequisite for that course with a grade of C or higher.

Probation: A student will be placed on probation for any of the following reasons:

1. The student's cumulative GPA falls below 2.00.
2. The student's semester GPA is below 2.00 for all degree courses.
3. The student receives D, F, or I grades in more than two courses in one semester.
4. The student transfers into the college from another program at UNLV or from another institution with a GPA less than 2.50 but at least 2.00.

Requirements for Probationary Students: Once a student has been placed on probation as a major in the department, the following general guidelines apply:

1. The student must meet with a faculty advisor to agree upon a probationary course of study. This course of study must include at least 15 credits that apply toward a degree in the major, with a majority of the credits coming from courses in the college, unless all requirements within the college

have been completed. Specific courses will be selected in consultation with the faculty advisor based on the student's previous progress and on established degree program requirements. Upon agreement on a course of study, the advisor will place a memorandum outlining the course of study in the student's file.

2. Students are expected to complete the probationary course of study within two consecutive semesters and one summer. With approval of the faculty advisor, three consecutive semesters (and the intervening summer) may be allowed if course schedules make it necessary. Students who complete the probationary course of study within the allotted time with a GPA (for the course of study only) of at least 2.50 will be removed from probation.

Advisement

Students who declare geology, environmental geology or earth science as a major are automatically assigned a faculty advisor. The student is required to meet with the advisor at least once a year, but the department recommends each semester.

Degree Requirements

Geology

- 1) English Composition 6 credits
ENG 101 and ENG 102
- 2) English Literature 3 credits
ENG 231 or 232
- 3) Constitutions 4-6 credits
- 4) Mathematics 3 credits
MATH 181
- 5) Distribution Requirement
(Life & Physical Sciences & Analytical Thinking)
Humanities and Fine Arts 9 credits
Social Science 9 credits
- 6) Multicultural (see notes)
International (see notes)
- 7) Degree Requirements:
Required Department Courses:..... 59 credits
GEOL 101, 102, 220, 221, 301, 302, 330, 333, 341,
348, 370, 372, 427, 462, 12 credits of GEOL 300 level
or above.
Related Required Courses..... 24-25 credits
MATH 181; MATH 182 or STAT 152 or STAT 491 or CS
119; CHEM 121 and 122, PHYS 151 and 152, or PHYS
180 and 180L and PHYS 181 and 181L, SCI 101
- Electives 7-10 credits
- Total: 124 credits

Notes:

1. Students must complete 40 upper-division credits (satisfied by the degree requirements in the major).
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.

Earth Science

- 1) English Composition 6 credits
ENG 101 and ENG 102
- 2) English Literature 3 credits
ENG 231 or 232
- 3) Constitutions 4-6 credits
- 4) Mathematics 3 credits
MATH 128
- 5) Distribution Requirement
(Life & Physical Sciences & Analytical Thinking)
Humanities and Fine Arts 9 credits
Social Science 9 credits
- 6) Multicultural (see notes)
International (see notes)
- 7) Degree Requirements:
Required Department Courses: 46 credits
GEOL 101, 102, 220, 221, 301, 302, 333, GEOG 101,
GEOL 303 and GEOG 390, 14 credits of other GEOG and
GEOL courses of which 10 credits must be 300-level or
above.

Related Required Courses 27 credits
MATH 128, CS 119 or STAT 152 or 491, CHEM 121,
PHYS 151, AST 103, 104, 105 (lab), ENV 101, SCI 101

Electives: 18-21 credits
Total: 125 minimum

Notes:

1. Students must complete 40 upper-division credits (satisfied by the degree requirements in the major).
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.

Environmental Geology

- 1) English Composition 6 credits
ENG 101 and ENG 102
- 2) English Literature 3 credits
ENG 231 or 232
- 3) Constitutions 4-6 credits
- 4) Mathematics 3 credits
MATH 181
- 5) Distribution Requirement
(Life & Physical Sciences & Analytical Thinking)
Humanities and Fine Arts 9 credits
Social Science 9 credits
- 6) Multicultural (see notes)
International (see notes)
- 7) Degree Requirements:
Required Department Courses 58 credits
GEOL 101, 102, 220, 221, 330, 333 or 410, 334, 341,
348, 430, 462, 472, 474, 485, and twelve credits from;
GEOL 333, 335, 370, GEOG 390, GEOL 404, 410, 427,
433, 434, 443, 471, 477, 478, 488, 491, or 496, or other
courses approved by geoscience advisor.

Related Required Courses 32 credits
MATH 181, MATH 182, CHEM 121, 122, CHEM 220 or
241 plus 241L, PHYS 151 or 180 & 180L, PHYS 152 or
181 & 181L, STAT 152 or 491, SCI 101

Electives 1-3 credits
Total: 125 credits

Notes:

1. Students must complete 40 upper-division credits (satisfied by the degree requirements in the major).
2. Every student must complete a three-credit multicultural course and a three-credit international course. Courses satisfying other requirements may simultaneously satisfy the multicultural and international requirements except one course cannot satisfy both the multicultural and the international requirements.

Geography

GEOG 101

Physical Geography of Earth's Environment

Study of processes that form and modify landscapes, climates, and ecosystems. Interrelationships among the atmosphere, water, earth, and life with emphasis on relationships between humans and environmental processes. 3 credits.

GEOG 104

Physical Geography Laboratory

Provides an opportunity to apply concepts in physical geography, including map interpretation, computer GIS, meteorological processes, development of landforms and an understanding of the dynamics of the earth. Corequisite: GEOG 101. 1 credit.

GEOG 116

Introduction to Oceanography

Fundamentals of oceanography will be covered including a brief history followed by the spatial aspects of geological, physical, chemical and biological oceanography. An emphasis will be placed on the role of oceans on climate change in the past, present and future, including global warming. Three hour lecture. 3 credits.

GEOG 140

Conversations With Earth

(Same as GEOL 140.) Discussion of current topics on Earth's origin, evolution, and habitability. Topics include: radioactive waste storage, catastrophic floods, evolution and extinction on life, climate change, global warming, volcanism, mountain building, ice ages, Nevada geology, ore deposits, and groundwater, among others. 3 credits.

GEOG 390

Meteorology and Climatology

Study of the atmosphere and its effect on our daily weather. Horizontal and vertical currents in the atmosphere and the distribution of solar energy, moisture, and storms. Prerequisites: GEOG 101 and MATH 128. 3 credits.

Geology

GEOL 101

Introductory Geology: Exploring Planet Earth

Fundamentals of geology with emphasis in plate tectonics, earth structure and composition, surface processes, geologic hazards, geologic time, and their relevance to informed citizens. Three hours lecture and three hours laboratory. 4 credits.

GEOL 102

Earth and Life Through Time

Systematic review of the history of the earth and the methods by which the details of earth history are unraveled. Field trips required. Three lectures and one three-hour laboratory per week with occasional weekend field trips. Prerequisite: GEOL 101 or equivalent. 4 credits.

GEOL 105

Introduction to Geology of National Parks

Geology of selected national parks in North America with emphasis on surface processes including the causes and effects of Pleistocene glaciation and major tectonic events that have shaped the topography of the United States and Canada. 3 credits.

GEOL 110

Global Warming

Introduction to the science of global warming, and investigation of the wide array of evidence that documents global warming, including changes in the cryosphere, biosphere, hydrosphere, and atmospheric greenhouse gas concentrations. Investigates the use of climate models to forecast climate under varying greenhouse gas concentrations. 3 credits.

GEOL 120

Natural Disasters

Causes of natural disasters and their impact on people and property. Focuses on geological hazards such as earthquakes, volcanic eruptions, landslides, and floods. 3 credits.

GEOL 126

Science in American Culture

Analysis of the relationship between science and American culture from colonial times to the present. Key themes include 1) evolving relationships between science, religion, and art, 2) influence of the maturation of the historical sciences on American culture in the nineteenth century, and 3) role of science in American public policy today. Three hours lecture. 3 credits.

GEOL 130

Water and the West

Examination of the physical processes governing the distribution and movement of water within the western United States. Consideration of the impact of water on human settlement and activities and also the impact of human activities on the natural hydrologic system. Topics include case studies from throughout the western United States. 3 credits.

GEOL 135

Earth Resources and Society

Geological availability, exploitation, and use of nonrenewable resources including metallic minerals, nonmetallic minerals, and energy resources. Duplicate credit not allowed in GEOL 135 and GEOL 335. Three hours lecture. 3 credits.

GEOL 140

Conversations with Earth

(Same as GEOG 140.) Discussion of current topics of Earth's origin, evolution, and habitability. Topics include: radioactive waste storage, catastrophic floods, evolution and extinction of life, climate change, global warming, volcanism, mountain building, ice ages, Nevada geology, ore deposits, and groundwater, among others. 3 credits.

GEOL 220

Mineralogy

Study of classification, chemistry, physical properties, and crystallography of minerals forming rocks, ore deposits and soils. Identification of hand samples. Study of associations of minerals in geologic environments. Prerequisites: GEOL 101/101D. 4 credits.

GEOL 221

Introduction to Optical Mineralogy and Petrography

Optical properties of minerals in thin section. Laboratory identification of minerals based on optical properties. Study of associations of minerals in thin sections of rocks. Introduction to petrography. Two hours lecture, three hours laboratory. Prerequisite: GEOL 220. 3 credits.

GEOL 301

Fossil Record

History and evolution of life as recorded in the fossil record. Field trips required. Prerequisites: GEOL 102 or BIOL 197. 3 credits.

GEOL 302

Paleontology Laboratory

Identification of the major fossil forming groups and analysis of paleontological data, with emphasis on invertebrates. Field trips required. Prerequisites or Corequisite: GEOL 301. 1 credit.

GEOL 303

Global Environmental Change

Interdisciplinary introduction to the dynamics of the interactions among the lithosphere, biosphere, and atmosphere and their effects on the environment throughout geologic time. Emphasizes dimensions and consequences of both natural and human induced climate change. Prerequisite: Junior standing. 3 credits.

GEOL 330

Introduction to Geochemistry

Fundamental geochemical processes operating within the earth's lithosphere, hydrosphere and atmosphere. Topics include chemical differentiation of the earth, crystal chemistry, mineral stability and phase diagrams, aqueous geochemistry, isotope geochemistry, organic chemistry. Corequisite: CHEM 122. Prerequisites: MATH 128; GEOL 220. 3 credits.

GEOL 333**Principles of Geomorphology**

Description and classification of landforms; evaluation of erosional and depositional processes with respect to earth materials, structure, and geologic history. Field trips required. Emphasis on fluvial, marine, eolian, and glacial origins of landforms. Three hours lecture and three hours laboratory. Prerequisites: GEOL 220/221. 4 credits.

GEOL 333L**Principles of Geomorphology Laboratory**

Laboratory component of GEOL 333. Includes aerial photograph and topographic map interpretation, use of computers and geographic information systems in geomorphology, and other classroom and field exercises to complement lecture material. Prerequisites: GEOL 220/221. 0 credits.

GEOL 334**Environmental Geology**

Control and use of the of the geological environment in modern society. Includes surface and sub-surface processes, mineral resources, and rock properties. Prerequisite: GEOL 333. 3 credits.

GEOL 335**Earth Resources and the Environment**

Geological availability, exploitation, and use of nonrenewable natural resources including metallic minerals, nonmetallic, energy resources. Component of the Environmental Studies Program. Duplicate credit not allowed in GEOL 135 and GEOL 335. Three hours lecture. 3 credits.

GEOL 341**Structural Geology**

Study of structural features of the earth's crust and their development. Laboratory work involves study and preparation of geologic maps and cross sections as well as structural analysis techniques. Three hours lecture and three hours laboratory. Field trips required. Corequisites: PHYS 151 or 180 and 180L. Prerequisites: GEOL 220, MATH 128 or equivalent. 4 credits.

GEOL 348**Field Geology I**

Basic tools and techniques of geologic mapping, map preparation, and report writing. Nine hours field. Corequisite: GEOL 341. Prerequisite: GEOL 221. 3 credits.

GEOL 352**Field Trip**

Field trip to selected areas of geologic significance. May be repeated once for credit. Prerequisites: GEOL 101 or equivalent and consent of instructor. 1-3 credits.

GEOL 370**Intermediate Field Geology**

Intermediate-level techniques of geologic mapping, map preparation, and report writing. Preparation of reports includes professional maps, structure sections, and geologically reasonable interpretations. Requires three-week commitment during winter break. Prerequisite: GEOL 348. 3 credits.

GEOL 372**Advanced Field Geology**

Advanced field techniques including analysis of geologically complex areas; independent and collaborative field projects, and preparation of professional maps and reports. Oral presentation of projects. Requires three-week commitment after spring semester. Prerequisite: GEOL 370. 3 credits.

GEOL 404**Principles of Palynology**

Principles, methods, and techniques for studying modern and fossil pollen assemblages. Emphasis on pollen and spore frequencies as indicators of former vegetational patterns and paleoclimates. Two hours lecture and six hours laboratory. Prerequisites: Junior standing and consent of instructor. 4 credits.

GEOL 410**Soil Classification and Resource Management**

Morphology and classification of soils based on their physical, chemical and mineralogical composition. Introduction to soil genesis, soil mapping, and the relationship of soils to the limitations and potentials of land use. Three lectures and one laboratory per week. Prerequisites: Junior standing and either GEOG 101 or GEOL 101, or consent of instructor. 4 credits.

GEOL 420**Introduction to X-ray Diffraction and X-ray Spectrometry Methods**

Introduction to the principles and methods of x-ray analysis as applied to the study of minerals. Powder camera, diffractometry and spectrometry methods covered. Two hours lecture and six hours laboratory. Corequisite: GEOL 330. Prerequisite: GEOL 220. 4 credits.

GEOL 427**Igneous and Metamorphic Petrology/Petrography**

Description, classification, and interpretation of igneous and metamorphic rocks in hand specimen and thin section. Three hours lecture and three hours laboratory per week. Prerequisites: GEOL 220 and GEOL 221. 4 credits.

GEOL 429**Geochemical Thermodynamics and Kinetics**

Survey of the basic principles of thermodynamics and kinetics and their application to geological processes; applications to include igneous, metamorphic, hydrothermal, diagenetic, weathering, and aqueous systems. Prerequisites: GEOL 330 and MATH 181. 3 credits.

GEOL 430**Geographic Information Systems (GIS): Theory and Applications**

Survey of computer-based techniques in the storage, retrieval, analysis, and representation of spatially referenced data. Emphasis on the application of GIS technology to geologic problems such as natural hazard mapping, surface runoff and erosion, and environmental impact assessment. Three hours lecture and three hours lab. Prerequisite: MATH 127 or 128. 4 credits.

GEOL 433**Glacial and Periglacial Geology**

Origin and regimen of glaciers. Geomorphology and stratigraphic analysis of glacial and associated non-glacial deposits and environments. Prerequisite: GEOL 333. 3 credits.

GEOL 434**Quaternary Geology**

Survey of global paleoenvironments, including geologic, climatic, and biotic changes during the Quaternary. Examination of the geological record of marine and terrestrial glaciated and nonglaciated environments. Prerequisite: GEOL 433. 3 credits.

GEOL 436**Quaternary Paleocology**

Examination of the fossil record of the Quaternary including vertebrate, invertebrate, and floral assemblages. Emphasis on paleoenvironmental and paleoclimatological reconstructions. Field trips required. Prerequisites: GEOL 333. 3 credits.

GEOL 437**Paleoclimatology**

Paleoclimatic history of the Earth, with emphasis on the Neogene and Quaternary Periods. Survey of marine and terrestrial geological records of paleoclimate, including physical sedimentology, geochemistry, and pollen profiles of ice and sediment cores and speleothems. Prerequisite: GEOL 333. 3 credits.

GEOL 440**Volcanology**

Description and classification of volcanoes, volcanic eruptions, and volcanic deposits. Emphasis on the dynamics of volcanic eruptions, pyroclastic rocks, lava flows, and volcanic hazard assessment. Prerequisite: GEOL 427. 3 credits.

GEOL 443**Plate Tectonics**

Study of the earth's origin, age, thermal and magnetic history; the dynamics and internal structure of lithospheric plates; the mechanisms and geometric constraints of plate motion; and a review of the motions of plates in the past. Prerequisite: GEOL 341. 3 credits.

GEOL 444**Tectonics of Orogenic Belts**

Study of crustal deformation and the creation of mountain belts around the world. Emphasis on the comparative structural development of different regions around the globe within the context of plate tectonics. Prerequisites: GEOL 220 and 341. 3 credits.

GEOL 445/445L**Geophysical Methods**

Introduction to geophysical methods, including measurement techniques, rock properties, and interpretation methods using seismology, gravity, magnetics, ground penetrating radar, resistivity and well logs. Three hours lecture and three hours lab. Prerequisites: GEOL 101, MATH 182, PHYS 152 or 182. 4 credits.

GEOL 446**Geologic Application in Remote Sensing**

Introduction in the acquisition, processing, and interpretation of remote sensing data. Topics covered include basic mapping concepts, the structure of remote sensing data and analysis, thermal and radar techniques, and classification schemes. Laboratory computer based. Two hours lecture and three hours laboratory. Corequisite: PHYS 152 or PHYS 182 and 182L. Prerequisite: GEOL 101. 3 credits.

GEOL 449**Geochronology**

Theoretical foundations and modern analytical techniques used in isotopic dating of rocks. Discussion of applications to specific geologic problems and the thermal significance of isotopic dates. Survey of new dating techniques. Prerequisites: GEOL 427 and CHEM 122. 3 credits.

GEOL 462**Principles of Stratigraphy and Sedimentation**

Analysis and application of stratigraphic concepts, and the genesis and classification of sediments. Study of regional stratigraphic patterns and their related sedimentary environments. Three hours lecture and three hours laboratory. Prerequisites: GEOL 301, CHEM 121, and MATH 181. 4 credits.

GEOL 471**Petroleum Geology**

Origin, migration, accumulation, and geologic distribution of petroleum. Surface, sub-surface and geophysical methods of exploration. Three hours lecture and three hours laboratory. Prerequisites: GEOL 341 and GEOL 462. 4 credits.

GEOL 474**Hydrogeology**

Factors controlling the occurrence and distribution of water resource, its quality and quantity, methods of exploration and development. Prerequisites: GEOL 341, CHEM 122 and MATH 181. 3 credits.

GEOL 477**Geology of Metallic Ore Deposits**

Geology of metallic ore deposits, origin, occurrence, and alteration. Application of ore deposit characteristics to exploration. Three hours lecture and three hours laboratory. Field trips required. Prerequisites: GEOL 220 and CHEM 121. 4 credits.

GEOL 478**Hydrogeochemistry**

Principles of aquatic geochemistry such as chemical thermodynamics, tableaux, and oxidation reduction and environmental organic geochemistry such as physicochemical properties of organic compounds and air/water/soil exchange of organic compounds for environmental studies. Concepts for practical environmental problems, geochemical modeling, and contaminant transport. Prerequisite: CHEM 122 and MATH 181. 3 credits.

GEOL 485

Engineering Geology

Application of physical geology to the construction industry. Consideration given to landslide problems, sites for dams, bridges, tunnels and canals; and possible control of erosion and sedimentation by rivers and oceans. Two hours lecture and three hours laboratory. Prerequisite: GEOL 333. 3 credits.

GEOL 488

Microtechniques in Geoscience

Microanalytical techniques including transmitted and reflected light petrology and petrography, micro-imaging scanning electron microscope (SEM) and electron microprobe (EMP), chemical microanalyses (EMP), fluid inclusion microthermometry, and melt inclusion petrography. Project tailored to the student's interest required. Prerequisites: GEOL 220/221. 3 credits.

GEOL 491

Seminar

Lectures in selected fields of geology. Subject of seminar and number of credits announced in class schedule for the semester course is offered. Prerequisite: Consent of instructor. 1-3 credits.

GEOL 495

Independent Study and Research

Independent study and research projects in some field of geology. Open only to upper-division students. Proposed project for study and/or research must be submitted in writing to the department chair for approval and credit evaluation prior to registration. May be repeated to a maximum of six credits. Prerequisites: Upper-division student and consent of instructor. 1-3 credits.

GEOL 496

Advanced Topics in Geoscience

Variety of advanced studies of current and/or topical interest in specialized areas of geoscience. May be repeated to a maximum of six credits. Prerequisite: Varies depending upon the specific topic. 1-3 credits.

GEOL 497

Senior Thesis

Independent original research in geoscience. Requires a written thesis and an oral exam. Proposed project of study must be submitted in writing to the department chair and undergraduate coordinator at least two weeks prior to registration. 3 to 6 credits.

Department of Mathematical Sciences

Purpose and Focus

The Department of Mathematical Sciences provides opportunities for learning and research in several fields of concentration. Mathematics provides the language and concepts in terms of which knowledge in almost all disciplines is understood and communicated, and it often provides the means and techniques for solving problems. The courses required in the various optional concentrations of the department's program serve several purposes which include helping students along paths leading to branches of science and technology as well as to mathematical specializations. These courses are designed to provide routes by which students may arrive at the research level in any of the special areas listed and to allow students to prepare themselves for work in industry or government or in educational institutions.

Accreditation

Northwest Commission on Colleges and Universities

Degree Objectives/Learning Outcomes

Upon completion of the bachelor's degree in mathematical sciences, students would have been trained to think analytically, would have rigorous problem-solving skills, and would have a solid background to enable them to pursue graduate studies in mathematical sciences.

Undergraduate Majors

Mathematical Sciences — Bachelor of Arts

Mathematical Sciences — Bachelor of Science

Areas of Concentration

Actuarial Sciences

Minors

A minor in the Department of Mathematical Sciences includes at least 20 credits in areas of concentrations as follows:

Actuarial Sciences

Includes MATH 181, 182, 320, 330 or 365, 473, and 471.

Mathematics

Includes MATH 181, 182, 251 or 283, 330 or 365, and nine additional upper-division credits of MATH or STAT.

Statistics

MATH 181, 182, 330 or 365; STAT 391 or 411, or 463 or 491; STAT 413 and 493.

No course in which a grade of C- or lower is earned may be applied to any minor in the College of Science.

Admission to the Major

Minimum GPA: 2.50