

# EASC – EARTH AND PLANETARY SCIENCES

## EASC 101

### Introduction to Physical Science

**3 Credits Weekly (3-3-0)**

Learn how the Earth formed and evolved through time! We'll explore how minerals and rocks form and change, what causes volcanoes and earthquakes, how faults and folds form, and how plate tectonics affects it all. In the lab, you'll learn how to identify different minerals and rocks, how to interpret topographic and geologic maps, and learn more about geologic time and earthquakes.

## EASC 102

### Introduction to Environmental Earth Science

**3 Credits Weekly (3-3-0)**

The Earth is changing in many ways all the time, and right now it's changing rapidly. Learn about different Earth systems such as energy pathways, the atmosphere, the hydrosphere, and the cryosphere and how they all interact with each other and affect climate. In this course, the global energy budget and major energy pathways, the Earth's patterns of weather systems and their impact on temperature, precipitation, moisture and winds are covered. Atmospheric and oceanic circulation systems and their effect on the global environmental system are discussed. Components of the atmosphere and their interactions to create weather and climate are also topics dealt with in this course, including paleoclimates and anthropogenic climate change. The hydrologic cycle and local water balance calculations are examined, extending to discussions on groundwater, river systems and the cryosphere. The description and development of soils and human impact on soils are discussed.

## EASC 206

### Geology of the Solar System

**3 Credits Weekly (3-0-0)**

This course demonstrates how information gleaned from both manned and robotic space missions, as well as astromaterials available for direct study, are used to gain an understanding of the geology of our Solar System. Geological processes that were, and continue to be, active in the Solar System are examined with a special emphasis on impact cratering. The similarities and differences in the geology of planets, how these relate to the origin and evolution of the Solar System, and their implications for the search for life are also investigated.

*Prerequisites: A minimum grade of C- in EASC 101 or ASTR 120.*

## EASC 219

### Mineralogy

**3 Credits Weekly (3-3-0)**

This course employs a theory and lab-oriented approach to understanding mineralogy. Topics include mineral origin and formation, classification and crystallography. Hands-on mineral identification will be undertaken in the labs with a focus on major rock forming minerals, such as the silicates. The opportunity to examine rare meteorites in thin section will also be provided. Students will be assigned their own petrographic microscope for use during the term, with an additional lab designed to utilize the Raman spectrometer. A field trip to the Royal Alberta Museum will be conducted during the term.

*Prerequisites: Minimum grade of C- in EASC 101.*

## EASC 221

### Introduction to Geographic Information Systems

**3 Credits Weekly (3-3-0)**

This course provides a theoretical and practical introduction to Geographic Information Systems (GIS) as applied to geologic and environmental sciences. Lectures combine an overview of the general principles of GIS with a theoretical treatment of the nature and analytical use of spatial information. Laboratories impart the technical aspects through hands-on experience with appropriate software.

*Prerequisites: A minimum grade of C- in one of EASC 101, EASC 102, or ANTH 206.*

## EASC 225

### Introduction to Geomorphology

**3 Credits Weekly (3-3-0)**

This course introduces students to geomorphology - the study of landforms and landscape-shaping processes. Fluvial, glacial, periglacial, slope, and aeolian landforms and processes are examined. A special emphasis is placed on Alberta's landscape and the geomorphology of the Late Cenozoic, especially the Quaternary Period. Central to this course is fieldwork in Edmonton's river valley.

*Prerequisites: Minimum grades of C- in EASC 101 and EASC 102.*

## EASC 226

### Introduction to Soil Science

**3 Credits Weekly (3-3-0)**

This course examines the fundamental aspects of soil formation and soil occurrence in natural landscapes. Physical, chemical, mineralogical, and biological properties of soils are emphasized, and how these properties relate to the geological record, environmental conditions and ecology. Identification of soils is practiced and estimates of their performances in both natural and agricultural ecosystems are analyzed. Note: A 100-level chemistry course is strongly recommended.

*Prerequisites: A minimum grade of C- in one of EASC 101, EASC 102 or ANTH 206.*

## EASC 230

### Invertebrate Paleontology

**3 Credits Weekly (3-3-0)**

This course addresses principles and problems associated with paleontology in areas such as origin of life, evolution, mass extinction, paleoecology, functional morphology, biogeography and biostratigraphy. There is a systematic coverage of invertebrate fossils, including microfossils, Porifera, Cnidaria, Brachiopoda, Bryozoa, Mollusca, Echinodermata, and Arthropoda. Labs promote recognition of fossils and their attributes.

*Prerequisites: A minimum grade of C- in EASC 101 or EASC 103.*

## EASC 238

### Geology of Natural Resources

**3 Credits Weekly (3-0-0)**

This course consists of the geological study of the major types of economically important metallic and nonmetallic ore minerals and energy resources. Basic processes which form and concentrate these materials in the Earth are examined. Various methods of exploration and mining of the resources are detailed. Alberta's coal and petroleum resources are emphasized. Environmental effects of the production and use of mineral and energy resources are discussed.

*Prerequisites: Minimum grades of C- in EASC 101 and EASC 102.*

**EASC 240****Sedimentology and Stratigraphy****3 Credits Weekly (3-3-0)**

Focusing on the production, transport, and deposition of sediment, this course explores sedimentary depositional environments, processes, controls, and structures. The course further examines stratigraphic relationships between sediments (including litho-, bio-, chemo-, and chrono-stratigraphic approaches), and facies analysis – the examination and interpretation of sedimentary characteristics that reflect specific environmental conditions under which a given material was deposited or formed. Course topics include the environmental controls on sediment generation, transport, and deposition; properties and classification of clastic, carbonate and evaporitic sediments and rocks; sequence stratigraphy, correlation, and facies analysis; tectonic development of sedimentary basins; hydrocarbon formation and generation; and the interface between sedimentary processes and environmental contamination and rehabilitation. The subsurface characterization of the Western Canada Sedimentary Basin will be introduced as part of this course. In laboratory sections, students will identify characteristics of common sedimentary facies, describe and classify sedimentary rocks in hand specimen, map and correlate sedimentary units, and create stratigraphic sections.

*Prerequisites:* Minimum grades of C- in EASC 101 and EASC 102.

**EASC 270****The Atmosphere****3 Credits Weekly (3-0-0)**

This course provides an introduction to atmospheric science, weather, and climate. Topics include the composition and vertical structure of the atmosphere, humidity and clouds, atmospheric dynamics, circulation, weather systems, weather forecasting and maps, atmospheric boundary layer, and climate dynamics. Training for reading and interpreting weather maps, and modeling atmospheric processes is provided. Note: MATH 114 is recommended.

*Prerequisites:* A minimum grade of C- in any 100-level EASC (p. 1), CHEM (<https://calendar.macewan.ca/course-descriptions/chem/>), or PHYS (<https://calendar.macewan.ca/course-descriptions/phys/>), or in either BIOL 107 or BIOL 108.

**EASC 271****The Oceans****3 Credits Weekly (3-3-0)**

Covering nearly three quarters of the Earth's surface, the oceans play a fundamental role in the Earth system. This course provides an overview of the discipline of oceanography, as well as highlighting the importance of the oceans within a global context. The course examines the physical, chemical, biological, and geological properties of the oceans. Topics include the origins of the oceans, the physical and chemical properties of seawater, water mass structure and chemistry, the physical structure of ocean basins and marine provinces, ocean circulation, wave and tide dynamics, ocean sediments and sedimentary records, biological oceanography and primary productivity, and the role of, and consequences for, the oceans in a changing climate. Furthermore, relevant methods in oceanographic research and data analysis are discussed and applied within the laboratory component of this course. Emphasis is placed on the interdisciplinarity of oceanography, alongside the linkages of the oceans to other spheres of planet Earth, including the atmosphere, biosphere, hydrosphere, and cryosphere. EASC 271 includes an optional field trip to a coastal area.

*Prerequisites:* A minimum grade of C- in EASC 102.

**EASC 320****Introduction to Geochemistry****3 Credits Weekly (3-3-0)**

This course provides an introduction to the interdisciplinary science of geochemistry. The first part of the course examines our home planet from a geochemical perspective and includes formation of the Earth and our solar system, the origin of the elements and their distribution within the Earth, and evolution of the crust, mantle and core. An introduction to the essential geochemical tools of thermodynamics and kinetics, isotope geochemistry and trace element geochemistry is also provided. The second part of the course examines the geochemistry of igneous, sedimentary and metamorphic rocks and covers topics as diverse as the melting and crystallization of rocks to the contamination of our water supplies and the stability of carbonates in our oceans. Note: Credit can only be obtained in one of EASC 320 or CHEM 320.

*Prerequisites:* Minimum grades of C- in a 200-level EASC (p. 1) course and a 200-level CHEM (<https://calendar.macewan.ca/course-descriptions/chem/>) course.

**EASC 321****Structural Geology and Tectonics****3 Credits Weekly (3-3-0)**

The globe has been shaped by enormous forces that have created mountains and oceans and destroyed continents. In this course, students will learn to interpret geologic maps and cross sections, calculate the stress and strain involved in creating faults, folds, and joints, as well as those involved in orogenies, rift formation, and other crustal tectonics.

*Prerequisites:* Minimum grades of C- in one of EASC 225 or EASC 240 and in one of PHYS 124 or PHYS 144.

**EASC 322****Introduction to Biogeochemistry****3 Credits Weekly (3-3-0)**

Biogeochemistry is the study of the chemical, physical, geological, and biological processes and reactions that govern planet Earth. This course provides an introduction to the discipline, focusing on the exchange of energy and elements between the biosphere and the geosphere. The fundamental components of the Earth's system are examined, including the atmosphere, hydrosphere, biosphere, and geosphere, alongside their evolutionary histories and linkages. Topics include the principle biogeochemical cycles, such as the carbon, sulfur, and nitrogen cycles, and their histories. These cycles are assessed in the context of recent environmental and climate change driven by anthropogenic activities. This course incorporates a multitude of disciplines, spanning geology, chemistry, biology, and environmental science. Note: Credit cannot be obtained in both CHEM 322 and EASC 322.

*Prerequisites:* Minimum grades of C- in a 200-level EASC (p. 1) course and a 200-level CHEM (<https://calendar.macewan.ca/course-descriptions/chem/>) course.

**EASC 324****Quaternary Environments****3 Credits      Weekly (3-3-0)**

This course offers an introduction to the Quaternary Period. It provides a broader context for studying modern environmental phenomena and delivers an overview of the key techniques and proxies used in reconstructing Quaternary environmental histories. The course situates the Quaternary within a broad history of Earth's climate, discussing Quaternary glaciations and conditions during and since the last Ice Age in detail. This course also reviews the methodologies used to reconstruct past conditions, focusing on how these methods are used as windows into the past. The course concludes with the detailed examination of several Canadian case studies using the latest research and environmental reconstructions, such as (but not restricted to) the glaciation and deglaciation of Alberta; Quaternary environmental change in the Canadian Arctic Archipelago; and the paleoenvironments of Beringia. The laboratory classes give hands-on experience with basic environmental reconstruction methodologies.

*Prerequisites:* Minimum grade of C- in one of EASC 208, EASC 225 or ANTH 206.

**EASC 326****Soil Chemistry****3 Credits      Weekly (3-3-0)**

This explores the chemistry and biology of soils, pivotal in understanding soil's role in natural and managed ecosystems. It builds upon foundational knowledge of soil formation and emphasizes the interactions between chemical, physical, mineralogical, and biological properties of soils. Students will learn about the mechanisms that govern soil processes and their implications for nutrient cycling, plant growth, and environmental sustainability. Through a combination of lectures, reading assignments, and practical exercises, students will learn about the chemical reactions in the soil solution, at the soil/water interface, and the fundamentals of surface charge, ion exchange, precipitation and dissolution, complexation, and redox reactions, and their implications for plant nutrition, microbial activity, and environmental quality.

*Prerequisites:* Minimum grades of C- in either EASC 226 and CHEM 102, or one of EASC 320 or CHEM 320 and EASC 219.

**EASC 330****Igneous, Sedimentary, and Metamorphic Petrology****3 Credits      Weekly (3-3-0)**

This course highlights Earth's chemistry, the chemistry of minerals, the chemistry of rocks in different environments, and physical processes in the context of mineral stability and different rock chemistry. There are three main regimes in which rocks form: igneous (from a molten rock material that originated in the interior of the Earth), sedimentary (from weathering of rocks on the Earth's surface and lithification of loose sediment), and metamorphic (when rocks get exposed to different temperature/pressure regimes within the Earth). Hands-on laboratory exercises provide professional skills for complete mineral and rock identification, and interpretation of rock textures using hand lens, petrographic microscope, and chemical analyses.

*Prerequisites:* A minimum grade of C- in EASC 219.

**EASC 334****Remote Sensing****3 Credits      Weekly (3-3-0)**

Satellite imagery is being used more and more frequently to assess everything from oil spills to fire hazards, from mining potential to archaeology, from water on Mars to methane lakes on Titan. In this course, students learn to analyze and interpret images from several different satellite and airborne instruments for applications in geology, environmental studies, urban planning, mining, archaeology, forestry, and planetary science.

*Prerequisites:* A minimum grade of C- in EASC 221, EASC 225, or ANTH 206.

**EASC 373****Anthropogenic Climate Change****3 Credits      Weekly (3-0-0)**

This course provides an advanced examination of the natural physical processes that have driven the global climate system in the past and present. It focuses in particular on how humans are interfering with the climate system and the potential future consequences. It further provides an introduction to simple on-line computer models of the climate system.

*Prerequisites:* A minimum grade of C- in EASC 102 or EASC 270.

**EASC 375****Paleoclimatology****3 Credits      Weekly (3-0-0)**

This course provides an extensive overview of the methods used in paleoclimate research and an in-depth examination of important climate events since the Late Proterozoic, with a concentration on the Late Mesozoic and Cenozoic. Aspects of creating paleoclimate reconstructions, climate effects on geological and biological processes, and the modeling of present climate and extrapolation to past and future climates are emphasized.

*Prerequisites:* A minimum grade of C- in EASC 324, or in both EASC 270 and EASC 102.

**EASC 398****Independent Study****3 Credits      Total (0-0-72)**

This course permits an intermediate-level student to work with a faculty member to explore a specific topic in depth through research or through directed reading in primary and secondary sources. The student plans, executes and reports the results of their research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.

*Prerequisites:* A minimum of one 200-level course in EASC (p. 1) and permission of the department; faculty mentors may require specific prerequisites according to the project needs.

**EASC 406****Planetary Materials****3 Credits      Weekly (3-0-0)**

A fundamental goal of planetary science is to understand the timing and process by which our solar system formed and evolved. Planetary materials - meteorites, interplanetary dust particles and returned sample missions including Apollo, Hayabusa and Stardust - provide us with tangible samples from the vast reaches of our solar system from which high-precision analytical measurements can be made. In this course, we will explore the earth's current inventory of planetary materials, with a focus on their mineralogy, petrology and geochemistry, with the goal of gaining insights derived from their study.

*Prerequisites:* A minimum grade of B- in EASC 320 or minimum grades of C- in EASC 219 and EASC 206 and a B- in any 300-level EASC (p. 1) course.

**EASC 409****Geology of Western Canada****3 Credits Weekly (3-0-0)**

This course presents an overview of the geology in Western Canada. This course will cover the rich history of marine life, mountain building, vast river networks, and glaciation that has shaped the western landscapes. Geological processes of mountain building and past and present landscape evolution are emphasized. In addition, the economic resources that formed as a result of these geologic processes will be addressed. Important paleontological sites will be described and their history outlined. The National Parks within Western Canada will be examined in context of their geology and formation, describing why they are important regions to conserve. Students can only receive credit for one of EASC 209 and EASC 409.

*Prerequisites: Minimum grades of C- in each of EASC 219, EASC 240, and EASC 321, or consent of the department.*

**EASC 495****Special Topics****3 Credits Weekly (0-0-3)**

This course involves reading, discussing and critically evaluating current research on specialized topics in Earth and Planetary Science. Topics covered vary with the interests of students and faculty. Students should consult with faculty members in the Earth and Planetary Science area for details regarding current offerings. Note: This course is intended for students in the final year of their degree. This course may be taken twice for credit.

*Prerequisites: A minimum grade of B- in a 300-level EASC (p. 1) course and permission of the department.*

**EASC 498****Advanced Independent Study****3 Credits Total (0-0-72)**

This course permits a senior-level student to work with a faculty member to explore a specific topic in depth through research or through directed reading in primary and secondary sources. The student plans, executes and reports the results of their research or study project under the direction of a faculty supervisor. To be granted enrollment in the course, the student must have made prior arrangements with a faculty member willing to supervise his or her project. This course can be taken twice for credit.

*Prerequisites: A minimum grade of B- in a 300-level EASC (p. 1) course and permission of the department; faculty mentors may require specific prerequisites according to the project needs.*