# Bachelor of Science in Geology

Required 120 credits (a minimum of 36 of which must be from courses numbered 300 or above), including:

I. Essential Studies Requirements (see University ES listing).

Eleven of the university-required 39 Essential Studies credits will be earned through successful completion of GEOL 101 Introduction to Geology, GEOL 102 The Earth Through Time, and their accompanying laboratories (GEOL 101L and GEOL 102L), plus GEOL 420 Geology Capstone; the remaining 28 credits must be earned through successful completion of other Essential Studies courses.

II. Geology Required Core Courses

| Code | Title | Credits |
|---|---|---|
| GEOL 101 & 101L | Introduction to Geology and Introduction to Geology Laboratory | 4 |
| GEOL 102 & 102L | The Earth Through Time and The Earth Through Time Laboratory | 4 |
| GEOL 220 | Computer Applications in Geology and Environmental Science | 2 |
| GEOL 215 & 215L | Introduction to Paleontology and Introduction to Paleontology Lab | 4 |
| GEOL 218 & 218L | Mineralogy and Mineralogy Lab | 3 |
| GEOL 219 & 219L | Petrology and Petrology Lab | 3 |
| GEOL 312 & 312L | Sedimentology and Stratigraphy and Sedimentology and Stratigraphy Lab | 4 |
| GEOL 330 & 330L | Structural Geology and Structural Geology Laboratory | 4 |
| GEOL 414 | Applied Geophysics | 3 |
| GEOE 417 | Hydrogeology | 3 |
| GEOL 420 | Geology Capstone | 3 |
| GEOL 421 | Seminar | 1 |
| GEOL 487 | Undergraduate Research | 1 |
| GEOL 494 | Senior Thesis | 1 |
| Geology Field Experience [1] | | 3 |
| **Total Credits** | | **43** |

[1] Geology Field Experience credits must be pre-approved by the department and may be satisfied by successfully completing a total of 3 credits including, but not limited to: approved professional field camps, GEOL 491, GEOE 397, and internships.

III. Requirements outside of the College of Engineering and Mines

| Code | Title | Credits |
|---|---|---|
| CHEM 121 & 121L | General Chemistry I and General Chemistry I Laboratory | 4 |
| or CHEM 121C & CHEM 121L | General Chemistry I and General Chemistry I Laboratory | |
| CHEM 122 & 122L | General Chemistry II and General Chemistry II Laboratory | 4 |
| or CHEM 122C & CHEM 122L | General Chemistry II and General Chemistry II Laboratory | |
| MATH 165 | Calculus I | 4 |
| MATH 321 | Applied Statistical Methods | 3 |
| or ECON 210 | Introduction to Business and Economic Statistics | |
| PHYS 211 | College Physics I | 4 |
| or PHYS 211C & 211CL | College Physics I and College Physics I Laboratory | |
| or PHYS 251 | University Physics I | |
| or PHYS 251C & 251CL | University Physics I and University Physics I Lab | |
| Select one of the following: | | 4 |
| MATH 166 | Calculus II | |
| PHYS 212 | College Physics II | |
| or PHYS 212C & 212CL | College Physics II and College Physics II Laboratory | |
| PHYS 252 | University Physics II | |
| or PHYS 252C & 252CL | University Physics II and University Physics II Lab | |
| **Total Credits** | | **23** |

IV. Free Electives

Students must complete a minimum of 12 credits of additional free elective courses which are not otherwise specified.

V. Concentrations

Students must complete 16 credits in a Concentration of their choice. The area of concentration will appear on their transcript. We offer these Concentrations at present:

## Concentration in General Geology

Students must complete a minimum of 16 credits of any GEOL and GEOE courses at the 300 level or above; credits earned from the Geology Required Core Courses listed in section I above do not count toward the Concentration.

## Concentration in Paleontology

Follow your passion for dinosaurs and fossils by earning this Concentration. Few subjects in the geosciences are as captivating worldwide as fossils, and few geoscience disciplines are as informative to other disciplines as paleontology. Fossils can help reveal the age of rocks, the character of past environments, and the nature of evolution and extinction as natural processes. North Dakota hosts a wealth of remarkable fossils, from Ice Age mammoths to mummified dinosaurs, making our state the perfect place to explore this fascinating discipline. Through completing a series of specialized courses and capitalizing on the interdisciplinary nature of paleontology, you will learn practical skills and gain foundational knowledge about the evolutionary history of life on Earth recorded in the fossil record. The Concentration in Paleontology is designed to prepare students for careers in fossil-related industries (e.g., paleomitigation or museum educators) or, for those seeking to conduct research with museums or in higher education, preparation for graduate school in paleontology.

| Code | Title | Credits |
|---|---|---|
| Students must complete the following three courses: | | |
| GEOL 416 | Vertebrate Paleontology | 4 |
| GEOL 417 | Dinosaur Paleontology | 4 |
| GEOL 418 | Taphonomy and Fossilization Processes | 4 |
| Students must also complete at least 4 credits from the following list: | | |
| BIMD 220 & 220L | Human Anatomy Physiology I and Human Anatomy Physiology I Lab | 4 |
| BIOL 376 & 376L | Animal Biology and Animal Biology Laboratory | 4 |
| GEOL 321 | Geochemistry | 3 |
| GEOL 410 | Site Characterization | 3 |
| GEOL 491 | Geologic Problems | 1-4 |
| GEOL 515 | Advanced Paleontology | 3 |

## Concentration in Petroleum Geology

Geology is a critically important discipline in the exploration for and extraction of petroleum. These activities require skills in visualizing and understanding sedimentary rocks, especially those in the subsurface. The range of typical applications is wide and the methods used are diverse. Expertise provided by this Concentration include aspects of sedimentary geology, stratigraphy, structural geology and geophysics. This expertise is highly sought after by industries and government agencies that find and produce the oil that fuels today's economies. Furthermore, it has become equally important to train replacements for an aging workforce in this important technological area. The Concentration in Petroleum Geology is designed to prepare students for careers as petroleum geologists.

Students must complete a minimum of 16 credits from the following list:

| Code | Title | Credits |
|---|---|---|
| GEOE 301 & 301L | Petrophysics and Petrophysics Laboratory | 4 |
| GEOL 321 | Geochemistry | 3 |
| GEOL 407 | Petroleum Geology | 3 |
| GEOL 500 | Sedimentary Geology | 3 |
| GEOL 518 | Topics in Advanced Stratigraphy | 2-4 |
| PTRE 401 | Well Logging | 3 |

## Concentration in Water Resources

Freshwater is a vital resource for economic growth, global ecosystems and well-being of human lives. Recently water resources are also severely under pressure across the world due to substantial population growth and migration, climate and land-use changes, and anthropogenic pollution. Water security and quality are increasingly also recognized as a critical national security priority. Moreover, water management is becoming increasingly complex and complicated, demanding a thorough and sound understanding of hydrologic and hydrogeologic processes and their vulnerabilities to climate, land-use changes and anthropogenic usages. These interactions require skills in visualizing and understanding water and contaminant transport through subsurface rocks (sedimentary, igneous and metamorphic) and surface waterways. The range of typical applications is wide and the methods used are diverse. Expertise provided by this Concentration includes aspects of hydrogeology, groundwater contamination and remediation, water quality and lab analyses and cold region hydrology. This expertise is highly sought after by industries and government agencies that deal with critical water resources and environmental problems. Furthermore, it has become equally important to train replacements for an aging workforce in this important technological area. The Concentration in Water Resources is designed to prepare students for careers such as hydrogeologist, hydrologist, environmental geologist and environmental engineer.

Students must complete a minimum of 16 credits from the following list:

| Code | Title | Credits |
|---|---|---|
| GEOL 321 | Geochemistry | 3 |
| GEOL 322 | Geology, Society, and the Environment | 3 |
| GEOL 342 | Conservation and Environmental Hydrology | 3 |
| GEOL 540 | Water Sampling and Analysis | 3 |
| GEOE 419 | Groundwater Monitoring and Remediation | 3 |
| GEOE 421 | Cold Region Hydrologic Modeling | 3 |
| GEOG 374 & 374L | Environmental Remote Sensing and Environmental Remote Sensing Laboratory | 3 |

## Teacher Certification

Students seeking secondary teacher certification in Geology must complete the Department of Teaching and Learning Requirements in Secondary Education. Students seeking certification should follow the curriculum for the B.S. in Geology. The 24 additional hours in science, computer science, statistics, engineering, mathematics, or a world language must include each of the following: at least one course in Biology with lab equaling 4 credits, Atmospheric Sciences, and Astronomy.

Geology majors seeking secondary certification must have an adviser both in the Harold Hamm School of Geology and Geological Engineering and in the Department of Teaching and Learning. Formal admission to Teacher Education is required and is normally sought while the student is enrolled in T&L 250 Introduction to Education (see Department of Teaching and Learning (https://catalog.und.edu/undergraduateacademicinformation/departmentalcoursesprograms/teachingandlearning/) listing).